

Sharmiladevi, Jekka Chandrasekaran

## Article

# Impact study of agricultural value added on foreign direct investment, economic development, trade openness for India following ARDL approach

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## Impact study of agricultural value added on foreign direct investment, economic development, trade openness for India following ARDL approach

J.C Sharmiladevi

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\*Corresponding author: Sharmiladevi J.C., Symbiosis Centre for Management Studies, Symbiosis International (Deemed University), Survey # 231, Near Lunkad Gold Coast, Viman Nagar, Pune, Maharashtra, 411014, India  
E-mail: [sharmiladevi@scmspune.ac.in](mailto:sharmiladevi@scmspune.ac.in)

Reviewing editor:  
Goodness Aye, Agricultural economics, University of agriculture, makurdi benue state, Nigeria

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## DEVELOPMENT ECONOMICS | RESEARCH ARTICLE

# Impact study of agricultural value added on foreign direct investment, economic development, trade openness for India following ARDL approach

J.C Sharmiladevi<sup>1\*</sup>

**Abstract:** This research aims to identify the impact of agriculture, forest and fishing value-added on international business, capital flow, and economic growth for India from 2000 to 2022, by examining short-term and long-term equilibrium using the Auto Regressive Distributive lag (ARDL) approach. Agriculture value added is taken as a dependent variable, and inward Foreign Direct Investment (FDI), stock of net FDI, economic growth and trade openness are taken as independent variables. Results indicate that there exists a long-term and short-term relationship between agriculture value added, economic growth and trade openness. Economic growth and trade openness have a statistically significant relationship with agricultural value added in the short and long run. Inward FDI and stock of FDI are not significant to agriculture value added. ARDL Bound test results indicate that there is a long-term cointegrating relation among the variables. The error correction term is also strong and significant (-13.96), suggesting resistance to shocks. Existing

## ABOUT THE AUTHOR



J.C Sharmiladevi

Sharmiladevi J.C., born in the temple city of Madurai in Southern India, got her doctorate from Bharathiar University, Coimbatore, India. She teaches courses in Economics and Management domains. Her research works are in the areas of Foreign Direct Investment, International Finance, Financial Inclusion, Open Economy Macroeconomics, Higher Education, and Research Methodology. She works at Symbiosis Centre for Management Studies, Pune Symbiosis International (Deemed University), Pune, India. She has presented papers in many international conferences and reviewed papers in Scopus-indexed journals.

## PUBLIC INTEREST STATEMENT

Agriculture is the backbone of India and for many economies. Nations have overcome hunger and poverty, but food self-sufficiency and nutrition are still questionable. The focus and attention towards agriculture and allied sectors are blurring with time, leading to fundamental changes in food, health and wellness. General Opinions indicate that capital flow can bridge many development gaps and can bring growth. In contrast, a nation's absorptive capacity and government policy play a synergistic role in creating new areas of development and enhancing the existing structure of the agrarian base. Through this paper, the author touches upon the connecting areas of agriculture, forest and fishing value added with foreign direct investment, economic growth, openness to trade and agglomeration and attempts to evaluate the implications and dynamics in the short and long term, suggesting policy implications on bringing sustainable agriculture, ecological balance and food self-sufficiency.

literatures coverage on agriculture and international business is scarce in the Indian context, and this research will be significant in that line. The results of this study resonate with the findings of a few studies conducted in other geographical areas, indicating the fact that the receptivity and absorptive capacity prevailing in an economy play a dominant role in receiving maximum benefits from inward capital flow leading to economic growth. This research reinstates that agriculture still influences economic growth in India. Openness is essential for creating a conducive atmosphere for economic development. The study also indicates the direction for future research.

**Subjects:** Development Studies; Economics and Development; Economics

**Keywords:** agriculture value added; foreign direct investment; economic growth; trade openness

**JEL Classification:** F14; F63

## 1. Introduction

Food security is one of the prime agendas of the United Nations' Sustainable Development Goals for eradicating poverty, promoting health and nutrition and ensuring sustainability. Our planet's requirement for food is increasing in multi-folds. Growing food production demands a minimum of USD 80 to 83 billion investment annually for production and USD 300 billion per year in productivity enhancement. Promoting environmentally friendly technologies, expanding agricultural investment, research and extension systems, and enhancing farmers' education accompanied by technology transfer from developed countries are the crucial components of policy implementations to improve food security (Havemann et al., 2020; Msuya, 2007; Rockström et al., 2009; United Nations UN, 2015).

