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Research Article

Regional Convergence In Land Productivity Growth In Haryana: Before And After Liberalisation

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ABSTRACT

This study examines the question of convergence in land productivity in Haryana agriculture from 1966-67 to 1990-91 and 1991-92 to 2019-20. The diminution of variation measured by coefficient of variation in land productivity levels is tested using the σ-convergence approach. The propensity of low-productivity zones to catch up with high-productivity zones is studied through the unconditional β-convergence approach. The results reveal that agro-climatic zones of Haryana are converging in terms of land productivity for the selected crops i.e. rice, grams, R&M, cotton and sugarcane during before liberalisation period. The results reveal also that zones are converging for the crops rice, wheat, jowar, bajra, R&M and cotton during the period of after liberalisation. The results indicating that there is a catch-up among the zones for the crops wheat, grams, R&M, cotton and sugarcane during the period of 1966-67 to 1990-91 and there is catch-up for the crops rice, wheat, bajra, grams, R&M, cotton and sugarcane for the period of 1991-92 to 2019-20.

KEYWORDS: convergence, land productivity, liberalisation, catch-up, agro-climatic zones.

INTRODUCTION:

Indian agriculture has witnessed enormous growth during the past several decades with the implication of Green Revolution and agricultural strategy. The abolition of intermediaries was the most important contribution of land reforms. Land reforms were played important role in increasing agricultural production and productivity from 1947 to 1960. Later year, to encourage the farmers to application of modern technology, the government of India was set up the Agricultural Price Commission in 1964 to give the advice to government on the fixation of agricultural Minimum Support Price (MSP) of crops. Later this, Indian government was adopted many strategy for agricultural development i.e. green revolution, agricultural diversification, agricultural subsidies, economic reforms and new agricultural policies. The result of implication of agricultural strategy, agriculture of India has experienced a continuous increasing in agricultural production and productivity. The performance of agriculture sector was considered a reasonably satisfactory. The production of food grains and non-food grains helps to accelerated agricultural growth.

The issues of regional disparity in agricultural growth have attracted considerable attention among researchers and policy makers. Balance agricultural growth of all regions of Haryana has been considered essential for economic viability of the State itself. With a view of accelerating agricultural growth, Haryana has adopted Green Revolution in the form of large investment programs in irrigation, roads, use of high yielding variety seeds etc. as an instrument of growth in the agriculture output and productivity of major crops. However, agriculture sector of Haryana is characterized by large inter-regional disparities. The disparities in agricultural output growth have often been attributed by inter-regional variations in agro-climatic conditions and resource endowment. This resulted in accentuating the existing disparities in the levels and growth of agricultural production and productivity across various regions. The Indian economy has been implementing comprehensive economic reforms involving large-scale structural change in the form of liberalization, privatization and globalization programs since 1991. The policies that have direct and indirect impacts on agriculture are expected to bring about changes in the agriculture sector of India as well as Haryana. Against this background, it seems important to examine the direction of change in the regional disparities of agricultural development due to Green Revolution and economic reforms.

