

OPEN ACCESS

Manuscript ID:
ECO-2020-08033218

Volume: 8

Issue: 3

Month: June

Year: 2020

P-ISSN: 2319-961X

E-ISSN: 2582-0192

Received: 23.04.2020

Accepted: 18.05.2020

Published: 01.06.2020

Citation:

Chitra, M., and Chinnasamy Agamudai Nambi Malarvizhi. "An Empirical Analysis on India's Food Grain Cultivation, Production and Yield in Pre & Post Globalisation." *Shanlax International Journal of Economics*, vol. 8, no. 3, 2020, pp. 1–10.

DOI:

<https://doi.org/10.34293/economics.v8i3.3218>



This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

An Empirical Analysis on India's Food Grain Cultivation, Production and Yield in Pre & Post Globalisation

M. Chitra

*Assistant Professor, Department of Econometrics, School of Economics
Madurai Kamaraj University, Madurai, Tamil Nadu, India*

 <https://orcid.org/0000-0002-6427-0988>

Chinnasamy Agamudai Nambi Malarvizhi

Senior Lecturer, Multimedia University, Cyberjaya, Malaysia

Abstract

Globalization is, directly and indirectly, contributing to its effect in all sectors of an economy. The agricultural sector is not exempted from the effect of change due to globalization as a component of the primary sector and a prime sector for human survival needs. The status of self-sufficient in the production of food grain will lead a nation to make a walk of pride among the other member globally. India is an agro-economy. In other words, agriculture is the backbone of the Indian economy. So the production of food grain and its cultivation and yield should be normally high to meet out the demand of a growing population. Also, with the implementation of a policy of globalization, there might be some change in cultivation, production, and yield of food grains in India. In this paper, an attempt was made to examine/ identify the change in area under cultivation, yield, and production by using the secondary sources of data from 1970 to 2017. The selected breakeven point of time was 1991-1992. The annual growth rate pictured the change in a particular point of time; the linear and quadratic model gave the growth over the period selected for the study, and dummy used regression model presented the difference in structural change. AGR results dominated by the negative growth rate; the linear growth model for production depicts that 3.6 percentage of tons of production will be move when a year moves upward. The area under cultivation is deteriorating in AGR, and other models used gave a weakness in explanatory level concerning time for the area under cultivation of food grain. Regarding the obtained results for yield reflect that a positive change exists after globalization, even though a reduction in area under cultivation.

Keywords: Globalisation, Area under Cultivation, Production, Yield, Food grains.

Introduction

Globalization has allowed agricultural production to grow much faster than in the past. A few decades ago, fast-growth was somewhat over 3 percent per year. Now it is 4 to 6 percent.¹ In 2017-18, total food grain production was estimated at 275 million tons (MT). India is the largest producer (25% of global production), a consumer (27% of world consumption) and importer (14% of pulses in the world)² Agriculture, as the largest private enterprise in India and provides the underpinning for India's food and livelihood security and supports the economic growth and social transformation. During 2008-09 the agricultural sector contributed to approximately 15.7 percent of India's GDP (at 2004-05 prices). It was 14.6 percent in 2009-10 and 10.59% percent of total exports besides employing around 58 percent of the work force. The target of GDP growth in the country for the Eleventh Plan is 8.5 percent per annum, with the agriculture sector expanded to grow at an annual average rate of 3-3.5 percent.

1 Mellor, J., *Agriculture on the Road to Industrialization*, Johns Hopkins University Press, 1992. .

2 Report of FAO India at a glance 2018.

A higher allocation of public sector resources was projected for Agriculture and Allied Activities, from the Tenth Plan realization level of Rs.60,702 crore to Rs. 1,36,381 crore during the 11th Five Year Plan at 2006-07 prices by the Centre, States, and UTs, which was 124 % step-up; share of Centre is 50,924 crores. Although the global recession witnessed during the Eleventh Plan period affected the overall availability of resources, allocation to Agriculture and Allied sector in the Central Plan. The outlay has been significantly raised during the 11th Five-Year Plan, which can be seen from the following Gross Capital Formation (GCF) in agriculture and allied activities, which was around 8 percent of GDP from agriculture and allied activities during the nineties, has since increased to 20 percent in 2009-10.³ On the other hand, the contribution of the agricultural sector to GDP has continued to decline over the years. Successive Five Year plans have stressed self-sufficiency and self-reliance in food grains production, and concerted efforts in this direction have resulted in a substantial increase in agricultural production and productivity. This is clear from the fact that from a level of about 52 million tons in 1951-52, food grains production rose to above 241.5 million tons (4th advance estimates) in 2010-11 (Gol, 2011b). However, since the early 1990s, liberalization and globalization have become core elements of the development strategy of the government, which had indirect policy implications and impacts on Indian agriculture. As a part of economic reforms, agricultural markets were freed, external trade in agricultural commodities was liberalized, and industry was de-protected to create more competition, thereby reducing input prices and making terms of trade favorable to agriculture. In this context, the present paper discusses the globalization in India concerning food grains.

