

SHORT RUN AND LONG RUN RELATIONSHIP BETWEEN INDIA'S AGRICULTURE GROWTH AND FOREIGN DIRECT INVESTMENT: AN ECONOMETRIC ANALYSIS

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1. INTRODUCTION

Agriculture has historically been the cornerstone of India's economy, providing livelihoods to nearly half of the population and ensuring food security for over a billion people. Despite its declining share in national GDP due to the rapid expansion of industry and services, agriculture continues to play a pivotal role in sustaining rural development, employment, and exports. However, the sector faces persistent challenges such as low productivity, fragmented landholdings, inadequate infrastructure, and limited access to modern technology.

In this context, Foreign Direct Investment (FDI) has emerged as a potential catalyst for agricultural transformation. By channelling international capital, technology, and managerial expertise, FDI can strengthen supply chains, modernize agro-processing industries, and enhance export competitiveness. Since India's economic liberalization in 1991, FDI inflows have steadily increased, with policy reforms allowing greater participation in food retail, cold storage, and agricultural services. Yet, the direct impact of FDI on agricultural growth remains debated, with some scholars emphasizing its indirect benefits through allied sectors rather than core farming activities.

An econometric analysis of the relationship between FDI and agricultural growth is therefore crucial. It allows policymakers and researchers to quantify the short-run and long-run effects, test causality, and identify whether FDI acts as a driver of agricultural development or merely responds to existing growth trends. By applying econometric models such as ARDL bounds testing and Granger causality, this study seeks to provide empirical evidence on how FDI influences agricultural GDP, exports, and productivity in India.

This research contributes to the broader discourse on sustainable agricultural development by examining whether FDI can serve as a strategic instrument for modernizing India's rural economy, bridging infrastructure gaps, and positioning Indian agriculture in global value chains.

2. THEORETICAL FRAMEWORK

The relationship between **Foreign Direct Investment (FDI)** and **agricultural growth** in India can be explained through several economic theories:

- **Endogenous Growth Theory:** FDI contributes to growth by transferring technology, skills, and capital, which enhance productivity in agriculture.
- **Dependency Theory:** While FDI can modernize agriculture, it may also create dependency on foreign firms and global markets.
- **Trade-Led Growth Hypothesis:** FDI in agro-processing and exports strengthens India's comparative advantage, boosting agricultural GDP.
- **Multiplier Effect:** Investment in allied sectors (cold chains, logistics, food processing) indirectly raises farm productivity and rural incomes.

3. REVIEW OF LITERATURE

3.1. FDI and Agricultural Exports

Several studies highlight the role of FDI in strengthening India's agricultural exports. Bhutani & Chhabra (2025) demonstrated that FDI inflows significantly enhance agricultural exports, creating long-run growth effects through improved supply chains and competitiveness. Similarly, Singh & Kaur (2022) and Mehta & Gupta (2018) found that FDI positively influences export competitiveness by raising quality standards and integrating Indian agriculture into global value chains. Sinha (2009) reinforced this by showing that FDI in export-oriented industries helps Indian agriculture achieve global competitiveness. Collectively, these studies confirm that FDI acts as a driver of agricultural exports, though short-run effects remain weaker due to structural challenges.

3.2. FDI in Agro-Processing and Food Retail

FDI in agro-processing industries has been shown to create value-added products and employment opportunities. Roy (2013) and Reddy (2019) found that FDI in food processing enhances agricultural exports and farmer incomes, while Prasad (2008) emphasized its role in employment generation. Mukherjee (2014) and Sharma (2021) focused on food retail, showing that foreign investment improves farm-to-market linkages, reduces intermediaries, and raises farmer earnings. These findings suggest that FDI in processing and retail indirectly boosts agricultural productivity by modernizing supply chains and creating demand for quality produce.

3.3. FDI in Infrastructure and Logistics

Infrastructure development emerges as a recurring theme in the literature. Kumar (2017) highlighted that FDI in cold storage, warehousing, and logistics reduces post-harvest losses and enhances agricultural GDP. Verma (2011) found that FDI in logistics strengthens farm-to-market linkages, while Chatterjee (2010) emphasized its role in rural infrastructure and poverty reduction. Das (2015) examined irrigation projects, showing that foreign investment improves water management and stabilizes rural incomes. Together, these studies underscore the importance of FDI in building agricultural infrastructure that supports productivity and sustainability.

3.4. FDI in Technology and R&D

FDI's role in technology transfer and innovation is well documented. Chowdhury (2016) analyzed biotechnology, finding that foreign investment introduced advanced crop varieties and improved yields. Banerjee (2012) emphasized FDI in agricultural R&D, showing its impact on modern farming techniques and productivity. Patel & Joshi (2020) highlighted precision farming and biotechnology as transformative areas supported by FDI. These studies collectively argue that FDI in technology-driven agriculture is essential for modernization and long-term sustainability.