REVIEW OF LITURATURE

Sawant, S.D. and Achutan, C.V. (1995) examined growth performance for fifteen major states in food grain, non- food grains and all crops at all India level during the period 1968-69 to 1992-93.. They found that states which had very low share in production from 1968-69 to 1981-82, their share increased from 1981-82 to 1990-91 by increasing their productivity at a faster rate during these years. As a result, the regional disparity in agricultural growth was declined since 1980s. Nagaraj, R. *et.al.* (1998) investigated the conditional beta convergence in 17 major states from 1970-1994 with the help of panel data and per capita income. They applied a regression-based approach to assess conditional beta convergence, taking into account independent factors such as the share of agricultural output in each state's output, among other factors. The results of conditional beta convergence revealed a negative coefficient of the initial per capita output and found evidence for presence of conditional beta convergence. Chaudhary, M.K. *et.al.* (2000) have analyzed the regional variation in resources development and income from agriculture and responsible factors for the variation in Haryana. For analyzing the variation in resources development and agriculture income in various regions two time periods were selected i.e.1980-81 and 1996-97. The variations in income for agriculture, production and productivity were the direct outcome of irrigation facilities and development of agricultural infrastructure. Mukherjee, A. N. and Kuroda, Y. (2003) analyzed the Total Factor Productivity Growth in Indian agriculture across fourteen major states for the period 1973 to 1993. To measure Total Factor Productivity Growth for each state during the period they include 33 crops and 3 major livestock products in total production. For the study they try to find evidence of sigma convergence. It is found that sigma is divergence in these groups of states over time and testing for long-run convergence in levels of agricultural productivity, we find evidence of conditional beta-convergence. Pujari, A. K. (2005) examined the issues of technological efficiency, TFP, and convergence for cereal crops production in Indian agriculture based on data from 281 districts across 13 main states. For technical efficiency analysis they apply a stochastic frontier model, while for TFP measurement, they used the Malmquist index and uses a regression technique to determine sigma and beta convergence. The found irrigation, fertilizers, tractors all contributed to increase production. The results of convergence demonstrate that Indian districts tend to sigma and beta convergence in the production of wheat, rice, bajra and jowar, but that they divergence in the production of maize and total cereal crops. Swain, M. and et.al (2009) examined regional disparities in agricultural development in Orissa state of India for the period of pre and post economic reform. In the post reform period regional disparity in Orissa has been declined. The Irrigation is the most responsible factor of increasing agricultural productivity and regional disparity in Orissa. This study found there is need to increase irrigation facility. This paper suggested that the use of water, efficient and sustainable and distribution should be equitable for balanced agricultural development. Zin and Qin (2009) have studied the regional disparity in agricultural productivity growth of China. The agricultural productivity growth was decomposed into technical changes, efficiency changes and input accumulation per worker. The convergence test was used to analyze the determinants of regional disparity. It is concluded that during 1987 and 2005, the growth of China's agricultural labour productivity is mainly depended on the accumulation of inputs and technical changes contributed more to the regional disparities in agricultural productivity growth. The increase in inputs for western China, and the improvement in technical change for Central and Western China were found to be significant aspects to promote the growth of agricultural productivity and narrow the gap in agriculture productivity with the eastern China. Liua, Y. and et.al. (2011) examined the effect of health and inter-state industry knowledge spillover on TFP growth and convergence in 48 states of United States agriculture by using recently developed procedures for panel data and growth accounting model. Cross-sectional tests for sigma-convergence and unconditional beta convergence were carried out in this study. The result of unconditional beta convergence was found to be well confirmed and there was no evidence for sigma convergence. It is concluded that the disparity in agricultural TFP between the 48 states tends to reduced over time. Kumar, V. and et.al. (2012) examined disparities in agricultural development of Haryana after liberalisation of Indian economy. This study used composite development index to measure the regional disparities in agriculture development of Haryana for the year 1990-92, 2000-02 and 2007-09. This study reveals that two major factors, green revolution and irrigation facilities are responsible for disparities in agricultural development between Northern and Southern Haryana. This study revealed that regional disparities in agriculture development have convergence from 1990-92 to 2000-02, but after this convergence in 2007-09 divergence has started again. Ramphul (2012) has been examined the specialization in different crops and examined the suitability of the different districts for various crops in Haryana during 1991-92 to 2008-09. The study has been examined that Ambala district does specialization in maize crop, Hisar in cotton crop, Faridabad and Hisar in wheat crop, Karnal and Kurukshetra districts in rice, Rewari district in mustard, Yamunanagar in sugarcane, Faridabad district in barley crop, Rohtak in jowar, Mahendragarh in bajra and gram crops and Sonipat district in remain specialization in fruits and vegetables. It is also concluded that the crops such as jawar, gram, bajra and barley are less versatile than rice, sugarcane, mustard, and wheat because of the specific eco-climatic conditions of the state. The Bhiwani district is more versatile means various crops are growing in the district while Karnal district is less versatile, its means the Karnal district has fewer crops diversification during the study period. It is suggested that Karnal district needs for more crop diversification. While versatility index has been increased in Kurukshetra, Panipat, Ambala, Sonipat, Gurugram, Bhiwani Jind,