Review of Literatures

Indian agriculture can be divided into six phases viz. green revolution period (1960–61 to 1968–69), early green revolution period (1968–69 to 1975–76), a period of wider technology dissemination (1975–76 to 1988–89), a period of diversification (1988–89 to 1995–96); post-reform period (1995–96 to 2004–

05), and period of recovery (2004–05 to 2010–11)⁴ The period of diversification, reform, recovery periods is termed as the post-globalization period. Globalization is the new buzz word that has come to dominate the world since the nineties of the last century. Globalization can be simply defined as “The Expansion of Economic activities across political boundaries of native states.” Globalization refers to increases in the movement of finance, inputs, outputs, information, and science across vast geographic areas. Globalization aims at the integration of the Domestic Economy with the Global Economy and the optimum utilization of growth potential. Calum Brown et al. (2014) stated that a reductions in overall productivity, but increases in production per unit area, under globalization, and increases in overall productivity under regionalization, reducing the productivity gap between globalized and regionalized systems.⁵ A researcher Renjini (2012) attempted to identify the factors affecting food grain production, was carried out a regression analysis. A positive shift in production was observed more in the case of rice and wheat as compared to other cereals and pulses both in India and Punjab. Overall growth in the area, production, and productivity of rice were observed more for Punjab as compared to India, while in the case of wheat, both India and Punjab followed the same trend. Decomposition analysis of growth in production revealed that productivity was the major contributory factor in changes in food grain production. Regarding variability, rice and wheat observed more stable as compared to other crops. The impact of Minimum Support Price (MSP) on production was found significant for Punjab. In contrast, that of the net irrigated area was found significant for India.⁶ Kaushik Basu (2018) suggested and stated that agriculture as a share of value-added in GDP has over the last 50 years become quite small, but it is still a vital sector that employs around half

4. Khatkar, B.S., Chaudhary, N. and Dangi, P. “Production and Consumption of Grains: India.” *Encyclopedia of Food Grains*, vol. 1, 2016, pp. 367-373.

5. Brown, C. et al. “Experiments in Globalisation, Food Security and Land Use Decision Making.” *PLoS ONE*, vol. 9, no. 12, 2014, e114213.

6. Renjini, V.R. *Growth and Stability of Foodgrain Production in India with Special Reference to Punjab*. Punjab Agricultural University, 2012.

³ www.planningcommission.gov.in.

of the nation's labor force. Even a small decline in its production can cause food inflation, large welfare losses among the poor, and even political instability. Therefore, agriculture as a sector will continue to need nurture.⁷ Further, specifically, food grain production covered under this statement for self-sufficient of India by a single word of food inflation. Meanwhile, Khatkar (2016) et al. said that the total food grain demand would increase from 201 million tonnes in 2000 to about 291 and 377 million tonnes by 2025 and 2050, respectively.⁸ So the production of food grain in India is essential to meet the growing population demand to fulfill the second prime goal of Sustainable development. Hence the researcher intended to examine the status of total food grains production, cultivation, and productivity in India before and after globalization, which will help the Indian Planners and policy makers to decide about the implications of globalization.

