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Trends of Total Factor Productivity in Hamirpur, Mahoba, Banda and Chitrakoot Districts of Uttar Pradesh Since 1990 To 2008

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Abstract

It is well known fact that productivity is the key factor in agriculture sector**.** In this paper, total factor productivity of foodgrain crops of four districts of u.p. was assessed. Four districts were selected for the present study. Findings indicated that two districts showed the negative total factor productivity growth during the period of the study.

Keywords: Compound Average Growth Rate (CAGR) and Total Factor Productivity.

Introduction

Achievement of significant increase in agricultural production depends upon the technology used in the farm production and its organization. The scope for increasing agricultural production by using the traditional technology is limited.[1] An increase in the productive capacity of the agriculture can be brought about by the combination of two courses (a) by extending the area under cultivation and (b) by improving the yield per hectare on intensive cultivation.[2] The extensive agriculture's elasticity would not bear much stress. Increase in the agricultural productivity has therefore to be sought for largely on the intensive side and here is obvious scope for improvement. A remarkable illustration of possibilities of intensive cultivation was furnished by pre-war Japan which supported population of nearly 60 million on the cultivated area of barely 17 million acre.[3]

Objectives of the Study

1. To measure the district-wise total factor productivity (TFP) for foodgrain crops in four (Hamirpur, Mahoba, Banda and Chitrakoot) districts of Bundelkhand zone of U.P..
2. To suggest policies and strategies to sustain the growth in TFP by district.

Review of Literature

Total Factor Productivity

The increased use of input, to certain extent , allows the agricultural sector to move up along the production surface by increasing the yield per unit area. Their use may also induce an upward shift in production function to the extent that technological change is embodied in them. It has long been recognised that partial productivity measure , such as output per unit of individual inputs , is of limited use as indicater of real productivity change as defined by the shift in a production function. The concept of total factor productivity (TFP), which implies an index of output per unit of total factor input, measures properly this shift or increase in output, holding all inputs constant. The relative sectoral growth rates of productivity are important determinants of structural transformation of economy, and the rate of growth of productivity in the long-run ; productivity being the ' engine of growth '. Since the publication of solow's paper in 1957, voluminous literature dealing with the measurement and analysis of productivity at different levels of aggregation has appeared. Until recently, much of it was concerned mainly with developed countries.

Shetty (1970) analysed agricultural production trends at all India level and measured the contribution of area, yield per acres and crop pattern to the growth of agricultural production (period 1920-21 to 1964-65). His conclusion was that the long term trend in agriculture productive over this period showed a rising tendency, and acreage expansion was the most important source of growth of production at all India level.

Christensen (1975) discussed the various index numbers advocated by different authors and more particularly the Laspeyre's index and Tornqvist index. The Laspeyre's index is exact for linear production fuction, which specifies a priori that all factors are perfect substitute in the production process.

Tornqvist index is exact for homogenous translog production function. The Fisher index is geometric mean of Laspeyre's and Paasche indices. This index is exact for the quadratic production function, which is flexible. The homogenous translog production function also provides a second order approximation to an arbitrary twice differentiable homogenous production function. In contrast to the assumption of perfect substitutability in case of linear function, the Translog function does not require inputs to be perfect substitutes. Keeping in view the advantage of Tornqvist Divisia index, it was recommended for use in analysing most production situation.

Kumar et al. (2002) analysed the performance of irrigated agriculture by measuring TFP indices at district and regional levels in the Indo-Gangetic Plains (IGP). The result revealed that the TFP index of the crop sector in IGP had risen by 1.2 percent during 1981-1997. It was higher in the Lower Gangetic Plain (3.1 PERCENT) and Lowest in the middle Gangtic Plain (0.4 percent). Productivity alone had contributed to the total output growth in IGP. The TFP had contributed in 65 percent of the GCA in IGP. Only one third of the GCA did not witness any contribution of technical change. The public policies such as investment in research, extension and infrastructure had been the major source of TFP growth in IGP. They have concluded that the sustainability issue of the crop system in the IGP has to be addressed for maintaining the country's overall economic development and the national food and household security.

Pratt (2008) indentified and TFP is measured using a non-parametric Malmquist index which allows the decomposition of TFP growth into its components: efficiency and technical change. Comparing TFP growth in China and India it is found that efficiency improvement played a dominant role in promoting TFP growth in China, while technical change has also contributed positively. In India, the major source of productivity improvement came from technical change, as efficiency barely changed over the last three decades, which explains lower TFP growth than in China. Agricultural research has significantly contributed to improve agricultural productivity in both China and India. Even today, returns to agricultural R and D investments are very high, with benefit / cost ratios ranging from 20.7 to 9.6 in China and from 29.6 to 14.8 in India.

Methodology

The Kendrick Index

This index is based on the assumption of a linear production function of the following from assumed by Kendrick (1961)

$$Q = aL + bK.$$

Where a and b are positive constants, and Q, L and K convey the usual meanings.

This index is the ratio of output to weighted average of the two factors of production, where base year rates of reward are taken as weights.