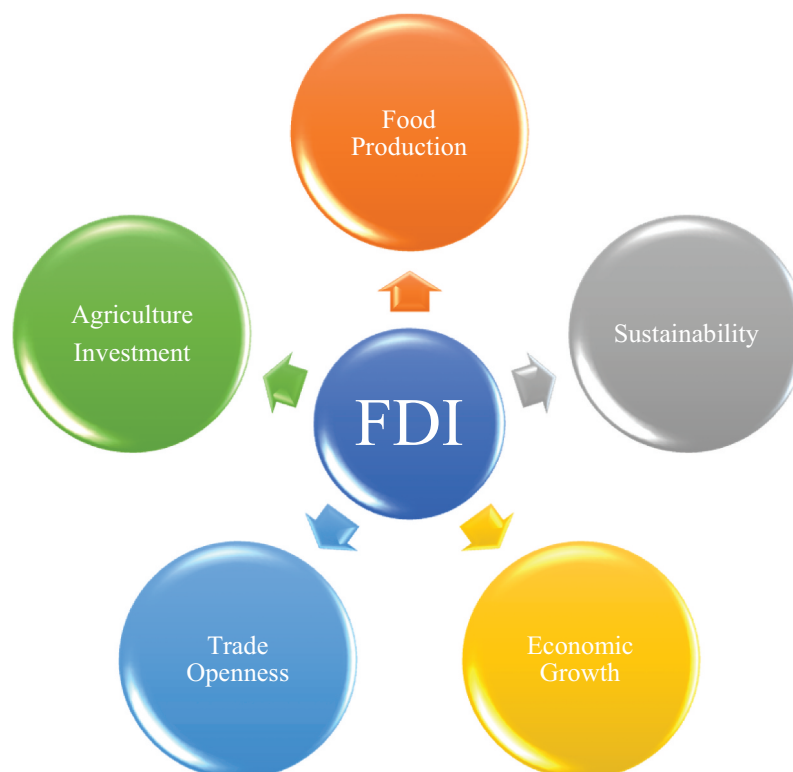
Agricultural and allied sector forms part of the global food system that ensures livelihood, health, equity, sustainability and economic growth (Liu, 2014). Global value added generated from agriculture, forestry, and fishing reached USD 3.6 trillion in 2020, with 65% contribution from the Asian region (FAO, 2022; Rockström et al., 2009). Agriculture, the home for 64.6 per cent of the population in India, is responsible for maintaining livelihoods as it supplies food and nutrients and is significant for rural development. The central role of agriculture in economic development has been debated for centuries; still, economic growth depends on the development of the agricultural sector, as the future depends on shared prosperity (Castaneda et al., 2016; Gollin et al., 2002; Schultz, 1964; Singer & Thorbecke, 1971). As many developing countries face increasing trends towards population, living standards and life expectancy, investment in agriculture and allied activities becomes a prerequisite for economic growth, income generation, industrialisation, food chain and for many upstream specialisations (Amendolagine et al., 2019; Datt & Ravallion, 1998; Dowrick & Gemmell, 1991; Punthakey, 2020; Schultz, 1964; Thirtle et al., 2003).

Agricultural development also burdens the environment with many pollutants like nitrate, ammonia, methane and nitrous oxide into the atmosphere, which also reduces productivity due to soil degradation (Nelson & Maredia, 2001). Clearing forests for cultivation often leads to biodiversity issues endangering species, requiring substantial investment to mitigate climate change and improve production, creating gainful employment and value creation (Nyiwul & Koirala, 2022). Bringing a trade-off between agricultural development and ecological and environmental balance is challenging. Although opportunities are available to bring balance, available solutions are complex. To conduct balanced agricultural activities, huge investments are needed. With government spending on agriculture declining, most developing countries struggle to enhance agricultural investments.

With low trade flows, the current Ukraine, Russia war and the subsequent sanctions on Russia are creating substantial challenges in the global food markets as many countries rely on Russian wheat and fertiliser imports (Behnassi & El Haiba, 2022; Osendarp et al., 2022; Parker, 2022). The Covid pandemic and the current geopolitical events are creating major implications on global supply that are closely linked with capital flows. Global air cargo is also affected due to air space bans between Russia and other countries (Guenette et al., 2022; Kennes et al., 2022; WTO, 2022). These inter-dependent geo-political happenings have major implications for food production, agriculture, supply chain, international business, FDI and economic growth. With insufficient outputs and poor income, overcoming food, land, and greenhouse mitigation gaps in food production and feeding the population can be an exorbitant challenge (Searchinger et al., 2019).

International capital flows like Foreign direct investment (FDI) possess the inherent ability to successfully address the above challenges (World Bank, 2020). Endogenous growth theories emphasise that FDI is a key determinant of economic growth, as they have the potential to reduce unemployment and increase productivity (Chenaf-Nicet & Rougier, 2016; Lipsey, 2000). Advocates of agriculture-led growth hypothesis indicate that investment in agriculture and allied activities create infrastructure which is a prerequisite for economic growth, a catalyst for national output growth via its effect on rural incomes and provision of resources for transformation into an industrialised economy, that can enhance well-being significantly (Datt & Ravallion, 1998; Dowrick & Gemmell, 1991; Jones, 1985; Kadir & Amalia, 2016; McArthur & McCord, 2017; Ozturk, 2017; Schultz, 1964; Thirtle et al., 2003; Timmer, 1995, 2002). Openness to trade positively impacts agriculture, as it encourages and increases production (Joël & Glory, 2018). Investments in agricultural infrastructure and eliminating income inequalities by adopting measures aimed at increasing the households' purchasing power, especially those in rural areas, are key drivers for improving food access in countries worldwide. Figure 1 illustrates the connection between FDI and other significant variables like agricultural investment, food production, trade openness, economic growth and sustainability.

**Figure 1. FDI relationship.**



Developing countries received the maximum share of FDI, but surprisingly, limited literatures examine the contribution of capital flows into agriculture. Therefore, this research aims to bridge this gap and empirically understand the dynamic relations among foreign capital flow, agriculture, international business, and economic growth, taking India as the sample country. Indian agriculture has been crucial in raising national income and ensuring food self-sufficiency. Currently, Indian agriculture is the global agricultural powerhouse by being the world's largest producer of milk, pulses, jute, and spices, and has the world's largest cattle herd (buffaloes). India is the second largest producer of rice, wheat, cotton, sugarcane, tea, groundnut, fruits, vegetables, and goat meat (Reserve Bank of India, 2022). This sector could withstand the COVID-19 shock and registered an above-average real growth of 3.6 per cent in 2020–21. When many nations were trying to pile up their food grains stock due to rising concerns of the pandemic, India was comfortable with buffer stocks of food grains with public stocks of cereals at 2.8 times as per norms (Reserve Bank of India, 2022). Supplying with healthy investments, the Indian agriculture sector can get the potential to feed the entire world, which makes this study vital. Anthropogenic emissions, climate change, overgrazing, subsistence farming, subdivision, and land fragmentation are some of the classical limitations of Indian agriculture, apart from others. Indian agriculture is facing many challenges, a few of them including but not limited to fragmentation, lack of awareness, and portfolio risks (WTO, 2022). Agriculture growth across different states in India is different due to various reasons like agro-climatic ecological conditions, cropping pattern, input usage, infrastructure support, yield levels, etc., and faced many changes since the introduction of the green revolution in 1960 (Chatterjee, 2017).