Objectives

- a. To trace the movements of food grains production, an area under cultivation, and productivity of food grains in India during pre-globalization and post-globalization period
- b. To examine the structural difference in the production, an area under cultivation and yield of food grains in India during the pre-globalization and post-globalization period

Methodology of Data Analysis

The necessary data has been collected from Agricultural Statistics at a Glance 2018 published by the government of India from page number 71 and 72 for this paper, which carries the data from 1950 to 2018. The study period is divided into two periods as Pre-globalization (1970-71 to 1990-91) and post-globalization period (1991-92 to 2015-16). Annual Growth rate, linear Growth rate, and Quadratic growth model were used to find the movements of food grain production, an area under cultivation, and yield. To estimate the Annual Growth Rate (AGR),

7. Basu, Kaushik. *A Short History of India's Economy: A Chapter in the Asian Drama*. WIDER Working Paper 2018/124, 2018.
8. Khatkar, B.S., Chaudhary, N. and Dangi, P. "Production and Consumption of Grains: India." *Encyclopedia of Food Grains*, vol. 1, 2016, pp. 367-373.

the following formula was used.

$$AGR = \frac{Y_t - Y_{t-1}}{Y_{t-1}} \times 100$$

Where AGR = Annual Growth Rate, Y_t = current year, Y_{t-1} = Previous year, t = Time Period. The linear growth model: $Y_t = \alpha + \beta_1 \text{Years} + U_t$ and Quadratic equations / model $Y_t = \alpha + \beta_1 \text{Years} + \beta_2 \text{Years}^2 + U_t$ were used to trace movements of a trend in Production, Area under Cultivation and Yield concerning time/years as an independent variable. The second objective is to study the structural difference in the production, an area under cultivation, and yield of food grains in India used the Dummy variable model. The objective of this model is to provide a means for analyzing the behavior of the system to experiment and improve its performances concerning globalization.

$Y = \alpha + \beta_0 t + \beta_1 D_t + U_t$ where
Y = Production, Area under cultivation and yield of food grains in India

t = Time trend variable taking values 1,2,3,...
 $D = 1$, for time period 1990-91 to 2015-16 (post-globalization)

$D = 0$, for otherwise in 1970-71 to 1990-91 (pre-globalization)

α, β_0, β_1 are unknown parameters where α is an intercept, β_0, β_1 is differential coefficients. The difference between the differential intercept coefficients of β_0, β_1 will give the coefficient result of the benchmark or pre globalization period.

Findings and Discussion

(a) Production of Foodgrains 1970 to 2017

Table 1: India's Production of Food Grain in Pre-(1971-1991) and Post-Globalization Period (1992-2017) (in Tons)

Year	pre-globalization	Year	post-globalization
1970-71	108.42(-)	1991-92	168.38(-4.54)
1971-72	105.17(-3.00)	1992-93	179.48(6.59)
1972-73	97.03(-7.74)	1993-94	184.26(2.66)
1973-74	104.67(7.87)	1994-95	191.50(3.93)
1974-75	99.83(-4.62)	1995-96	180.42(-5.79)
1975-76	121.03(21.24)	1996-97	199.43(10.54)
1976-77	111.17(-8.15)	1997-98	193.12(-3.16)
1977-78	126.41(13.71)	1998-99	203.61(5.43)

1978-79	131.90(4.34)	1999-00	209.80(3.04)
1979-80	109.70(-16.83)	2000-01	196.81(-6.19)
1980-81	129.52(18.07)	2001-02	212.85(8.15)
1981-82	133.30(2.92)	2002-03	174.78(-17.89)
1982-83	129.52(-2.84)	2003-04	213.19(21.98)
1983-84	152.37(17.64)	2004-05	198.36(-6.19)
1984-85	145.54(-4.48)	2005-06	208.59(5.16)
1985-86	150.44(3.37)	2006-07	217.28(4.17)
1986-87	143.42(-4.67)	2007-08	230.78(6.21)
1987-88	140.35(-2.14)	2008-09	234.47(1.60)
1988-89	169.92(21.07)	2009-10	218.11(-6.98)
1989-90	171.04(0.66)	2010-11	244.78(12.23)
1990-91	176.39(3.13)	2011-12	257.44(5.17)
-----	-----	2012-13	257.125(-0.122)
-----	-----	2013-14	265.044 (3.08)
-----	-----	2014-15	252.021(-4.91)
-----	-----	2015-16	252.208(0.074)
		2016-17	275.11(9.08)

Source: Agricultural Statistics at a Glance 2018, Government of India Ministry of Agriculture & Farmers Welfare, and Figure in parentheses are AGR