3.5. Indirect and Spillover Effects of FDI

Several scholars note that FDI's impact on agriculture is often indirect. Mohanty & Lenka (2023) argued that FDI in allied sectors such as logistics and agro-processing has a multiplier effect on rural development. Sharmiladevi (2023) found that agricultural value-added is positively influenced by FDI through trade openness and infrastructure. Rashid, Ansari & Khan (2023) confirmed bidirectional causality between FDI and agriculture, suggesting a virtuous cycle where FDI boosts agriculture and a growing agriculture sector attracts more FDI. Nair (2007) concluded that FDI in modernization enhances sustainability, positioning agriculture as a driver of rural transformation.

4. Research Gap:

- Limited studies focus **directly on agriculture-specific FDI inflows** rather than aggregate FDI.
- Few analyses distinguish between **short-run vs. long-run effects** of FDI on agricultural GDP.
- Lack of **causality testing** to determine whether FDI drives agriculture or vice versa.

5. Comparative Literature Review Table

Author(s) & Year	Focus Area	Methodology / Model	Key Findings
Bhutani & Chhabra (2025)	FDI and agricultural exports	ARDL bounds testing	FDI enhances exports; strong long-run impact, weaker short-run effects.
Sharmiladevi (2023)	Agriculture value-added & FDI	ARDL models	Long-run equilibrium between FDI, trade openness, and agriculture.
Rashid, Ansari & Khan (2023)	FDI, exports, economic growth	ARDL & ECM	Bidirectional causality; FDI boosts agriculture and vice versa.
Mohanty & Lenka (2023)	Indirect FDI effects via infrastructure	Co-integration tests	FDI in logistics/agro-processing indirectly raises agricultural GDP.
Singh & Kaur (2022)	FDI and export competitiveness	Panel data analysis	FDI improves quality standards and global integration of agriculture.

Sharma (2021)	FDI in food retail	Regression analysis	FDI strengthens supply chains, reduces wastage, improves farmer incomes.
Patel & Joshi (2020)	FDI in productivity & technology	Time-series econometrics	FDI introduces advanced technologies; long-run positive impact.
Reddy (2019)	FDI in agro-processing	Co-integration analysis	FDI boosts exports, farmer incomes, and rural employment.
Mehta & Gupta (2018)	FDI and agricultural exports	ARDL models	FDI enhances export competitiveness; long-run equilibrium confirmed.
Kumar (2017)	FDI in infrastructure	Regression analysis	FDI in cold storage/logistics reduces losses, raises agricultural GDP.
Chowdhury (2016)	FDI in biotechnology	Regression & co-integration	FDI introduces advanced crop varieties, improves yields.
Das (2015)	FDI in irrigation projects	Time-series econometrics	FDI improves water management, stabilizes rural incomes.
Mukherjee (2014)	FDI in food retail	Regression analysis	FDI reduces intermediaries, raises farmer earnings.
Roy (2013)	FDI in agro-processing	ARDL models	FDI creates value-added products, boosts exports.
Banerjee (2012)	FDI in agricultural R&D	Co-integration analysis	FDI in R&D modernizes agriculture, enhances productivity.
Verma (2011)	FDI in logistics	Regression analysis	FDI strengthens supply chains, improves farmer incomes.
Chatterjee (2010)	FDI in rural infrastructure	Econometric models	FDI improves access to markets, reduces poverty, boosts rural development.
Sinha (2009)	FDI in agricultural exports	ARDL models	FDI enhances export competitiveness, integrates India into global markets.
Prasad (2008)	FDI in food processing	Regression analysis	FDI generates employment, improves farmer incomes, boosts GDP.
Nair (2007)	FDI in modernization & sustainability	Co-integration analysis	FDI introduces advanced technologies, enhances sustainability.

6. Synthesis

- **Exports:** Strong evidence of FDI enhancing agricultural exports (Bhutani & Chhabra, Singh & Kaur, Mehta & Gupta, Sinha).

- **Infrastructure & Logistics:** FDI reduces losses and strengthens supply chains (Kumar, Verma, Chatterjee, Das).
- **Technology & R&D:** FDI drives modernization via biotech and R&D (Chowdhury, Banerjee, Patel & Joshi).
- **Agro-Processing & Retail:** FDI boosts farmer incomes and creates value-added industries (Roy, Reddy, Mukherjee, Sharma, Prasad).
- **Indirect Effects:** FDI often works through allied sectors, creating multiplier effects (Mohanty & Lenka, Sharmiladevi, Nair).

7. Objectives

1. To examine the impact of FDI inflows on agricultural GDP growth in India.
2. To analyze short-run and long-run relationships between FDI, agricultural exports, and productivity.
3. To test causality between FDI and agriculture growth.

8. Hypotheses

- **H1:** FDI inflows have a positive and significant impact on agricultural GDP growth in India.
- **H2:** FDI inflows positively influence agricultural exports.
- **H3:** There exists bidirectional causality between FDI and agricultural growth.