The focus of most of the literatures are on identifying some of the conventional areas like determinants, impacts, effects, spillovers, and composition of FDI. With rising global capital flows across various sectors, literature studies about inward FDI in the primary sector are niche despite its significance. This research gap needs to be addressed. Further, the existing extant literature indicates contradictory results, leading to inconclusive evidence. The use of different variables, time periods studied, data sets and methodology adopted are also responsible for dissimilar results. Literatures that indicate the comparative overall effects and benefits of agricultural value added on economic growth, FDI and openness to trade are not done in the Indian context. India is the second largest recipient of inward FDI compared to other emerging economies. Studies on FDI follow a quantitative approach and overlook the endogeneity issues associated with the time series model. Considering the above issue, this study used the autoregressive distributed lag (ARDL) model and has overcome endogeneity and ensured stability. ARDL-bound testing ensures the presence/absence of cointegration. Further, the error correction estimation establishes the equilibrium relations and speed of adjustments of returning back to equilibrium after any potential shocks. This paper addresses the research issues with respect to understanding the impact and dynamics of agricultural value added upon FDI, international business and economic growth by following the ARDL approach, checking for the presence of cointegration, bounds test and error correction modelling. The rest of the paper covers literature reviews, methodology adopted, discussion of results, policy implications and direction for future research.

## 2. Literature review

The literature survey consists of four sub-sections. The first sub-section deals with the review with respect to international capital flow and agriculture, covering dependency theory, modernisation theory and globalisation impact. The second sub-section reviews the literature on food production and agriculture; the third covers economic growth and agriculture, and the fourth deals with trade openness and agriculture.

The three pillars of international capital flow and agriculture – the dependency theory, modernisation theory and globalisation impact, as mentioned by Mihalache O'Keef & Li (2011) reflect three different views about the nexus between capital flow and agriculture. Dependency theory indicates that inward foreign capital increases income inequality, leading to food insecurity and dependency (Matunhu, 2011). Modernisation theory indicates that foreign capital flow creates

growth, benefiting the host and source country by disseminating knowledge, methods, and innovations that lead to transformation, thereby creating awareness and development. The globalisation view indicates that the globalisation-induced development outcomes of the late 20<sup>th</sup> and early 21<sup>st</sup> century are mostly in manufacturing and services trade and can be called financial globalisation rather than globalisation in general, leading to an imbalance within and between countries and within and between sectors, shifting agriculturist into manufacturing and service businesses (Nayyar, 2006). Nayyar also indicates that countries which received foreign investments were not able to develop their agricultural prowess as its progress is not dependent wholly on national characters, but it is deeply intertwined in international policy and political developments, regulatory mechanisms, etc. Few of the compliances and regulatory mechanisms, like the patenting of seeds and the presence of strong multinationals in farm equipment and inputs, crowd out small farms, resulting in multiple challenges (Hartungi, 2006). Reviews about dependency and modernisation theory embrace foreign capital for agricultural performances, while that of globalisation impact has shown mixed results with specific outcomes across regions.

### **2.1. Nexus between agriculture and food production**

FDI in agriculture guarantees food security, as it can expand the market, agro-technology, management expertise, and employment opportunities (Jiang et al., 2018), significantly creating positive impacts in the short run (Edeh et al., 2020). Nyiwul and Koirala's (2022) study suggests that the primary sector receives medium- and long-term positive benefits from FDI and recommends improving institutional mechanisms in favour of foreign investments. Agricultural FDI promotes green total factor productivity (Wang et al., 2019), enhances national welfare by preventing unemployment (Chaudhuri & Banerjee, 2010), and positively influences food security by expanding land used for crop production (Santangelo, 2018). Studies conducted by (Almfraji & Almsafir, 2014; Bilal Khan et al., 2019; Magombeyi et al., 2018; Shamim et al., ; Ucal, 2014; Zaman et al., 2012) indicated that FDI established strong linkages, and these linkages are utilised for creating growth which are useful for poverty alleviation.

For Africa, inward FDI directly impacts agricultural production and guarantees national food security by expanding the markets and bringing in new technology, managerial expertise, and employment, thereby reducing the burden on domestic capital and leading to moderating the effect of the government's investment burden in research and development on agriculture production (Adom et al., 2018). Dhahri and Omri's (2020) study explains that different types of foreign assistance impact agriculture production and can reduce food insecurity and poverty. In the meantime, Hartungi's (2006) study believes that the influence of multinational companies (MNEs) can lead to fundamental changes in basic agricultural practices that can pose multiple threats to small farmers in developing countries. Further, this study also makes us think that the interference of the World Trade Organisation (WTO) with their regulatory mechanisms like seed patenting is most advantageous to developed countries and MNCs rather than to small farmers. Multiple literatures indicate positive impact of FDI on agriculture (Antwi et al., 2013; Baba Insah, 2013; Gameli Djokoto et al., 2014; Msuya, 2007; Oloyede, 2014; Sakyi, 2011).