Hisar and Sirsa districts means these districts are moving toward more specialization and diversification in various crops. Motebennur (2013) examined spatial variations in agricultural productivity of Dharwad district in Karnataka state in India. This study found that the irrigation facility, use of HYV seeds, fertilizers, pesticides and the use of modern farm technology are the main responsible factors for high agricultural productivity in Navalagund and Hubli talukas. The low fertility of soil and lack of irrigation facility are responsible factors in the two talukas, Dharwad and Kundagol which are medium range of agricultural productivity regions. The Kalaghatagi taluk falls under the low productivity region due to lack of irrigation facility and applied traditional methods of farming. Balaji, S.J. and Pal, S. (2014) examined whether land and labour productivity converging in Indian agriculture between 1991 and 2011. They measuring unconditional beta convergence and Galton fallacy approaches. In their analysis they find that land productivity has been improving steadily in all states since 1991. It is found that the rate of land productivity increased more rapidly in those states whose land productivity was very low at the initial level. Thus, beta convergence is occurred in this case. The study also found that the disparity in land productivity has reduced among the state in the country. As a result, there has been convergence of the Sigma. Shimar, R. (2014) examined growth and instability in agriculture production of major crops in Haryana during the period from1980-81 to 2006-07. This study based on secondary data which is collected from the Statistical Abstracts of Haryana. Total 12 major districts have been selected for the study. To measure instability of crops production Cuddy-Della Valle Index has used. This study revealed that the instability is low in crop wheat in all the selected districts. The instability in production of rice is decreasing with karnal, Kurushatra, Ambala, Jind, Hisar, Sirsa and Faridabad districts during the study period. Kumar, N. and *et.al.* (2017) have studied the farm mechanization level of different operations for major crops in Haryana. The study was conducted in 40 villages from four districts namely Karnal, Fatehabad, Bhiwani, Mewat and five farmers from each village were randomly selected, in total, 200 farmers were selected for the study. They concluded that the adoption level of farm machinery was different for different crops at the different level of land holding category. Moreover, they found that the adoption level of different farm machinery was increase with increase in land holding in all the crops and paddy crop have lowest level and cluster bean has highest in adoption of farm machines. Ram, K. (2017) has used Bhalla 1989 index to compute the level of agricultural productivity of Haryana's districts. He concluded that Gurugram district has lowest agricultural productivity and Sirsa district has highest productivity during the study period from 2012 to 2015 in Haryana.

Therefore, from the point of view of balanced regional agricultural growth, it is important to understand the long-run movement of regional disparities in agricultural output and productivity, and to respond appropriately to correct such imbalances. It is important to examine the convergence hypotheses for the agricultural sector separately, with special focus on the question of whether there has been a tendency towards convergence or divergence in agricultural productivity across regions.

Objectives of the Study:

The present study is conducted with the following objectives

1. To investigate sigma-convergence in productivity growth across agro-climatic zones of Haryana.

2. To investigate Beta-convergence in productivity growth across agro-climatic zones of Haryana.

RESEARCH METHODOLOGY

The present study is based on secondary data which is collected from various issues of statistical abstract of Haryana from 1966 to 2020 and from the web site International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The study has been conducted zone-wise analysis for the period 1966 to 2019 and whole period is divided in to two sub- period (1) 1966-67 to 1990-91 ,which is Before Liberalization period and (2) 1991-92 to 2019-20, which is After Liberalization period. The plain of former Punjab state were bifurcated to form the state of Haryana and the present Punjab. Haryana comprised basically seven districts namely, Hisar, Gurgaon (Gurugram), Rohtak, Karnal, Mahendergarh, Jind and Ambala. Subsequently, these districts were further re-organised from time to time and 15 more were formed to make a total of 22 districts in the State. Following changes were necessitated because of the reorganization of the districts. So, club the data of various districts to form a particular agro-climatic zone into their parential district. Based on ecology and cropping pattern, the State is divided into four agro-climatic zones are follow.