Kendrick index of TFP is given by:

$$A_t^K(t) = \frac{Q_t}{W_0L_t+r_0K_t}$$

W_0 and r_0 are the base year rates of reward for labour and capital respectively.

In the present study due to limitation of data, we have used kendrick index for measuring the Total Factor Productivity (TFP) in agricultural sector. In this study we have taken yield as output and fertilizer, pesticides, Seeds, working capital used as inputs. Then this formula is convert as:

$$A_t = \frac{Y_t}{WC+F+S+P}$$

where Y_t= yield in 't' year
WC= Working Capital per hectare in 't' year
F= Fertilizer consumption per hectare in 't' year
S= Seed Consumption per hectare in 't' year
P= Pesticide consumption per hectare in 't' year
A_t= Index of Total factor productivity in 't' year

In the above formula, we take equal weightage of all inputs (Non availability of price data at district level) and we make indexing of inputs and outputs.

In this paper, TFP is measured for foodgrain crop sector in four (Hamirpur, Mahoba, Banda and Chitrakoot) districts of Bundelkhand zone of U.P. during the period from 1993/94 to 2007/08. For analytical convenience this period has been divided into two sub periods, namely, 1993/94 to 1999/2000 (first sub-period) and 2000/01 to 2007/08 (second sub-period). The study covers four districts of Bundelkhand zone of U.P.. We have taken rice, wheat, jowar, bajara, maize, barley and gram crops as foodgrains.

A widely accepted exponential model, $y = a\ b^t\ e^u$, has been fitted to the time series data for estimating growth rates. The logarithmic form of this function is given by;

$\ln(y) = \ln(a) + t \ln(b) + u$

where,

y is the dependent variable whose growth rate is to be estimated.

t is the independent variable (Time)

u is the disturbance or error term.

a and b are the parameters to be estimated from sample observations. The regression coefficient b is estimated by ordinary least squares (OLS) technique.

The Compound Average Growth Rate (CAGR) in % term is estimated as:

$$CAGR = \{antilog\ (b) - 1\}$$

Results and Discussion

Productivity as a source of growth has been an important theme of analytical enquiry in economics all along. Analysis of total factor productivity, attempts to measure the amount of increase in total output which is not accounted for by increase in total inputs.

There is a large residual which is the contribution of the knowledge sector; this is called technological change or total factor productivity. The total factor productivity index is computed as the ratio of an index of aggregate output to an index of aggregate inputs.

This chapter is divided into two sections. Agricultural performance of four (Hamirpur,Mahoba,Banda and Chitrakoot) districts of Bundelkhand zone of U.P., i.e, trend analysis of Area, Production and Yield, has been discussed in Section I. Section II appraises the district-wise trends and growth of total factor productivity in foodgrain crops at district level in Hamirpur,Mahoba,Banda and Chitrakoot.

Section I: District-wise Agricultural Performance of Hamirpur, Mahoba, Banda and Chitrakoot

The results of estimation of CAGR of area, output and yield in respect of foodgrains of Hamirpur, Mahoba, Banda and Chitrakoot districts of Bundelkhand zone of U.P. for the two sub-periods i.e. 1990-91to 1999-2000, 2000-01 to 2007-08 and as also for the complete period i.e., 1990-91 to 2007-08 are presented in Table1.

The results of estimation of CAGR of area, production and yield in respect of foodgrains of four (Hamirpur, Mahoba, Banda and Chitrakoot) districts of Bundelkhand zone of U.P. in Table 1.

The district-wise results make clear that CAGR of agricultural output for foodgrain crops in four (Hamirpur, Mahoba, Banda and Chitrakoot) districts of Bundelkhand zone of U.P. in the later period i.e. 2000-01 to 2007-08 has significantly decreased as compared to first period i.e. 1990-91 to 1999-2000. It is also observed from these results that all districts experienced a fall in output growth rate of foodgrains over the study period 1990-91 to 2007-08 except Mahoba and Chitrakoot. But the CAGR of output of foodgrain crops varied. All districts have so bad experienced over the entire period of study except chitrakoot.

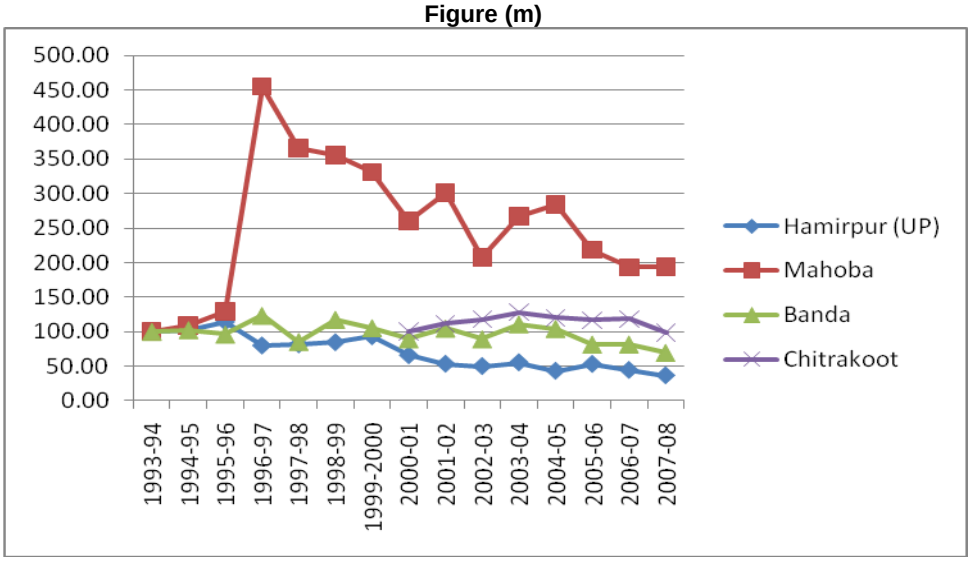
Table 1: District-wise CAGR in Area, Production and Yield for Foodgrain (in per cent)