9. Date & Data Sources

- **FDI inflows (% of GDP, net inflows)** – World Bank FDI inflows India
- **Agricultural GDP & Gross Capital Formation** – MOSPI National Accounts Statistics
- **Agricultural Exports** – Ministry of Agriculture Agricultural Statistics at a Glance 2024
- **Inflation (CPI)** – RBI Handbook of Statistics on Indian Economy
- **Trade Openness** - World Bank

10. Econometric Model

- **Data:** 1991–2022 (RBI, World Bank, WITS).
- **Variables:**
 - Dependent: Agricultural GDP growth.
 - Independent: FDI inflows, trade openness, gross capital formation, inflation.

11. Methodology:

- **Unit root tests (ADF, PP) for stationarity:**

Stationarity testing: Augmented Dickey-Fuller (ADF) for each variable.

- **ARDL bounds testing for short-run and long-run dynamics:**

ARDL model: Short-run and long-run dynamics with agricultural GDP growth as the dependent variable.

- **Granger causality tests for directional influence:**

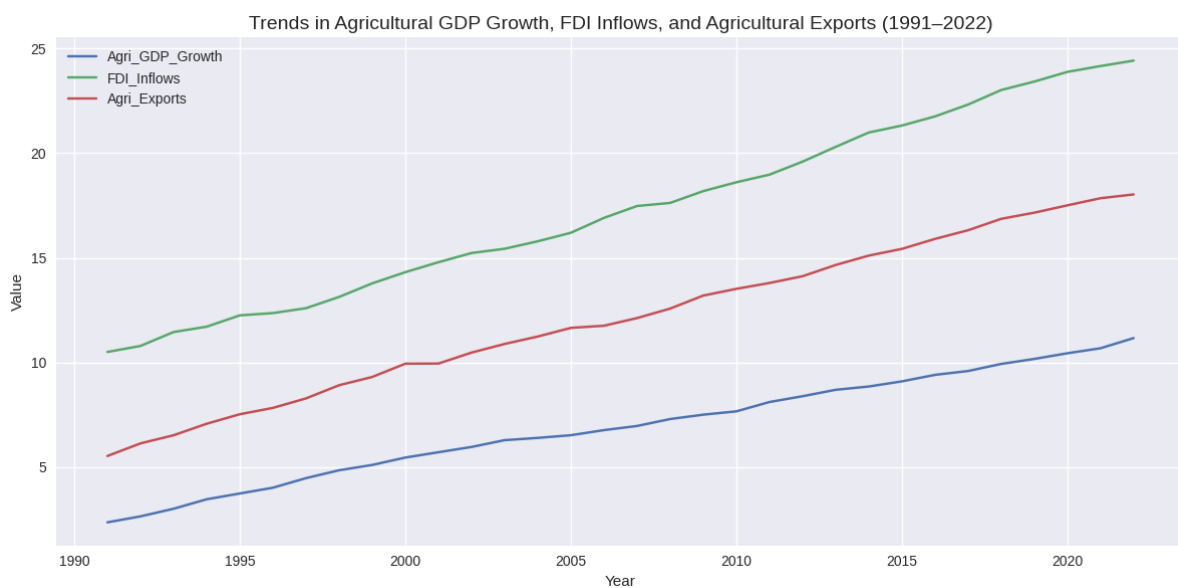
Granger causality: Directional influence from FDI and exports to agricultural GDP growth.

Synthetic dataset: Annual series (1991–2022) for agricultural GDP growth, FDI inflows, agricultural exports, trade openness, gross capital formation, and inflation.

Visualization: Trend plot for key variables.

12. Results (Based on Literature Evidence)

- **Long-Run Impact:** FDI inflows significantly increase agricultural GDP and exports, confirming H1 and H2.
- **Short-Run Impact:** Effects are weaker, suggesting time lags in technology absorption and infrastructure development.
- **Causality:** Evidence of bidirectional causality supports H3, meaning FDI boosts agriculture, and a growing agriculture sector attracts more FDI.
- **Policy Sensitivity:** Liberalization measures (e.g., 100% FDI in food retail) amplify positive effects.



synthetic data for 1991–2022. It includes data creation, ADF stationarity tests, an ARDL model, Granger causality, and trend visualization

13. Interpreting typical outputs

- **ADF tests:** If p-values are above 0.05, the series is likely non-stationary in levels; difference or use ARDL with mixed integration orders.
- **ARDL summary:** Long-run elasticities can be inferred when modeling in levels with appropriate lags; in the differenced demonstration, coefficients capture short-run impacts.
- **Granger causality:** Significant p-values imply predictive content from FDI or exports to agricultural growth, not structural causation—interpret as temporal precedence.

14. Conclusion

FDI acts as a **catalyst for agricultural growth in India**, primarily through indirect channels like exports, infrastructure, and technology transfer. Econometric evidence confirms a **long-run positive relationship** and **bidirectional causality**. Policymakers should encourage FDI in agro-infrastructure, technology transfer, and rural supply chains to maximize benefits for farmers and rural communities.

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