

The Impact of FDI Inflows on Agricultural Output: A Pan-India Study Across 30 Years of Economic Liberalisation

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Abstract

In India, the agricultural industry generates 49% of employment and roughly 15.9% of the 2.7 trillion US dollar national GDP (2018–19). From a socioeconomic perspective, the agricultural industry is the most significant and requires attention at all levels. The Indian government is calling for the goal of achieving the epitome of the need to pursue all viable avenues for raising agricultural productivity and farmer profitability, with an added goal of accelerating efforts to achieve the Sustainable Development Goal of eradicating hunger, poverty, and malnutrition. It should be perceived as an integral part of a greater biome enveloping the entire primary sector including animal husbandry, fisheries, agricultural machinery, food processing industry and other allied activities.

By compensating the investment and technological disparity through enhanced trade position, foreign direct investment (FDI) plays a major role in hovering productivity. The government has permitted 100% of foreign direct investment to enter the agricultural sector and is adamant about portraying it as a potential industry for players on the world stage. Along with increasing capacity and yield, innovative agricultural practices that increase cash inflow and yield can also be used by farmers thanks to foreign investment in agriculture.

The agricultural sector of India is resilient; even in the face of the COVID-19 pandemic as it grew at a consistent 3.4 percent annual pace between 2020 and 2021, contributing 17.8 percent of the nation's GVA in 2019–20 (inflation un-adjusted prices).

In this paper, efforts have been made to establish a connotation between agricultural productivity and FDI, arable land, bank credit and agricultural raw materials imported using econometric tools. Considering a range of 30 years (1990–2020), time series records of food and non-food crops along with FDI inflows are associated and a robust relationship is recognised.

Keywords: FDI Inflow, Agricultural Productivity, Food crop and Commercial crop, ADF test

Introduction

Agriculture is a core sector of Indian economy in view of its contribution to employment and GDP since the independence in 1947. Venture in agriculture is essential to the growth of the industry and helps new technology get adopted. However, even with the most affordable interest rates, no amount of credit can ensure increased productivity or sufficient income for farmers, as their success depends on a host of other factors, such as the accessibility of agricultural inputs, ownership of land, institutional finance, subsidizations, facilities, and above all, the markets that will pay for their products. According to the CSO's provisional estimates of 2020 on national income, the country's Gross Value Added (GVA) at current prices for 2019–20 is 17.8 percent, with the agricultural and related sectors accounting for the majority of this share. Nonetheless, according to the Economic Survey-2020-21, (GOI) the GVA for agriculture increased by 3.4 percent in 2020–21 even while the GVA for the total economy shrank by 7.2 percent.

Directed ground level credit, interest support schemes, and directed loaning are the key supply-driven mechanisms used in India's agricultural credit programs. In the area of agricultural finance, these policies—along with other policy interventions at the government and RBI levels—have produced excellent results. The agronomic sector still faces a number of hitches, though, including a deficiency in capital

materialization, provincial incongruities, a dependence on non-institutional sources of loan at significantly higher rates by particularly small and marginal farmers, lessee farmers, landless labourers, and sharecroppers, anguish caused due to farmers not realizing the fair price for their produce, and the impact of farm loan waivers on credit culture and state finances.

Numerous notable changes and reforms have been implemented in the Indian agriculture sector. Farmers can sell their produce to whoever and wherever they like, according to the government's new agriculture policy. To adapt to the shifting dynamics and keep current with market knowledge, farmers would need to use new inventions. Engaging food producers and customers in new ways could be possible with the government's ambitious farm liberalization program, which took the form of three acts that are being enacted into law.

Along with increased funding, innovative farming practices that boost yield and production capacity are made possible by foreign investment in agriculture. But the Indian farmers are facing numerous challenges due to inadequate finance, prejudicial distribution of subsidies, high lending rates, old-fashioned skill and know-how, customary agricultural habit, inadequate crop alternation, unsatisfactory rainwater, and natural calamities. Investments in agriculture can be classified as either public or private, and international or domestic. Numerous studies have validated the benefits of advancing FDI in numerous industries. FDI is a necessary constituent to support agriculture and all other segments of the economy because national savings are remarkably scanty to meet the economy's mounting demands.