S. No.	Districts	area			Production			Yield		
		1990-2000	2000-2008	1990-2008	1990-2000	2000-2008	1990-2008	1990-2000	2000-2008	1990-2008
1	Hamirpur	-5.64	-3.79	-6.60	-2.86	-6.70	-5.63	2.94	-3.03	1.04
2	Mahoba	33.95	-0.12	14.05	26.14	-11.05	7.18	-5.83	-10.94	-6.03
3	Banda	-6.18	2.09	-5.12	-3.43	-2.13	-4.32	2.94	-4.13	0.84
4	Chitrakoot	47.20	1.73	28.12	43.19	-1.96	26.64	-2.72	-3.63	-1.16

Section II: Total Factor Productivity: District-wise Analysis of Hamirpur, Mahoba, Banda and Chitrakoot

The movements in TFP index of foodgrain in Hamirpur,Mahoba,Banda and Chitrakoot districts of Bundelkhand Zone (U.P.) over the period 1993-94 to 2007-08 presented in figure (a). The level comparisons among these districts over the period of study in figure (a) show that on an average TFP levels have been the highest in Mahoba.

Figure (m)



The compound annual growth rates of total factor productivity (TFP) in Hamirpur,Mahoba,Banda and Chitrakoot districts of Bundelkhand Zone (Uttar Pradesh) for foodgrain crop over the two sub-periods of the study as well as for the entire period were at the district level, and the results are presented in table 2.

The comparison between TFP growth rate in Hamirpur,Mahoba,Banda and Chitrakoot districts of Bundelkhand zone (U.P.) over the periods from 1993-94 to 1999-2000 and from 2000-01 to 2007-2008 very clearly establishes that a sharp deceleration. All two districts showed the negative total factor productivity growth during the period of the study. The results also indicate that the CAGR of TFP in the later period in comparison to the first period for food grain crops shows a sharp deceleration.

Table 2: District-wise CAGR in Output, Input and TFP for Foodgrain in Hamirpur, Mahoba, Banda and Chitrakoot. (In Per cent)

S.No.	District	Output			Input			TFP		
		1993-2000	2000-2008	1993-2008	1993-2000	2000-2008	1993-2008	1993-2000	2000-2008	1993-2008
1	Hamirpur	4.55	-3.03	0.64	8.19	3.11	8.61	-3.37	-5.95	-7.34
2	Mahoba	-4.75	-3.65	-3.76	-25.83	1.13	-6.04	28.42	-4.73	2.43
3	Banda	3.21	-4.13	0.12	2.07	-0.24	1.99	1.12	-3.91	-1.84
4	Chitrakoot		-0.82			-0.95			0.13	

To sum up the result of this study lead to the conclusion that It rises serious doubts about the sustainability of state's agricultural output and food security programmes in the face of no significant reduction being achieved in the population growth during the last two decade. It implies that the post higher growth rates of output and TFP observed in foodgrain crops may not be sustained without substantial technological improvements in future.

Suggestions

In view of the foregoing analysis of Agricultural Productivity of foodgrain crops in Utter Pradesh, it seems proper to evolve a sound strategy to raise the productivity of agriculture in Hamirpur, Mahoba, Banda and Chitrakoot districts of Bundelkhand Zone of Utter Pradesh, especially in low productive regions. For this the following suggestions for raising the productivity may be recommended.

1. First step should be taken to divert the population from agriculture sector to secondary and Service sectors.
2. The measures of land reforms should be strictly observed in all the districts and surplus land should be expeditiously distributed among land less persons.
3. Priority must be given to check the floods & water logging and soil erosion hazards.
4. Ground water development programmes with modern methods in areas of water scarcity.
5. The infra structural facilities i.e. road, electrified villages, banking system, transport etc. are also very poor in the state. But the situation is more distressing in the districts Bundelkhand Zone of Uttar Pradesh. Therefore, development of Infra structural facilities should be development at fast pace in these districts.
6. Soil and water conservation programmes is to be needed.
7. Regulated markets may be strengthened so that the farmers are able to obtain remunerative prices for their produce.

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Footnotes

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