### **2.2. Nexus between agriculture and economic growth**

Literature that studied the nexus between FDI and economic growth indicates three views – positive, negative and dependent. The positive view comes under neoclassical economic growth theory, indicating the positive impacts and endogenous growth effects. The negative view indicates the creation of inequalities like monopolies and income repatriations. The dependent view indicates the absorptive ability of the host country from FDI flows (El-Wassal, 2012). Few literatures on positive view includes, but not limited to (Bashir, 1999; Choong et al., 2010; Elkanj et al., 2013; Eller et al., 2005; Kumar & Pradhan, 2005; Lai et al., 2009; Li & Liu, 2005; Moran et al., 2005 and Samimi et al., 2010), literatures indicating negative views include (Chase-Dunn, 1975; Bornschier et al., 1978; Nolan, 1983;) literatures on dependent view include (Alfaro et al., 2004; Alfaro & Charlton, 2007; Ang, 2009; Antràs, 2003; Azman-Saini et al., 2010; Balasubramanyam et al., 1996; Blomstrom & Kokko, 1994; Borenzstein et al., 1998; Findlay, 1978; Mody & Murshid, 2005;

Rajan & Zingales, 1998 and Wang & Blomström, 1992). Some studies also show no evidence of either positive, negative or dependent views, which includes - Carkovic and Levine (2005), and Mohamed et al. (2013).

There exists a significant positive effect of FDI on domestic capital formation, as FDI generates technology diffusion (Borenzstein et al., 1998), creates innovative alternative management practices, and instrumental in enhancing skill, diffusion of knowledge, and technology (Balasubramanyam et al., 1996; De Mello, 1999), creates capital spillovers and paves way for knowledge transfer (Grossman, 1991; Lensink & Morrissey, 2001), faster GDP growth (Tian et al., 2004), enhance the speed of development of product varieties and quality, leading to international collaborations (Ikiara, 2003), adds to total factor productivity and income growth (Blomström et al., 2003; Chen & Démurger, 2002). Mihalache O' Keff & Li's (2011) extensive study confirms that FDI impact is not similar across primary, secondary and service sectors, and one needs to examine the firm-specific flow, composition and impacts of FDI across sectors syncing with other factors. Djokoto (2013) indicates that agricultural FDI crowds in domestic investment. Epaphra and Mwakalasya's (2017) empirical study indicates poor to no significant effect of FDI inflows on the agriculture value added-to-GDP ratio. Iddrisu et al. (2015) found that FDI in agriculture negatively impacted agricultural productivity in the long run but created a positive effect in the short run.

A recent study by Dinga (2023) indicates that agricultural value added is a suitable transmission mechanism through which GDP can affect ecological poverty. Another recent study by Zhao and Chen (2023) identified that agricultural investments are more tilted towards the developed countries, especially the USA, China and Russia, and food-insecure countries received only 20% of investments. The causality between agriculture value-added and FDI varies according to the region (Singh & Dhiman, 2023). Andrianarimanana et al. (2023) study suggests that FDI can boost the agriculture sector, especially in sustaining the spices supply chain. Lin and Yang (2017) panel study of ten sectors in China indicates that FDI can increase the degree of openness overseas for the agricultural product processing industry by narrowing the technology gap between the home and host countries. Climate Smart Agriculture (CSA) is adopted as a strategy for facing the challenges of climate change on food security. A lack of financial resources constrains the adoption of CSA (Amadu et al., 2020). Climate finance to support such initiatives needs hand holdings from private sector investments and public sector finance to create climate-resilient agricultural development. Conservation Agriculture (CA) has a significant role in addressing issues like food insecurity, climate change, biodiversity loss, environmental degradation, unsustainable diets and ill health (Kassam et al., 2022). Investments in creating climate-resilient agricultural development are likely to meet only a small share of total agricultural investment needs, estimated at US\$ 209 billion per year by 2050, to increase production to meet the demand (Lipper et al., 2014). Review study by Nugroho and Lakner (2022) recommends certain changes to enhance the benefits of economic growth and agricultural development, especially for developing countries, like enhancing skill formation and capacity building, elimination of disincentive policies, and creating partnerships with industries in developed countries to intensify research and development.

### **2.3. Nexus between agriculture and trade openness**

Agricultural sector performance and trade openness positively impact economic growth as per studies conducted by Joël and Glory (2018); De Silva et al. (2013); Potelwa et al. (2016); Laiprakobsup (2014). More open economies attract substantial investments (Mazhikeyev et al., 2015). Latin American countries that followed import substitution industrialisation experienced less economic growth than the East Asian Tigers, who embraced an export-led growth strategy and received substantial growth rates (Pigka-Balanika, 2013). Agriculture value added can significantly diversify the export sector, minimising carbon dioxide emissions using advanced technologies (Wang et al., 2020). Trade openness created a positive effect on the agricultural performance of Belarus (Mourão, 2015). Two studies conducted across different periods, one in 1995–2009 (Djokoto, 2013), and another in 1980–2013 (Iddrisu et al., 2015), for Ghana, indicated dissimilar and opposite results on the impact of trade openness and agriculture. Djokoto's study says that

agricultural performance was not found to be significant with trade openness and FDI in the long run, but in the short run, it showed statistically negative results. Nevertheless, Iddrisu et al.'s study results indicated that the effect of trade openness on agriculture was positive and significant in the long run. Dissimilar results of these two studies indicate that, using different statistical techniques (ARDL in the former, cointegration in the later), the time period studied can impact the study outcomes to a larger extent.