The above table 1 shows the annual growth of foodgrain production for pre-globalization (1971 to 1991) and the post-globalization period (1992 to 2017). The agricultural production in India has been moved in a zig-zag from 1970-71 to 2015-17. The highest annual growth of food grains production in India for the pre-globalization period is 21.24 percent in the year 1975-76, and the highest annual growth rate for the post-globalization is 21.98 percent in the year 2003-04. The annual growth rate is negative in the eighties before and after 1983-84 in the pre-globalization period with a high difference in previous and succeeding years. This was the period of sixth five-year plan and end of Mrs. Indra Gandhi as a Prime minister and attempted to execute her 20 point program for the betterment of the economy. The magazine, India Today (Dec31-1983), stated that there was an increase as expected in Kharif production and especially in rice output, which should be 51.5 million tonnes with a significant upsurge of 20 percent. Rabi performance, which is relatively better protected against the weather by irrigation, was unlikely as spectacular with food-grains growing a mere 2 percent, in simple words,

there was a bountiful harvest in 1983-84. Again it was in 1988-89 happened and election year too. The Rajiv Gandhi government policy emphasized the industrial sector.

Meanwhile, a good monsoon led a glut in food grain production and followed by V.P Singh government leadership in the period. The annual growth rate was double-digit in the years 1996-97, 2003-04, and 2010-11 as 10.54, 21.98, and 12.23, respectively. Food grain production in 2015 was a negative annual growth rate, which made fear about the fulfilling of domestic basic survival needs of the citizen. The policy makers and country ruling government attempted to use the globalization apt way and moved to positive in 2016 and reached 9.08 percent in 2017, which is a good sign for the availability of food grain to meet the domestic consumption.

The overall change in the production of food grain crops for the pre-globalisation and post-globalization period was manipulated by using a linear and quadratic equation. The linear equation gives the changes over the period in constant scale, while the quadratic equation gives the speed of change in the growth of food grain production. The following table-2 gives the information of pre, post, and total periods of food grains production taken for the study as 1970-91, 1991-2017, and 1970-2017 respectively. The obtained result of the total explanatory level of a model or the explanatory level of time-variable R-Square is above 85percent in all three periods' regression or for all equations. Also, the F value states that as significant in all three sets of values. The individual co-efficient of time variable value is 3.6 for pre, post and a total period of linear models, which means that a unit change or addition of year make a change in the increase of 3.6 percentage of production over the pre, post and total period of food grains taken for the study. In a linear model, β_1 reflects the growth rate, which is the slope of the linear equation. So, the growth rate 3.6 is the same for pre-globalization food grain production and post-globalization period in case of linear growth model and overall periods of food grain production too. According to the linear growth model, there is no impact of globalization on the growth of food grain production in India. The speed of production

of food grain is positive over the period before and after globalization from the sign of b_2 value and for overall periods. The summation of $\beta_1+2\beta_2t$ gives the growth rate for the quadratic model or speed of production over the periods. The sign of parameters gives a positive growth rate in the production of food grain over the period. The growth rate of the quadratic model for the pre globalization period is 74.739, which is manipulated by the summation

of $\beta_1+2\beta_2t$. The post globalization period growth rate is 95.55 and for the overall period is 170.657. The result of the quadratic model gives the picture of difference or change in the post-globalization period growth rate as 20.811 percentages in positive increasing speed. The growth rate of the overall period is 170.657. The difference will be checking out by the following dummy used model by breaking the same point of time.

Table 2: Trend of Production of Food Grains in India 1970 to 2017

Equation	Model Summary			Parameter Estimate		
1970-91 Before	R Square	F	Sig.	Constant	β_1	β_2
Linear	.858	114.386	.000	92.032	3.569	-
Quadratic	.878	64.859	.000	100.673	1.315	.102
Equation	Model Summary			Parameter Estimates		
1991-2017 After	R Square	F	Sig.	Constant	β_1	β_2
Linear	.848	134.059	.000	166.567	3.670	-
Quadratic	.872	78.668	.000	178.262	1.164	.093
Equation	Model Summary			Parameter Estimates		
1970-17 Total	R Square	F	Sig.	Constant	β_1	β_2
Linear	.956	985.754	.000	91.429	3.616	
Quadratic	.957	491.481	.000	94.836	3.199	.009

Source: Manipulated from secondary data of table -1

Table 3: Structural Break of Production of Food Grains in India 1970-2017 (1991-92 breaking point)