1. **Northern Zone:** Includes six districts namely, Panchkula, Ambala, Kurukshetra, Yamunanagar, Karnal and Panipat. Ambala and Karnal are the mother districts of other districts which are include in this zone.
2. **Western Zone:** It includes five districts namely, Sirsa, Fatehabad, Hisar, Bhiwani and Charkhi Dadri. Hisar district is the origin district of the selected districts of Western zone.
3. **Central Zone:** It consists five districts namely, Kaithal, Jhajjar, Rohtak, Jind and Sonepat. Rohtak and Jind are the basic districts of the Central zone.
4. **Southern Zone:** It consists six districts namely, Faridabad, Mahendergarh, Gurugram, Rewari, Palwal and Nuh (Mewat). Mahendergarh and Gurugram are the origin districts of the districts of Southern zone (Lal, R. and Singh, R.P., 1994)

For measure agricultural growth rate different methods are used such as CAGR (Compound Annual Growth Rate) and Simple Annual Growth Rate. This study used CAGR to analyzed zone -wise growth in productivity of major selected crops in Haryana. Land productivity (Yield per Hectare) is calculated by the formula (production/ Net Sown Area) in this study. To understand the level of regional disparity among the agro-climatic zones of Haryana a systematic methodology has been adopted. According to Sala-i-Martin (1996), Beta and Sigma indicators are the tools for measuring the degree of convergence and the speed for getting convergence. Sigma indicator shows the convergence and divergence tendency depending on the value of sample variance. Beta indicator shows the speed for accomplish the convergence when it is negative. Sigma convergence is used to measure convergence/divergence. Whereas co-efficient of variance (CV) has been used to quantify the disparity.

Co-efficient of Variations

Co-efficient of Variations is the ratio of the standard deviation to the mean. The higher the coefficient of variation represents the greater level of dispersion around the mean.

C.V = (Standard Deviation/Mean)×100

Standard Deviation = $[\Sigma (X_i - \bar{x})^2 / N]^{1/2}$

Where, N=Total Number of Observation, X_i=Productivity, $\bar{x}$=Mean of the Distribution

σ-convergence

When the dispersion of productivity across regions falls over time, there is σ - convergence. The model is

$$\mathbf{C.V._t = \eta + \tau t + \omega t}$$

There, C.V = coefficient of variation (Productivity)

η = Intercept, τ = Slope coefficient, ω = Error term, t= time (1966 to 2019)

β-convergence

The test for the absolute β-convergence hypothesis is performed by estimating the following equation by the ordinary least squares (OLS) method.

$$\mathbf{G.W_i = \alpha + \beta X_o + \mu_i}$$

Here, G.W. = Average Annual Growth rate (1966 to 2019), Productivity (Yield Per hectare of gross sown area)

α = Intercept, β = Slope Coefficient, μ = Disturbance term, X_o= Initial productivity,

RESULTS AND DISCUSSION

1. SIGMA CONVERGENCE ACROSS ZONE IN PRODUCTIVITY OF MAJOR CROPS IN HARYANA- BEFORE LIBERLIZATION

Table 1: Sigma convergence in productivity of major crops across zones of Haryana in the period of before liberalization (1966-67 to 1990-91)

Crop	Intercept	Growth Coefficient	R^2
Rice	3.34	-0.02	0.01
Wheat	1.04	0.01	2.61
Jowar	3.67	0.26	0.13
Bajra	4.06	0.04	0.01
Gram	4.44	-0.05	0.02
R&M	3.08	-0.03	0.04
Cotton	4.89	-0.01	0.03
Sugarcane	2.43	-0.02	0.01

Source: Compiled by Researcher.<

Table 1, shows the growth coefficient of variation of productivity for rice, grams, R&M,cotton and sugarcane crops decreased over the time and this indicates sigma-convergence in disparity of productivity across the zones during before liberalization period. Whereas sigma is divergence for wheat, jowar and bajra crops.