The nationwide epidemic resulted in lockdown in recent past has almost completely clogged the economic activities. The government anticipated that the agriculture sector could provide a bright spot for the Indian economy in the midst of that turmoil. NITI Aayog projected that the agriculture industry could expand at a 3 percent annual rate in 2020–21. In our current paper we have tried to show the actual effectiveness of foreign direct investment on net agricultural

productivity along with other explanatory variables like bank credit loans issued to agricultural sector, arable land used for agricultural purpose and imported agricultural raw materials. The following sections highlight the major objectives of this current paper, few laudable works by several scholars, research methodology and the model pursued for the current study and few facts and figures along with the analysis of the results obtained.

Review of Literature

Some of the research scholars have done laudable works in showing the impact of FDI in the development of economy, particularly the agriculture sector.

According to an analysis of the effects of FDI in Mexico by Burfisher, Robinson, and Thierfelder (1992), agricultural production has increased by 8 percent, which has raised demand for agricultural products. Deutsche Bundesbank (2003) infers that long-term effects of foreign direct investment (FDI) on a nation's growth include increased competition due to knowledge transfer, improved infrastructure, increased productivity, and the creation of new job opportunities. Dr. Shobhit Wadhwa & Dr. Sucheta Arora Wadhwa (2014) in a research paper entitled "FDI in agriculture sector in India: status and challenges" have stated that, rapidly expanding nations like India acquiring proficiency in worldwide expertise and global marketing tactics is crucial for attaining expansion and progression. FDI is encouraged by increased trade between countries. Sandeep Kumar and Kavita (2014) in a research paper entitled "Foreign Direct Investment in Indian Agricultural Sector: Opportunities and Challenges States" has stated that given its vast population, India must welcome foreign investment in order to deliver trustworthy arrangements and trailblazing technology that are well-suited with Indian culture. P.N. Nnamocha and Charles N. Eke (2015) in their study re-affirms the fact that enabling investors to access loans at a reasonable cost, particularly for the agricultural industry, is a critical role of banks and other financial institutions. Due to the poor credit or high lending rates can result in low investment levels, which will then translate into low farming yield. Using time series

data spanning from 1970 to 2011, Joseph Chisasa and Daniel Makina (2015) examined the dynamic link between bank loan and agricultural output in South Africa. Using the Johansen cointegration test, they have observed bank credit and agricultural output to be cointegrated. In the long run they found credit and capital formation to have significant positive impact on agricultural output. Dr. Anjali Chaudhary (2016) in a research paper entitled “Role of FDI in the growth of Indian Agriculture Sector: A post reform study” has stated that by bridging the technical gap, foreign direct investment (FDI) plays a major role in increasing productivity. Comparing India to other developing nations, it has become less attractive to foreign investors in recent years. Dadson Awunyo-Vitor and Ruby Adjoa Sackey (2018) have thoroughly and analytically assessed the contribution that FDI inflow to the agriculture sector made to economic growth from 1975 to 2017, resulting in a longitudinal analysis of the causal relationship between agricultural sector foreign direct investment and economic growth in Ghana.

Objectives of the Study

This paper’s main goal is to analyse how FDI affects India’s net agricultural productivity. Secondly, we have made an attempt to derive the relationship between net agricultural productivity and arable land, bank credits issued and agricultural raw materials imported. Lastly, we have tried to establish a relationship between net FDI inflows in India and net productivity of food and non-food crops.

Data And Research Methodology

In this section, the data and research methodology that we have pursued for this current paper have been discussed and the techniques we have used to show the relationships among our respective variables as well. Time series data for net agricultural productivity, proxied by agriculture, forestry and fisheries gross domestic product, Net Foreign Direct Investment inflows, arable land, credit loans issued by banks for the period 1990 to 2018 was used in this study. For the current study quantitative secondary datasets have been collected from various reliable sources eg: World Bank, RBI,

mospi.nic.in, etc. to support our study over a period of 30 years.