Model Stochastic part	Unstandardized Coefficients		t-values	Sig.	R ² Value	F-Value	Durbin-d-Statistic
	value	Std. Error					
1 Constant - α	91.304	3.456	226.420*	.000	0.956	482.033 (.000 sig)	1.860
2 Time- β_0	3.635	0.229	15.859*	.000			
3 Dummy- β_1	-0.608	6.254	-0.097*	.000			

Source: Manipulated from secondary data of table 1

The value of R –Square gives the explanatory level as 95.6 percent by the selected explanatory variable as time and dummy. The F test is used to determine whether a significant relationship exists between the dependent variable and the set of all the independent variables. The F test is referred to as the test for overall significance. The F value is significant and reconfirms the goodness of model, while the Durbin Watson–d Statistic, also near two, (1.9 approximately) gives the absence of autocorrelation. The dummy used model, α stands for intercept and (α) is a measure of the extent of the variable (Y) that is not affected by the changes in a

variable (X). The beta coefficients (the standardized b values) useful for comparing the relative weights of the independent variables. β_0 stands for co efficient of overall years /time without a break, β_1 stands for differential co efficient or gives the value of the post-globalization period.

If the estimated regression equation is to be used only for predictive purposes, Multicollinearity is usually not a serious problem. Every attempt should be made to avoid including independent variables that are highly correlated. VIF (variance inflation factor) for each term in the model measures the combined effect of the dependencies among the

regressors on the variance of the term. Practical experience indicates that if any of the VIFs exceeds 5 or 10, it is an indication that the associated regression coefficients are poorly estimated because of multicollinearity. Here, in this model, the obtained result of VIF 3.874 and tolerance 0.258 for collinearity statistics, which is below the value 5 and given assurance of explanatory variables are not correlated and absence of multicollinearity.

The value of α is 91.304, which reflects the value of the linear model before and overall periods of table -2. So, the changes in explanatory variables are not affected, and certainly a production of 91.304 tons of food grain production produced in India. According to the last year, 2016-17 data said that 275.11 tons of production of food grains in India. If we compare with this result, more than one-third of the production of India is not affected by time variable and omitted variables. It means that, at any cost, certainly, there will be more than 91.304 tons of production of food grain in India, which is an important result for the policymaker to know the minimum expected production of food grain in India for revealing the food security measures.

In the above result of table-3, the time factor is shown as a positive sign and valued as 3.635 tons of food grains production in India. A unit or a year change will impact the agricultural production of food grain is upward sloping supply, positively as 3.635 percentage of production. The result reminds the result of the linear growth rate of overall periods, before and after globalization. So as per the variable time /result of β_0 , the production of food grain is normal constant growth irrespective of globalization.

The differential intercept coefficients β_1 gives the value of how much the value of the intercept that receives the value of 1 differs from the intercept coefficient of the benchmark category—the value of the benchmark category obtained from the difference of β_0 , β_1 coefficients. Here, from the table, the value of 3.027 obtained by subtracting the value of the coefficient of β_0 , β_1 which is positive and states that the unit of year movements made a 3.027 percentage of tons of production of food grain in pre globalization period. Meanwhile, the differential intercept coefficients, β_1 sign is negative;

it means that there is an inverse relationship between food grain production in India and the period of post-globalization. A year or a unit change will impact a negative change of food grain production or deteriorating of .608 percentage of food grain production from 1991 to 2017. It may be possible if there is an importing of food grain due to globalization.

(b) Area Under Cultivation of Foodgrains in India

Table -4 shows the Growth of area under cultivation pre-globalization (1970-71 to 1990-91) and post-globalization period (1991-92 to 2015-16). The area under cultivation in India has been fluctuations from 1970-71 to 2016-17. The pre-globalization highest annual growth rate of 6.67 percent is seen in the year 1988-89. The post-globalization highest annual growth rate of 8.41 percent is seen in the year 2003-04.