1. SIGMA CONVERGENCE ACROSS ZONE IN PRODUCTIVITY OF MAJOR CROPS IN HARYANA- AFTER LIBERLIZATION

Table 2. Sigma convergence in productivity of major crops across zones of Haryana in the period of after liberalization (1991-92 to 2019-20)

Crop	Intercept	Growth Coefficient	R^2
Rice	1.82	-0.01	0.02
Wheat	0.62	-0.02	0.03
Jowar	6.83	-0.14	0.25
Bajra	3.16	-0.03	0.04
Gram	1.15	0.18	0.30
R&M	1.97	-0.01	0.01
Cotton	10.53	-0.32	0.62
Sugarcane	1.04	0.03	0.23

Source: Compiled by Researcher.

Table 2 shows during the after liberalization period the growth coefficient for rice, wheat, jowar, bajra, R&M, and cotton crops productivity is recorded decrease which is indicates sigma-convergence over the time and CV is increased over time which is indicate sigma- divergence for grams and sugarcane crops.

2. BETA- CONVERGENCE OF LAND PRODUCTIVITY FOR MAJOR CROPS IN HARYANA- BEFORE LIBERLIZATION

We further explore the issue of regional variations in agricultural land productivity by undertaking tests for absolute Beta- convergence.

Beta-Convergence for Rice

The growth-initial land productivity regression for 1966-67 to 1990-91 is supported existence of Beta-divergence in land productivity across agro climatic-zones (Table 4). The coefficient of land productivity in the initial year (1966-67) against annual growth rate is positive (1.09) and it is highly significant, is indicating that the zones with higher land productivity is grow faster than the zones with low land productivity. In Table 3, land productivity growth rate is the highest in western zone (3.69) per cent, followed by Northern zone (3.28) per cent, Central zone (3.25) per cent and Southern zone (3.24). But, in absolute terms, land productivity is high in Western zone that is, 1545 kg/ha, other zones that are growing slower with low initial land productivity level are southern central and northern zones. Thus, while zones with low land productivity growth slower, by less than 3.5 per cent, high productivity zone grew by more than 3.5 per cent, indicating a strong Beta-divergence across them.

Beta-Convergence for Wheat

Table 3 and 4 shows that the coefficient of land productivity growth is negative (-6.05), and it indicates that there is tendency to convergence, but there is no statistical level of significant. It is indicating that the zones with lower initial land productivity are growing faster than the zones with high initial land productivity. In absolute terms, central zone and southern zone had higher initial land productivity than the northern and western zones, but central and southern zones grow slower than northern and western zones. Thus, it is indicating beta- convergence across zones.

Beta-Convergence for Jowar

It is indicating in the table 4 that the coefficient of land productivity growth is positive (0.22). It is indicated that there is tendency to divergence, but there is no statistical level of significant. It is indicating that the zones with lower initial land productivity are growing slower than the zones with high initial land productivity. In absolute terms, western zone and southern zone had lower initial land productivity than the northern zone, but western and southern zones grow slower than northern zone. Thus, it is indicating beta- divergence across zones.

Beta-Convergence for Bajra

It is indicating in the table 4 that the coefficient of land productivity growth is positive (0.12). It is indicated that there is tendency to divergence, but there is no statistical level of significant. It is indicating that the zones with lower initial land productivity are growing slower than the zones with high initial land productivity. In absolute terms, in the table 3, western zone had lower initial land productivity than the northern, central and southern zones, but western zone grow slower than other zones. Thus, it is indicating beta- divergence across zones.