We have performed Augmented Dickey-Fuller Test, Regression Analysis, Correlation Analysis and Hypothesis Testing in order to show the relationship between the variables taken into consideration for this study and to show stationarity of our respective variables. The analysis is performed using softwares like Eviews7 and Stata16.0.

Model Specification

- A. The production function we consider signifies the impact of major variables we consider on net agricultural productivity. The production function equation is :

$$\text{Agr}_t = f(\text{Land}_t, \text{FDI}_t) \quad (1)$$

- B. We have represented a production function in Cobb-Douglas form in order to show the impact of two major variables (Land and Capital) on the dependent variable net agricultural productivity. The Cobb-Douglas production function is :

$$Y = \alpha_0 K^{\alpha_1} L^{\alpha_2} \quad (2)$$

Where, K = Capital (Foreign Direct Investment and Bank Credits Issued), L = Arable Land sq. km. and α_0 , α_1 , α_2 are production function parameters.

- C. The yearly time series data, spanning 30 years from 1990 to 2020, is utilized to ascertain the correlation between foreign direct investment (FDI), bank credit, imported machinery, and net agricultural output in India. The unit root testing in this study are conducted using the Augmented Dickey Fuller (ADF) test. The stationarity of our relevant datasets for the current work is indicated by the ADF test. Regression modelling is employed in this investigation.:

$$\Delta Y = \beta_1 + \beta_2 \cdot Y_t + \beta_3 \cdot Y_{t-1} + \beta_4 \cdot Y_{t-2} + \sum_{i=1}^k \alpha_i \cdot \Delta Y_{t-i} + \varepsilon_t \quad (3)$$

All of the model variables at time t are tested for the existence of unit roots of Y_t using the ADF regression. The first differences with k lags are represented by the variable Y_{t-i} , while the autocorrelation errors are adjusted by the variable ε_t . $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ and α_i are the coefficients values.

The null hypotheses to be tested is:

$H_0 : \square = 0$ (existence of unit root in the data series)

$H_1 : \square < 0$ (non-existence of unit root in the data series)

The t-statistic and p-value of the coefficient of $\square$ are used to test the hypothesis. The decision rule is : If the null hypothesis is disapproved, the variables are stationary because they lack unit roots.

D. We have performed regression analysis to estimate the equation and formed a Multiple Linear Regression Model. OLS Method has been applied to analyse the regression equation. The equation for the multiple regression analysis is:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mu_t \quad (4)$$

where, Agri (Y) = Net Agricultural Productivity (Share of value added in agriculture sector to real GDP), FDI (X_1) = Net Foreign Direct Investment Inflows in India, Abr Land (X_2) = Arable Land (sq. km.), Credit (X_3) = Bank Credit (Loans issued) to Agriculture, Mcn (X_4) = Agricultural Machinery Imports, α = Intercept, $\beta_1, \beta_2, \beta_3, \beta_4$ = Coefficients, μ = Error Term and t = time period

The estimated equation for the multiple regression analysis is:

$$\Delta Y = \alpha + \beta_1 \Delta X_1 + \beta_2 \Delta X_2 + \beta_3 \Delta X_3 + \beta_4 \Delta X_4 + \mu_t \quad (5)$$

where, Δ is the first order derivative that denotes the change in a variable between period t and period $t-1$.

E. In order to investigate the relationship between our dependent variable, net agricultural productivity, and the explanatory variable, granted bank credit loans, we use the standard hypothesis testing for this purpose.

$$AGP_t = a + \sum_{i=1}^N nj \cdot Credit_{t-j} + \mu_t \quad (6)$$

where, AGP = Agricultural net productivity, Credit = Bank Credit to the agricultural sector, t = time period

The null hypothesis to be tested is:

$$H_0 : nj = 0 \text{ where } j = 1, 2, 3, \dots, N$$

$$H_1 : nj \neq 0 \text{ where } j = 1, 2, 3, \dots, N$$

If the null hypothesis is rejected, it means that bank credit affects agricultural productivity. We have performed paired t-test to establish the relationship between bank credit loans issued and net agricultural productivity.