Table 4: Area under Cultivation of Food Grains in India during Pre-Globalization (1971 to 1991) and Post-Globalization period (1992 to 2017) (in Hectare)

Year	pre-Globalization	Year	post-Globalization
1970-71	124.32(-)	1991-92	121.87(-4.67)
1971-72	122.62(-1.37)	1992-93	123.15(1.05)
1972-73	119.28(-2.72)	1993-94	122.76(-0.32)
1973-74	126.54(6.09)	1994-95	123.71(0.77)
1974-75	121.08(-4.31)	1995-96	121.01(-2.18)
1975-76	128.18(5.86)	1996-97	123.58(2.12)
1976-77	124.35(-2.99)	1997-98	123.85(0.22)
1977-78	127.52(2.55)	1998-99	125.16(1.06)
1978-79	129.01(1.17)	1999-00	123.11(-1.64)
1979-80	125.21(-2.95)	2000-01	121.05(-1.67)
1980-81	126.67(1.17)	2001-02	122.77(1.42)
1981-82	129.14(1.95)	2002-03	113.87(-7.25)
1982-83	125.09(-3.14)	2003-04	123.45(8.41)
1983-84	131.16(4.85)	2004-05	120.08(-2.73)
1984-85	126.67(-3.42)	2005-06	121.60(1.27)
1985-86	128.03(1.07)	2006-07	123.70(1.73)
1986-87	127.20(-0.65)	2007-08	124.06(0.29)
1987-88	119.69(-5.90)	2008-09	122.83(-0.99)
1988-89	127.67(6.67)	2009-10	121.12(-1.39)
1989-90	126.77(-0.70)	2010-11	125.73(3.81)

1990-91	127.84(0.84)	2011-12	126.74(0.80)
-----	-----	2012-13	120.776(-4.93)
-----	-----	2013-14	125.040 (3.53)
-----	-----	2014-15	124.300(-0.59)
-----	-----	2015-16	122.650(-1.34)
		2016-17	129.23(5.09)

Source: Agricultural Statistics at a Glance 2018, Government of India Ministry of Agriculture & Farmers Welfare, Figure in parentheses are AGR

The model used for studying food grain production was used for studying the area under

cultivation of food grain, which gave poor goodness of fit. Table 5 and 6 depicts the value of R-Square and F statistic, which are revealing the overall weakness of the model. So, studying the area under cultivation is not explained by the time variable and may say that 87 percent is representing the omitted stochastic error term. The sign of β_1 gives a negative relationship concerning time variable and area under cultivation in the post-globalization period. This result justifies the reasons for the negative of food grain production in the post globalization period in table three.

Table 5: Trend in Area under Cultivation of Food Grains in India from 1970 to 2017

Equation	Model Summary			Parameter Estimate		
1970-91 Before	R Square	F	Sig.	Constant	β_1	β_2
Linear	.139	3.070	.096	123.850	.187	
Quadratic	.253	3.047	.072	121.207	.876	-.031
Equation	Model Summary			Parameter Estimates		
1991-2017 After	R Square	F	Sig.	Constant	β_1	β_2
Linear	.081	2.113	.159	121.600	.101	
Quadratic	.208	3.027	.068	123.996	-.412	.019
Equation	Model Summary			Parameter Estimates		
1970-17 Total	R Square	F	Sig.	Constant	β_1	β_2
Linear	.063	3.007	.090	125.696	-.059	
Quadratic	.065	1.535	.227	126.081	-.106	.001

Source: Manipulated from secondary data of table 4

Table 6: Structural Break of Area under Cultivation of Food Grains in India during 1970-2017 (1991-92 breaking point)

Model Stochastic part	Unstandardized Coefficients		t value	Sig.	R ² Value	F-Value	Durbin-d-Statistic
	value	Std. Error					
1 Constant - α	91.304	3.456	226.420*	.000	0.956	482.033 (.000 sig)	1.860
2 Time- β_0	3.635	0.229	15.859*	.000			
3 Dummy- β_1	-0.608	6.254	-0.097*	.000			

Source: Manipulated from secondary data of table -4

(c) Yield Per Hectare Foodgrains in India During

The following table 7 shows the yield of food grains production in the pre-globalization and post-globalization period. The yield of food grains in India has been zig-zag status from 1970-71 to 2016-2017. The annual growth of yield of food grains in India is moving up and down during 1970-71 to 2016-17. The highest annual growth rate is 16.78 percent seen in the year 1980-81 and the highest annual growth rate of 12.51 percent during the year 2003-04.