Openness as a factor influencing inward FDI, thereby leading to creating impacts, is scarcely studied in literatures. One segment of studies indicates that trade openness promotes competition, leading to increasing efficiency in all areas of production (Helleiner, 1994; Nishimizu & Page, 1982; Ricardo, 2020; Smith, 1776; Tybout, 1992). The place occupied by trade openness in the current dynamic world with non-competitive pricing and national protection needs to be analysed because openness is not leading to enhancement and uniform development in all countries (Adenutsi & Ahortor, 2008; Demery, 1994; Elbadawi, 1992; Elbadawi & Rocha, 1992; Killick, 2010; Todaro, 1995).

A survey of the existing literatures on FDI in India indicates that more studies are concentrated in the manufacturing sector, followed by the service sector. As FDI received in the primary sector is very low, literatures that jointly studies agriculture and FDI are also less in number. An increasing number of studies are on understanding the determinants of inward FDI, which identifies different macroeconomic variables influencing inward FDI, followed by literatures about identifying the impact of FDI. Few studies are available on spillovers of FDI in different sectors of the economy, especially the manufacturing sector. We can see studies undertaken to check the advantages/disadvantages received by domestic and foreign firms due to inward FDI. Some studies identify the sectoral distribution and effects of FDI. Very few specific studies have been done on identifying the effect of inward FDI upon the primary sector, except for a few like Kaur et al. (2022); Glady (2019); Emir et al. (2022); and Naseem et al. (2021). Kaur et al. (2022) research indicates that agricultural FDI increases agricultural exports from India and enhances economic growth; Glady (2019) recommends the removal of barriers to FDI; Emir et al. (2022) study conveys that agriculture and FDI along with other variables favourably impact economic development and are also instrumental in causing environmental damage. Taking the electricity consumption in agriculture along with other variables, Naseem et al. (2021) study indicated an insignificant association between carbon dioxide emission and agricultural electricity use. Table 1 lists recent studies in the above-mentioned lines, indicating the extant literature available in this sector for India.

From the literature survey above, one can understand that studies that examine the effects and impacts of agriculture and its allied sector upon international capital flow especially FDI have not taken the centre stage of FDI literatures. Further, studies focussing and identifying the impact of agriculture, forest and fishing value added upon foreign capital inflows, economic development and openness to trade in the Indian context are extant. This study intends to fill the gaps in the existing literature on FDI and agriculture.

### 3. Methodology

This research is an applied research following empirical design. The objectives of this research are to identify the long-term and short-term impact of agricultural value added on FDI, international business and economic development and to understand the dynamic effect of agricultural value added on inward FDI, international business and economic development. Data source is the World Bank World Development Indicator, and the time period is from 2000 to 2022. Since the variables are a mixture of I (0) at level and I (1) at first difference, Auto-Regressive Distributed Lag (ARDL) and error correction metric (ECM) are studied to understand their relationships (Narayan and Smyth, 2005). The model used in this study is specified below.

**Table 1. Classification of recent literature on FDI in India**

<b>Cluster 1: Studies that identify the determinants of FDI</b>	<b>Cluster 2: Studies that identify the impact of FDI</b>	<b>Cluster 3: Studies identifying the spillovers of FDI upon different sectors</b>	<b>Cluster 4: Comparative studies about FDI receiving VS domestic firms</b>	<b>Cluster 5: Sector- specific effects of FDI</b>	<b>Cluster 6: Studies related to agriculture/ primary sector and FDI</b>
<i>Wagner and Delios (2023), Joo and Shawl (2023), Hartmann and Spruk (2023), Wannisinghe et al. (2023), Goswami (2023), Nadig and Viswanathan (2023), Bildirici and Çoban Kayıkçı (2023).</i>	<i>Asteriou &amp; Jefferies, (2023, Uddin et al., (2023), She &amp; Mabrouk, (2023), Tripathy et al., (2023), Kumari et al., (2023), Roy, 2023, Yoganandan &amp; Vasan, (2022).</i>	<i>Sarkar &amp; Lai, (2009), Ahmed &amp; Kialashaki, (2023), Roy &amp; Paul, (2022), Friedt &amp; Toner-Rodgers, (2022), Verma et al., (2022).</i>	<i>Saikia, (2022), Sharmiladevi, (2022), Ramachandran et al., (2020), Arora &amp; Lohani, (2017), Kuntluru et al., (2008).</i>	<i>Mehta et al., (2023), Aktaş &amp; Gattai, (2023), Ganai et al., (2023), Bhat et al., (2023), Fujimori et al., (2020); Ghosh, (2016)</i>	<i>Chaudhary (2016), Kaur et al. (2022), Glady (2019), Emir et al. (2022), Naseem et al. (2021)</i>

Source: Prepared by author.

### 3.1. Variables used

Variables studied are agriculture value added, foreign capital, openness and economic development. Agricultural value-added is measured through agriculture, forestry, and fishing value-added; net inflows of foreign direct investment are used for measuring foreign capital flow; economic growth is measured through gross domestic product; and openness is measured through imports and exports upon the gross domestic product

### 3.2. Control variables

Agglomeration: Stock of FDI or net FDI is used as the control variable in this model, as FDI has the inherent character of following previous investments (Krugman, 1997). Investors take inputs from previous investments in host countries to overcome the gaps in decision-making and uncertainties (Miniesy et al., 2019). Stocks of FDI are proxied for agglomeration. Results are expected to be positive.

### 3.3. Independent variables

Agriculture, forest and fishing value added: To understand the effect, impact, and direction of international business upon the primary sector, agriculture forest and fishing value added is used in studies in the literature (Iddrisu et al., 2015; Nyiwul & Koirala, 2022).