Beta-Convergence for Grams

Table 4 shows that the coefficient of land productivity growth is negative (-2.40), and it indicates that there is tendency to convergence, but there is no statistical level of significant. It is indicating that the zones with lower initial land productivity are growing faster than the zones with high initial land productivity. In absolute terms, in the table 3, southern zone had lower initial land productivity than the northern, central and western zones, but southern zone grow faster than northern, central and western zones. Thus, it is indicating beta- convergence across zones.

Beta-Convergence for Rapeseeds & Mustard

Table 4 shows that the coefficient of land productivity growth is negative (-0.79), and it indicates that there is tendency to convergence, but there is no statistical level of significant. It is indicating that the zones with lower initial land productivity are growing faster than the zones with high initial land productivity. In absolute terms, in the table 3, southern zone had lower initial land productivity than the northern, central and western zones, but southern zone grow faster than northern, central and western zones. Thus, it is indicating beta- convergence across zones.

Beta-Convergence for Cotton

Table 4 shows that the coefficient of land productivity growth is negative (-0.78), and it indicates that there is tendency to convergence, but there is no statistical level of significant. It is indicating that the zones with lower initial land productivity are growing faster than the zones with high initial land productivity. In absolute terms, in the table 3, southern zone had lower initial land productivity than the northern, central and western zones, but southern zone grow faster than northern and western zones. Thus, it is indicating beta- convergence across zones.

Beta-Convergence for Sugarcane

Table 4 shows that the coefficient of land productivity growth is negative (-5.15), and it indicates that there is tendency to convergence, but there is no statistical level of significant. It is indicating that the zones with lower initial land productivity are growing faster than the zones with high initial land productivity. In absolute terms, in the table 3, southern zone had lower initial land productivity than the northern, central and western zones, but southern zone grow faster than central and western zones. Thus, it is indicating beta- convergence across zones.

Table 3: Zone - Wise Land Productivity Annual Growth Rate of Major Crops in Haryana before liberalization (1966-67 to 1990-91)

Crop	Northern Zone	Western Zone	Central Zone	Southern Zone
Rice				
Initial Productivity @ 1966-67	1151	1545	1129	1000
Annual Growth Rate in (%)	3.28	3.69	3.25	3.24
Wheat				
Initial Productivity @ 1966-67	1353	1385	1491	1539
Annual Growth Rate in (%)	3.10	3.87	2.93	2.64
Jowar				
Initial Productivity @ 1966-67	186	181	204	147
Annual Growth Rate in (%)	6.00	0.62	0.38	1.54
Bajra				
Initial Productivity @ 1966-67	596	362	473	430
Annual Growth Rate in (%)	1.26	0.98	1.26	1.75
Grams				
Initial Productivity @ 1966-67	566	516	560	327
Annual Growth Rate in (%)	-2.51	-0.17	-0.41	0.02
Rapeseeds & Mustard				
Initial Productivity @ 1966-67	310	500	364	246
Annual Growth Rate in (%)	2.88	4.00	4.49	5.06
Cotton				
Initial Productivity @ 1966-67	229	317	239	130
Annual Growth Rate in (%)	-0.03	0.66	1.48	1.37
Sugarcane				
Initial Productivity @ 1966-67	3390	4118	3393	2538
Annual Growth Rate in (%)	1.34	-1.46	0.33	1.26

Source: Compiled by Researcher.

Table 4: Beta-Convergence Across Zones for major crops in Haryana: Before Liberalization (1966-67 to 1990-91)

	Intercept	Growth Coefficient	R^2
Rice	-4.34	1.09	0.89
Wheat	47.10	-6.05	0.49
Jowar	1.00	0.22	0.03
Bajra	0.59	0.12	0.01
Grams	14.03	-2.40	0.28
Rapeseeds & Mustard	8.69	-0.79	0.06
Cotton	5.09	-0.78	0.17
Sugarcane	42.15	-5.15	0.62

Source: Compiled by Researcher.