- F. We have performed correlation analysis to show the relationship between net FDI inflows and total food and non-food (commercial) crops produced in the economy over the period we have taken into consideration.

$$\text{Correlation Co-efficient (r)} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{[\sum (x_i - \bar{x})^2 \times \sum (y_i - \bar{y})^2]}} \quad (7)$$

where, r = correlation coefficient, x_i = values of FDI inflows, $\bar{x}$ = mean of the values of FDI inflows, y_i = values of net food (non-food) crops produced, $\bar{y}$ = mean of the values of net food (non-food) crops produced

Result Analysis

1. Results of Augmented Dickey-Fuller Test

The ADF unit root test results for the five variables in the levels and differences are shown in Table 1. It's interesting to note that after the first differencing, all of the variables became stationary in their levels.

The null hypothesis about unit root has been rejected at the 1%, 5%, and 10% levels of significance based on the critical t-values and p-values. In this case, the variables are taken

into account in both level and first difference form, with the intercept alone and with trend and intercept.

2. Trends in major variables

To ascertain the trend movements of the variables, a thorough exploration was conducted prior to the time series econometric analysis. Thirty years of annual observations on the chosen variables from 1990 to 2019 make up the entire data set. The trends in the factors that we have considered for the current study are displayed in this section.

Fig- 1 and Fig- 2 show the trend in annual growth rate and value added net productivity of agriculture, forestry and fishing respectively. Both the graphs show a positive trend in net productivity of agricultural output although the growth rate being sluggish. Next, we show the trend in net FDI inflows and bank credit to agriculture.

Now we observe the trends in net foreign direct investment into India and total credit issued to agriculture over a broad range in years. Fig- 3 and Fig-4 show that there is a positive trend in both net FDI inflows and total credit loans issued to the agricultural sector.

3. Regression Analysis

Using annual data for India from 1990 to 2018, the OLS approach was used to estimate the model and determine the nature of the association between net agricultural productivity and other explanatory factors.

According to Table 2's interpretation of the model based on the chosen economic variables, the explanatory variables account for 93% of the variance in the dependent variable, or R^2 of 0.93.

The explanatory variables were effective in describing the variation (92%) in inflation over the period, as comprehended by the adj. R^2 of 0.92. By estimating the regression equation, it has been observed that, the intercept (α_0) is 3.17 and the slope parameters ($\beta_1, \beta_2, \beta_3, \beta_4$) are 2.26, -5.76, 0.83, 1.16 respectively. It is observed that the tabulated probability values are highly significant at significant level of 1%, 5% and 10%.

The significant coefficients indicate the relationship between the dependent variable and the explanatory variables. We can clearly observe that over the years there is a positive relationship between net agricultural productivity and FDI (2.26), credit issued (0.83), agricultural machineries imported (1.16), while arable land and net agricultural production are negatively correlated which implies that the quality of the land and capital are more important than the amount of land.

Fig- 5 and Fig- 6 illustrate the actual effectiveness of net FDI inflows and bank credits on net agricultural productivity.

4. Correlation Analysis

The correlation coefficient (r) measures the relationship between the variables that have been taken into consideration over a period of 30 years. This section discusses the results from correlation analysis between net FDI inflows and net food grains produced ($r = 0.950$) and between net FDI inflows and commercial crops produced ($r = 0.957$). The results imply a significant positive correlation between net FDI inflows and net food and commercial crops produced in India.

5. Results for impact of agricultural credit on net agricultural productivity (Hypothesis Testing)

H_0 : The observed value does not deviate significantly from the expected value.

On the basis of the above results (Table-3) obtained we can reject the null hypothesis and imply that bank credit does affect net agricultural productivity significantly.