Table 7: Yield of food grains in Pre (1971 to 1991) post-globalization (1992 to 2017) (in Tons)

Year	pre-globalization	Year	post-globalization
1970-71	872(-)	1991-92	1382(0.14)
1971-72	858(-1.61)	1992-93	1457(5.43)
1972-73	813(-5.24)	1993-94	1501(3.02)
1973-74	827(1.72)	1994-95	1546(3.00)
1974-75	824(-0.36)	1995-96	1491(-3.56)

1975-76	944(14.56)	1996-97	1614(8.25)
1976-77	894(-5.30)	1997-98	1552(-3.84)
1977-78	991(10.85)	1998-99	1627(4.83)
1978-79	1022(3.13)	1999-00	1704(4.73)
1979-80	876(-14.29)	2000-01	1626(-4.58)
1980-81	1023(16.78)	2001-02	1734(6.64)
1981-82	1032(0.88)	2002-03	1535(-11.48)
1982-83	1035(0.29)	2003-04	1727(12.51)
1983-84	1162(12.27)	2004-05	1652(-4.34)
1984-85	1149(-1.12)	2005-06	1715(3.81)
1985-86	1175(2.26)	2006-07	1756(2.39)
1986-87	1128(-4.00)	2007-08	1860(5.92)
1987-88	1173(3.99)	2008-09	1909(2.63)
1988-89	1331(13.47)	2009-10	1798(-5.81)
1989-90	1349(1.35)	2010-11	1921(6.84)
1990-91	1380(2.30)	2011-12	1993(3.75)
-----	-----	2012-13	1952(-2.057)
-----	-----	2013-14	1981(1.48)

-----	-----	2014-15	2028(2.37)
-----	-----	2015-16	2056(1.38)
		2016-17	2129(3.55)

Source: Agricultural Statistics at a Glance 2018, Government of India Ministry of Agriculture & Farmers Welfare, and Figure in parentheses are AGR

The table -8 and 9 reveals the yield of food grain in the study period of linear, quadratic, and dummy used models. The value of R-square and F – statistic depicts that the goodness of the model. In general, the explanatory level of time variable is good and more than 88 percentages and confirming with the overall significance of F statistic values presented in both the tables. The obtained result of the linear model growth rate is 26.96, 25.997, and 28.875 for the pre-globalization, post-globalization, and total study periods, respectively. The yield is upward trending in both the periods but a percentage of growth decreasing in the post-globalization period compared with pre globalization period.

Table 8: Yield of Foodgrains in India from 1970 to 2017

Equation	Model Summary			Parameter Estimate		
1970-91 Before	R Square	F	Sig.	Constant	β_1	β_2
Linear	.886	147.800	.000	744.300	26.960	
Quadratic	.924	109.397	.000	831.409	4.236	1.033
Equation	Model Summary			Parameter Estimates		
1991-2017 After	R Square	F	Sig.	Constant	β_1	β_2
Linear	.920	276.022	.000	1389.268	25.997	
Quadratic	.928	147.617	.000	1434.098	16.391	.356
Equation	Model Summary			Parameter Estimates		
1970-17 Total	R Square	F	Sig.	Constant	β_1	β_2
Linear	.976	1824.288	.000	734.750	28.875	
Quadratic	.976	892.561	.000	730.734	29.367	-.010

Source: Manipulated from secondary data of table 5

The obtained result of VIF depicts that no multicollinearity and the value of Durbin Watson Statistics present in table 9 reveals that the absence of Autocorrelation. The sign of differential intercept coefficient β_1 is positive, meanwhile not significant at 5 percent and 10 percent level. The pre globalization period is significant and represents that a movement of one year to another year negative change as -54.308, which is obtained from the subtraction

of the differential coefficient value of β_0, β_1 . The intercept or constant value is 751.236 yield of food grains will exist in India. The value of the intercept is reflected in a linear growth model value of the constant term in pre globalization and over all study periods presented in table-8. The obtained result means that there exist constant yields of 751.236 tons irrespective of the time variable.