3. BETA- CONVERGENCE ACROSS THE ZONES FOR MAJOR CROPS IN HARYANA- AFTER LIBERALIZATION

Table 5 and 6 shows that the coefficient of land productivity growth is (-3.12), (-0.91), (1.15), (-0.28), (-1.35), (-3.49), (-1.67) and (1.94) for the crops of rice, wheat, jowar, bajra, grams, rapeseeds & mustard, cotton and sugarcane respectively during the after liberalization period. It is concluded that there is tendency to beta-convergence in respect of rice, wheat, bajra, grams, rapeseeds & mustard and cotton crops whereas there is beta- divergence in case of jowar and sugarcane crops.

Table 5: Zone - Wise Land Productivity Annual Growth Rate of Major Crops in Haryana after liberalization (1991-92 to 2019-20)

Crop	Northern Zone	Western Zone	Central Zone	Southern Zone
Rice				
Initial Productivity @ 1991-92	2817	3602	2573	3158
Annual Growth Rate in (%)	1.35	0.13	0.83	0.01
Wheat				
Initial Productivity @ 1991-92	3573	3822	3512	3409
Annual Growth Rate in (%)	1.18	0.96	1.07	1.05
Jowar				
Initial Productivity @ 1991-92	125	208	285	296
Annual Growth Rate in (%)	3.08	3.30	4.11	3.94
Bajra				
Initial Productivity @ 1991-92	800	541	825	481
Annual Growth Rate in (%)	4.18	3.09	3.30	4.29
Grams				
Initial Productivity @ 1991-92	556	658	620	722
Annual Growth Rate in (%)	1.28	0.84	3.10	1.37
Rapeseeds & Mustard				
Initial Productivity @ 1991-92	811	1041	906	1115
Annual Growth Rate in (%)	3.06	1.86	2.60	2.10
Cotton				
Initial Productivity @ 1991-92	85	471	310	333
Annual Growth Rate in (%)	4.92	1.80	3.01	3.04
Sugarcane				
Initial Productivity @ 1991-92	5783	5588	5512	4530
Annual Growth Rate in (%)	1.50	1.53	1.90	1.15

Source: Compiled by Researcher.

Table 6. Beta-Convergence across the zones for major crops in Haryana after Liberalization (1991-92 to 2019-20)

Crops	Intercept	Growth Coefficient	R^2
Rice	25.54	-3.12	0.52
Wheat	8.50	-0.91	0.25
Jowar	-2.56	1.15	0.85
Bajra	5.53	-0.28	0.02
Grams	10.37	-1.35	0.02
Rapeseeds & Mustard	26.35	-3.49	0.86
Cotton	12.43	-1.67	0.95
Sugarcane	-15.09	1.94	0.50

Source: Compiled by Researcher.

Beta-coefficients (Growth Coefficient) for land productivity are negative in some cases, but positive in some other cases. However, except cotton crop none of these coefficients is statistically significant, implying that there has been no significant Beta-convergence or divergence in land productivity across the agro-climatic zones of the State.

SUMMARY AND CONCLUSIONS

We have examined the regional disparities in agricultural land productivity across agro-climatic zones of Haryana during before and after liberalization periods. During the period of before liberalization, the estimates of Sigma-convergence show that the sigma-convergence of productivity across the zones over time in respect of rice, grams, R&M, cotton and sugarcane crops. Sigma convergence test confirms the divergence in productivity across the zones over time in respect of wheat, jowar and bajra crops. Other side, during the period of after liberalization the coefficient of sigma convergence indicates that there is sigma-convergence of land productivity across the zones over time in respect of rice, wheat, jowar, bajra, R&M and cotton crops. Sigma convergence test confirms the divergence in land productivity across the zones over time in respect of grams and sugarcane crops. The results reveal also that zones are converging for the crops rice, wheat, jowar, bajra, R&M and cotton during the period of after liberalisation. The results indicating that there is a catch-up among the zones for the crops wheat, grams, R&M, cotton and sugarcane during the period of 1966-67 to 1990-91 and there is catch-up for the crops rice, wheat, bajra, grams, R&M, cotton and sugarcane for the period of after liberalisation.

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