Policy Recommendations

The goal of agronomic foreign direct investment (FDI) policy is to draw capital for the purchase of apparatus, gears, seeds, plantation supplies, product storage conveniences, granaries, and other logistic arrangements. By reducing waste, predominantly of perishable fresh foods and vegetables, investments in farming infrastructure have the prospective to lift cultivators' returns. Resilient protocols for subventions and their use must also be outlined by the Department of Agriculture and the Ministry of Farmer's Welfare. To draw

in foreign investors, the nation must improve its internal agronomic organization and market potential. Coordination with state governments that are free from bureaucratic manoeuvring, outmoded regulations and customs, dishonesty, and intransparency is necessary when framing policies in this area. Due to the fact that trade openness spurs economic growth, reaching a particular level of development could be necessary before a nation can grow and liberalize its trade laws. For agriculture to grow more quickly, sustainably, and inclusively, all related activities need to receive the proper attention. Government should try to develop agrarian India as an emerging investment destination for foreign investors so that passage from “Green to Evergreen” Revolution can be covered with enhanced thrust.

Conclusion

The study’s primary focus was on how foreign direct investment affected India’s net agricultural output between 1990 and 2020. The empirical data shows that India’s net agricultural productivity and net foreign direct investment inflows are positively correlated. For the regression model, the ordinary least square method of estimation has been applied. Even when there is a negative correlation between arable land and net agricultural productivity, the empirical results of this study also demonstrated that agricultural machinery and bank loans have made significant contributions to India’s agricultural output. The findings have a crucial implication that food crops and commercial crops are both considerably impacted by ‘foreign direct investment’ in the agriculture sector.

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Appendix

Tables and Figures

Table-1

Table 1: Results of Augmented Dickey-Fuller (ADF) Unit Root Test

Variables	Test Form	ADF Test Statistic	Critical Values			p-value
			1%	5%	10%	
Net Agricultural Productivity	At 1 st Difference Form	-4.594910	-3.699871	-2.976263	-2.627420	0.0011
Net FDI Inflows	At 1 st Difference Form	-5.559607	-3.689194	-2.971853	-2.625121	0.0001
Arable Land	At 1 st Difference Form	-6.122612	-3.699871	-2.976263	-2.627420	0.0000
Bank Credit Loans issued to agriculture	At Level Form	-5.541303	-3.769597	-3.004861	-2.642242	0.0002
Agricultural raw materials imported	At 1 st Difference Form	-7.287465	-3.689194	-2.971853	-2.625121	0.0000

[Author's calculation ; Note: The test is performed using the software Eviews7]

Table-2

Table 2 : Results of estimated equation of regression

Dependent Variable: Net Agricultural Productivity Method : Ordinary Least Square Method			
Variable	Coefficient	t-Statistic	p-value
C	3.17	2.30	0.03
FDI	2.26	2.36	0.02
Arable Land	-5.76	-2.20	0.03
Credit Loans Issued*	0.83	3.72	0.00
Agricultural Machineries Imported	1.16	0.64	0.52
R-squared	0.93		
Adjusted R-squared	0.92		
S.E. of regression	3.28		
F-statistic	85.85		
Prob(F-statistic)	0.00		

[Author's calculation; Note: The test is performed using the software Eviews7]

Table-3**Table 3 : Paired t-test**

Variable	Observations	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Net Agricultural Productivity	29	1.91	2.20	1.19	1.46	2.36
Bank Credit	29	4.44	1.01	5.44	2.37	6.51
Hypothesized Mean Difference	df	t-Stat	P(T<=t) one-tail	t Critical one-tail	P(T<=t) two-tail	t Critical two-tail
0.00	28.00	10.75	0.00	1.70	0.00	2.05
Ho: mean(diff) = 0 Degrees of freedom = 28						
Ha: mean(diff) < 0 Ha: mean(diff) = 0 Ha: mean(diff) > 0						
Pr(T < t) = 1.00 Pr(T > t) = 0.00 Pr(T > t) = 0.00						

[Source : Estimated by authors ; Note: The test is performed using the software Stata16.0]