Table 9: Structural Break of Yield of Food Grains 1970-2017 (1991-92 breaking point)

Model	Stochastic part	Unstandardized Coefficients		t value	Sig.	R ² Value	F-Value	Durbin-d-Statistic
		Value	Std. Error					
1	Constant - α	91.304	3.456	226.420*	.000	0.979	1004.409 (0.000) sig	1.905
2	Time- β_0	3.635	0.229	15.859*	.000			
3	Dummy- β_1	-0.608	6.254	-0.097*	.000			

Source: Manipulated from secondary data of table 5

Conclusion

The present study reveals that globalization had a positive impact on the yield of food grains in India and hurt area under cultivation of food grains in India, which depicts that there exists a technology transition in India due to globalization. Hence, globalization is a boon to food grain yield, even

though there exists a deteriorating of the area under cultivation of food grain and which is reflected in the production of food grain. Last but not least, India is constantly producing a minimum of 100 tons of food grain production and 750 tons of yield irrespective of time and other stochastic variables influencing the food grain production and yield.

Table 10: Summary of Growth rate

Linear model from the value of β_1								
Production of food grain			Area under Cultivation			Yield of food grain		
Pre	Post	Total	Pre	Post	Total	Pre	Post	Total
3.569	3.670	3.616	0.187	0.101	-0.059	26.960	25.997	28.875
Quadratic model from the value of β_1 and β_2								
Production of food grain			Area under Cultivation			Yield of food grain		
Pre	Post	Total	Pre	Post	Total	Pre	Post	Total
74.739	95.55	170.657	4.074	2.626	-2.726	566.202	676.078	1357.689

Source: Manipulated from secondary data of table 2, 5 and 8

References

- Agricultural Statistics at a Glance 2018*, Department of Agriculture, Cooperation & Farmers Welfare Ministry of Agriculture & Farmers Welfare, 2019.
- Alagh, Y.K. *Globalisation and Agricultural Crisis in India*, Deep & Deep Publications, 2004.
- Basu, Kaushik. *A Short History of India's Economy: A Chapter in the Asian Drama*. WIDER Working Paper 2018/124, 2018.
- Bhalla, G.S. and Gurmail Singh. "Economic Liberalisation and Indian Agriculture: A Statewise Analysis." *Economic and Political Weekly*, vol. 44, no. 52, 2009, pp. 34-44.
- Brahmanand, P.S., et al. "Challenges to Food Security in India." *Current Science*, vol. 104, no. 7, 2013, pp. 841-846.
- Brown, C. et al. "Experiments in Globalisation, Food Security and Land Use Decision Making." *PLoS ONE*, vol. 9, no. 12, 2014, e114213.
- Firdos Ahmad, MD. and Shaukat Haseen. "The Performance of India's Food Grains Production: A Pre and Post Reform Assessment." *International Journal of Scientific and Research Publications*, vol. 2, no. 3, 2012, pp. 1-15.
- Globalization of Food Systems in Developing Countries: Impact on Food Security and Nutrition*, FAO Food and Nutrition Paper 83, 2004.
- Khatkar, B.S., Chaudhary, N. and Dangi, P. "Production and Consumption of Grains: India." *Encyclopedia of Food Grains*, vol. 1, 2016, pp. 367-373.
- Mak, A.H.N. "Globalisation and Food Consumption in Tourism." *Annals of Tourism Research*, vol. 39, no. 1, 2012, pp. 171-196.

- Mary, R.M. and P.C. Jose Paul. "Performance of Food Grain Production in India." *EPR International Journal of Economic and Business Review*, vol. 6, no. 8, 2018, pp. 47-50.
- Mellor, J. *Agriculture on the Road to Industrialization*, Johns Hopkins University Press, 1992.
- Renjini, V.R. *Growth and Stability of Foodgrain Production in India with Special Reference to Punjab*. Punjab Agricultural University, 2012.
- Report of India at a Glance*, FAO India, 2018.
- Shinde, U.R. "Globalization and Indian Agriculture - General Consequences." *Asian Journal of Management*, vol. 6, no. 2, 2015.
- Vijay Kumar, S. "Indian Agriculture in the Context of Globalization: Issues, Challenges and Government Policies." *Agrarian Crisis in Rural India: Issues and Challenges*, 2017. <http://www.planningcommission.gov.in>

Author Details

Dr. M. Chitra, Assistant Professor, Department of Econometrics, School of Economics, Madurai Kamaraj University, Madurai, Tamil Nadu, India, **Email ID:** chitra.eco@mkuniversity.org.

Chinnasamy Agamudai Nambi Malarvizhi, Senior Lecturer, Multimedia University, Cyberjaya, Malaysia, **Email ID:** malarvizhi@gmail.com