Economic Development: Gross domestic product (GDP) is proxied for economic development (Nyiwul & Koirala, 2022)

Trade openness: The openness of an economy, level of openness, and openness to trade is measured by adding exports with imports and dividing the same by gross domestic product (Djokoto, 2013).

### 3.4. Model and model specification

The variables are first checked for stationarity. After ensuring stationarity to incorporate endogenous and exogenous variables, an autoregressive distributed lag model is employed to understand the short-run effect and the long-run effect is measured with bound testing; error correction will indicate the stability of the model. Once the model is ensured with short-run equilibrium and long-

run cointegration and error correction, the model will be further checked for stability, normality, and collinearity. ARDL with other statistical tests like cointegration error correction were extensively employed to find out the long-run, short-run dynamic and equilibrium relationships in literatures (Ahmad et al., 2020; Narayan & Smyth., 2005). Studies like Chaudhry & Choudhary 2006; Pesaran et al. 2001; Zachariadis 2006 have used ARDL to investigate the relations between GDP with other variables. The ARDL model used in this study is given below. Equation (1) indicates the functional relationship among the variables. The Error Correction Model (ECM) representation of ARDL is formulated with reference to equation (2) in order to examine cointegration if present, among the variables defined in equation (1)

$$DAVA_t = f(DIFDI_t, DGDP_t, DTOP_t, DFDIN_t) \quad (1)$$

$$\Delta DAVA_{(t)} = \beta_0 + \beta_1 \Delta DAVA_{(t-1)} + \delta_1 LIFDI_{(t-1)} + \delta_2 LGDP_{(t-1)} + \delta_3 LTOP_{(t-1)} + \delta_4 LFDIN_{(t-1)} + \varepsilon_{(t)} \quad (2)$$

where

$\Delta DAVA_{(t)}$  = agriculture value added

DIFDI = inward FDI

DGDP = GDP

DTOP = trade openness

DFDIN = net FDI

$t$  = time from 2000 to 2022

$t-1$  = one period lag

$\beta$  = intercept

$\delta_1, \delta_2, \delta_3$  = coefficients

$\varepsilon$  = error term

#### 4. Analysis and interpretation

The dependent variable is agriculture, forest and fishing value-added, and the independent variables are inward FDI, GDP, trade openness and net FDI. Appendix 1 gives brief descriptions of the variables. Augmented Dicky Fuller (ADF) unit root test checks stationarity. All the variables are integrated to the I(1) order at first difference. Appendix 2 gives the details of the order of integration of variables. As the study variables follow I(1) order of integration, the ARDL model is suitable for checking the effects between independent and dependent variables.

ARDL model is run with one period lag and is found significant as the p-value is 0.00. The probability scores of GDP and trade openness are significant, but inward FDI and net FDI are not significant. Bounds test was carried out to understand the effects in the long run. Long-run Bound test estimation indicates the existence of cointegrating relations, as the F statistics value is above the lower and upper bound as shown in Table 2, ensuring long-run equilibrium cointegrating relations among the test variables. Long-run GDP and trade openness scores are significant at 5 per cent level and inward FDI and net FDI are not significant. From the long run coefficient scores, it is seen that a one per cent increase in agriculture value added will lead to 52.9 per cent increase in GDP as mentioned in Table 3.

**Table 2. ARDL bound test results**

Model	99% critical values		
$\text{LnAVA}_t = f(\text{LnIFDI}_t, \text{LnGDP}_t, \text{LnTOP}_t)$	Lower bound	Upper bound	F-Stat
Null Hypothesis No long-run relationship $\beta_1 = \beta_2 = \beta_3 = \beta_4$ No short-run relationship $\phi_1 = \phi_2 = \phi_3 = \phi_4$	3.74	5.06	6.947**

Note(s): \*\* indicates 1% statistical significance level.

Source: Authors' calculations from Eviews.

**Table 3. Long-run coefficient estimates**

Independent variables	Coefficient (standard error)	t stat (prob)
IFDI	-0.035(0.017)	-2.03(0.06)
GDP	0.529(0.035)	14.85(0.00)
TOP	-0.00(0.00)	-6.38(0.00)
FDIN	-0.035(0.01)	-2.03(0.06)

R-Square 0.74

Adjusted R-Square 0.70

Durbin Watson Stat-1.92

F Stat 16.76

Prob (F-Stat) 16.76

Normality [Jarque-Bera] 1.297

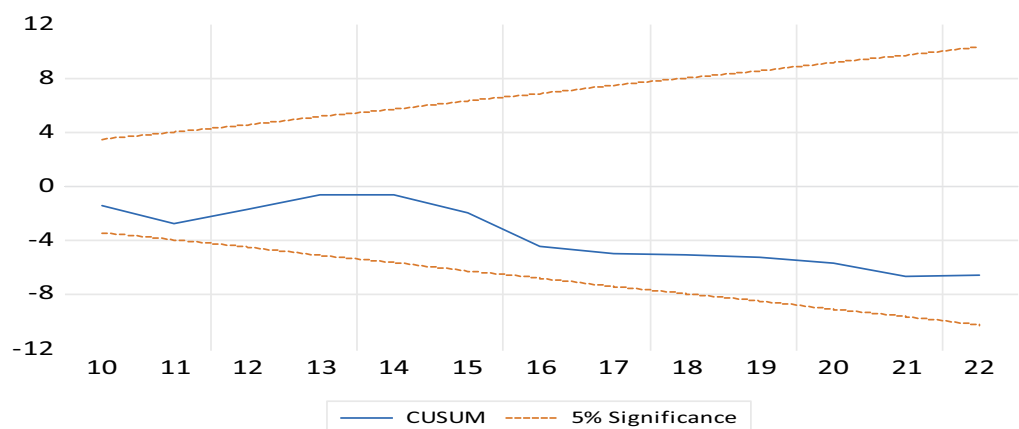
Heteroskedasticity test Breusch-Pagan-Godfrey (p-value) 0.287