Figures

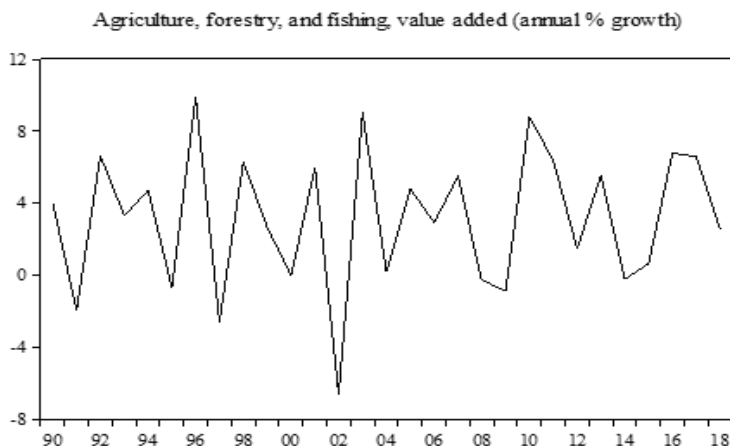
Fig-1

Fig-2

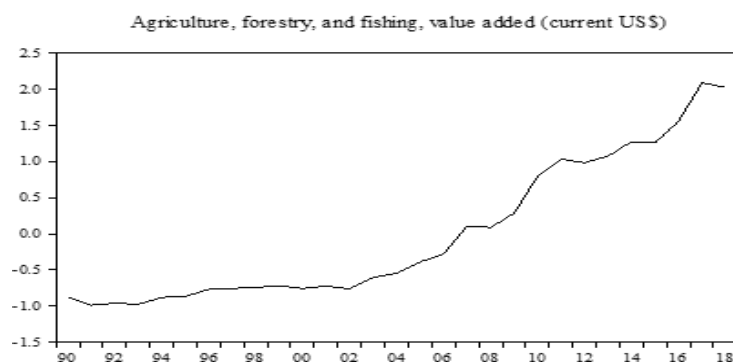


Fig-3



Fig-4

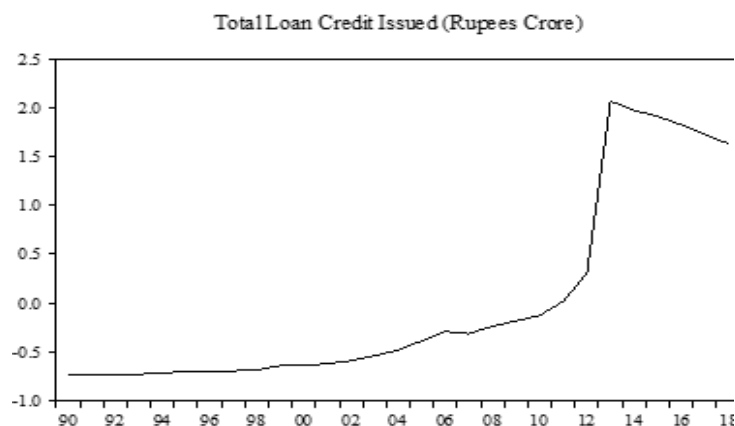


Fig-5

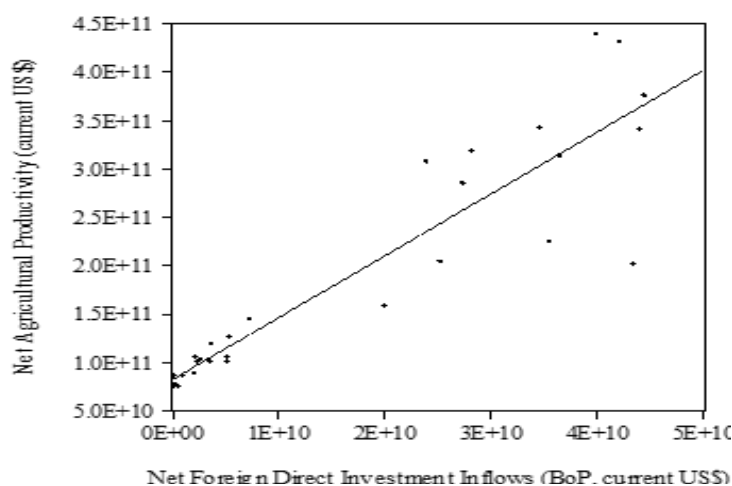


Fig-6