Ramsey RESET test [F-statistics] 0.986

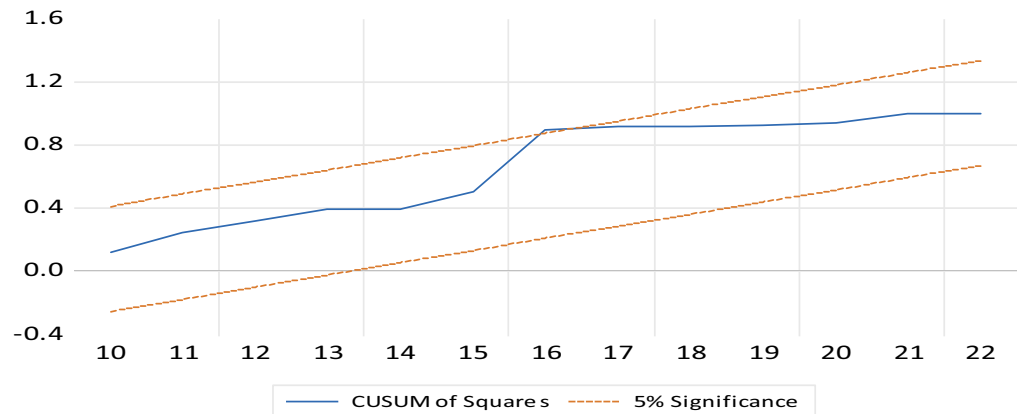
Source: Authors' calculations from Eviews.

Error correction estimates adjustments, causality, feedback, and dynamic relations among the variables. ECM integrates short-run and long-run equilibrium without losing the long-run information and takes care of spuriousity. The coefficient of error correction term shows the speed of adjustment from the short run to the long run for any disequilibrium and long-run causality relations. The error correction term is significant. The coefficient of ECM is -13.96, which means, the speed of adjustments for the previous year's errors and shocks will be corrected in the current year at a speed of adjustment of 139.6 per cent. R square value is 74 per cent, and the adjusted R square is 70 per cent, Durbin Watson score, F Stat score of 16.76 and probability scores indicating model fitness.

**Figure 2. CUSUM.**



**Figure 3. CUSUM sum of squares.**



Residual diagnostics with heteroskedasticity test of Breusch-Pagan-Godfrey, normality test with Jarque-Bera scores, and stability test using CUSUM test and CUSUM of Squares were conducted. The results of the above estimates are shown in Figures 2 & 3. Stability diagnostics are validated as the spread of the graph for CUSUM and CUSUM of Squares are within the upper and lower red lines. All the stability diagnostics tests are showing significant results, indicating no sign of heteroscedasticity, non-normality, serial correlation thereby ensuring stability.

### 5. Conclusion, policy implications and direction for future research

Literatures examining the impact of inward FDI and agriculture value added is scanty, so the objective of this study is to identify the dynamic effect of agricultural value added on FDI, international business, agglomeration and economic development and this study can make a significant contribution to that direction and gains importance to systematically understand the dynamic influence of agriculture value added on major macroeconomic indicators. Results of ARDL model indicates that there is a strong influencing and supporting short-term relationship among agriculture value added, economic growth and trade openness, similar to the study results of Iddrisu et al. (2015) for Ghana. In the long run, only economic growth and trade openness are significant to agriculture value added. This result goes in sync with the studies of Chaudhuri and Banerjee (2010) and Datt and Ravallion (1998) demonstrating the phenomenon that agriculture in the current time period is still concrete and acts as a significant indicator for economic growth for India. The probable reasons for the above phenomenon can be a. FDI takes time to get absorbed and exhibit visible results in the economy, b. the role played by inward FDI is different across different sectors, c. domestic industries do not have similar absorptive capacity and technology base (Borensztein et al., 1998; Hirschman, 1958; Li & Liu, 2005). Given the current technological progress, there is clear and significant evidence that domestic firms are finding it challenging to match with the absorptive capacities of foreign firms, as mentioned by I. Blomstrom et al. (2003), that FDI can create economic development in economies, provided, the domestic sectors have adequate absorptive capacities. Error correction term indicates that the speed of adjustment for any disequilibrium is very high. This phenomenon reflects the economic stability of India. Stability is a significant and welcoming determinant for receiving foreign capital and favourable international businesses. The political and economic conditions prevailing in India currently are conducive for receiving more FDI, signalling the abundant opportunity for international business. This study ensures novelty, as it bridges the gap in existing literatures in terms of linking the primary sector with international business, economic development and openness.

This study recommends an examination of the dynamic relations at the firm level to understand better the impact and outcomes of inward FDI with agriculture. Reflecting upon the study results of Ju et al. (2022) on trade openness and agriculture, this study demonstrates that India still needs time to harvest the benefits of international business in its primary sector.

India needs firm policies that can encourage FDI in the primary sector, especially in areas of technology transfer and physical asset creation. Stringent implementation of policies at the grassroots level is essential for the success of any initiative. Investments in technology areas that can minimise post-harvest loss and enhance rural supply chain, cold storage, and farm exports can help to harvest the benefits of both trade and foreign investment upon growth.

Recollecting the study of Prof. Deepak Nayyar and Prof. Abhijit Sen, disentangling the effects of trade policies on domestic agriculture is challenging, as agrarian developments are interconnected with international trade, so the long-term impact of trade policies are determined by interactions of changes in national and international trade policies (Nayyar & Sen., 1994). This phenomenon holds valid in the current time period also. When the Indian government increased budgetary spending to 9.6 per cent of gross farm receipts in 2019–20, it resulted in negative outcomes and decade-long fluctuations due to multiple international developments and climate dependency. Budgetary payments did not offset the price-depressing effect due to complex domestic marketing regulations and trade policy measures in 2002–02 (Martin, 2022). To reduce trade barriers, the Ministry of Commerce and Industry removed the selected list of pulses from the import quotas effect from November 2021, temporarily removing tariffs on lentils, and suspended tariffs on crude palm oil, crude soybean oil, and sunflower oil until March 2022. The subsidy of Sugar exports was reduced to 33 per cent per tonne, aiming to gradually reduce export subsidies.

Food security has been an important objective of the agricultural and trade policy of the Indian government since India's independence, and various measures have been taken to ensure food security and self-sufficiency. The government introduced the *Pradhan Mantri Garib Kalyan Anna Yojana* (PMGKAY) food distribution programme in November 2021 in response to the second wave of the COVID-19 pandemic; a plan of USD 1.48 billion was announced in July 2021 to enhance food self-sufficiency and to reduce vegetable oil imports bill. In the Union Budget 2021–22, the government introduced new services and programmes focusing on disease control, storage, marketing and infrastructure. The Union Budget 2022–23 introduced measures to improve financial services to farmers with a new fund started through the National Bank for Agriculture and Rural Development to finance start-ups in agriculture and other rural enterprises, to bring digitalisation in agriculture, marketing and extension services. A recent study by Tian (2023) reflecting the above suggests that foreign capital investors check host country initiatives towards creating positive spillover effects, such as programmes supporting food crop production and agricultural research.

Future studies can emphasise enhancing agricultural productivity to ensure food security on the one hand and ensuring environmental stability on the other hand. The increase in agriculture production also has its flip side of creating pollution, causing damage to human health, deforestation, climate change, and carbon dioxide emissions (Ahmed et al., 2022; Alharthi et al., 2021; Liu et al., 2022), as most countries failed to look into the environmental consequences of development for many years. Forest-dependent people and small agricultural holders who constitute one-third of the global production live inside the forest and depend heavily on the forest for livelihood and products have not yet received enough attention in many policy documents. The structure of global food production and the diversity of food supply, current and future practices on food production are fundamental for designing feasible responses towards attaining health for all (Hazell et al., 2010; Herrero et al., 2017; Newton et al., 2020; Ricciardi et al., 2018).

Globalisation-induced development and financial development are causing undue pressure on the environment, leading to natural resource depletion, environmental degradation, rise in temperature as documented in many developed and developing countries like Canada, Bangladesh, Latin America and India (Islam et al., 2021; Khan et al., 2022; Tillaguango et al., 2021). As the number of multinational companies' greenfield and brownfield FDI is increasing in developing countries, it is essential to calculate the implications of the Pollution Haven Hypothesis upon inward FDI to understand the net impact of capital flow-induced economic development (Dagar et al., 2022). Assessing the ecological footprint's economic complexity is essential to better

understand environmental degradation (Alvarado et al., 2021). As India has many agro-climatic zones, efforts towards enhancing farmers' education in identifying the best alternative crops across such zones will help farmers plan the cropping patterns (Dagar et al., 2021). Governments must start focusing on current and future domestic developmental prospects when receiving foreign capital; at the same time, multinational and global entities must ensure that they are fulfilling the specific development requirements in the investing countries by following fair and ethical business practices when undertaking investments abroad.

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#### Author details

J.C Sharmiladevi<sup>1</sup>

E-mail: [sharmiladevi@scmispune.ac.in](mailto:sharmiladevi@scmispune.ac.in)

ORCID ID: <http://orcid.org/0000-0001-8917-8056>

<sup>1</sup> Symbiosis Centre for Management Studies, Symbiosis International (Deemed University), Pune, India.

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## Appendix 1

Variable Description	Variable Representation	Description
Agriculture Forest & Fishing Value added	AVA	Agriculture Forest & Fishing Value added (constant 2015 US\$)
Agglomeration	IFDI	Foreign direct investment, net inflows (% of GDP)
Economic Growth	GDP	GDP Constant 2015 US\$
Foreign direct investment net FDI	NFDI	Foreign direct investment net (BOP Constant US\$)
Trade Openness	TOP	Exports added to imports and divided by GDP

## Appendix 2

Variables	At Level	At First Difference
<b>AVA</b>		
Constant	0.385(0.977)	-4.975(0.00)
Constant & Linear	-3.449(0.07)	-4.562 (0.00)
None	4.360 (0.999)	-3.628 (0.00)
<b>FDIN</b>		
Constant	-1.195(0.656)	-6.258 (0.000)
Constant & Linear	-2.534(0.310)	-6.200(0.000)
None 0.999	1.140(0.928)	-5.923(0.000)
<b>GDP</b>		
Constant	-0.880(0.774)	-4.614 (0.00)
Constant & Linear	-1.687 (0.722)	-4.700 (0.00)
None	8.042 (1.00)	-0.710 (0.395)
<b>IFDI</b>		
Constant	-2.372 (0.160)	-5.133(0.00)
Constant & Linear	-2.202 (0.465)	-5.073 (0.002)
None	-1.329 (0.164)	-5.254 (0.00)
<b>TOP</b>		
Constant	-0.243(0.918)	-4.561(0.00)
Constant & Linear	-0.800 (0.950)	-5.113 (0.00)
None	-0.996 (0.276)	-4.463 (0.00)