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Total Factor Productivity in Andhra Pradesh Agriculture

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Abstract

The variations in the indices of total factor productivity in the crop sector, foodgrain crops and non-foodgrain crops in Andhra Pradesh have been studied, and the contribution of the total factor productivity in the state during 1980-81 to 1999-2000 has been evaluated. Tornquist-Theil Index has been used to calculate the index of total factor productivity. The average annual index of total factor productivity during the post-reform period has been found five per cent less than that during pre-reform period in the state in the crop sector as a whole. In the case of non-foodgrains, it has been found nine per cent less than that during the pre-reform period, while in case of foodgrains, it is less than 100 during both the periods. The contribution of total factor productivity to yield growth has been found to be a healthy 31 per cent in the pre-reform period. An absolute decline (–37) has been noted during the post-reform period in the crop sector of the state. The absolute decline in the contribution of technical change has been drastic in the case of non-foodgrain crops in the state during the post-reform period. This absolute decline in total factor productivity seems to be one of the main reasons for the distress of farmers in the state which has been manifesting in the form of suicides since the late-1990s.

Introduction

Technical change in agriculture increases production at the same level of input-use and enables it to avoid trapping into Ricardo's law of diminishing returns to which the sector is more prone. It increases production at reduced unit costs/prices in real terms (Desai and Namboodiri, 1997).

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The introduction of seed-fertilizer technology in the early-1960s increased total factor productivity in Indian agriculture significantly. This has played an important role in achieving self-sufficiency in foodgrain production, along with infrastructure development (Dholakia and Dholakia, 1993; Rosegrant and Evenson, 1994; Desai, 1994). However, there is empirical evidence to believe that growth of total factor productivity has come down since late-1980s (Kalirajan and Shand, 1997; Kumar and Rosegrant, 1994). In fact, by the end of 1980s, the area under modern varieties had already reached the ceiling levels, particularly in the frontline states and major crops and yield levels had reached a plateau (Kumar and Mruthyunjaya, 1992).

The new economic policies relied on making terms of trade favourable to agriculture to bring dynamism in the sector and it assumed that the terms of trade for agriculture have a positive relationship with the private capital formation, technical change and output (Singh, 1995; Ahluwalia, 1996; Gulati, 1998; Mishra, 1998; Rao, 2004a). However, many scholars have questioned this assumption (Desai and Namboodiri, 1997; Desai, 2002). Andhra Pradesh is one of the states to implement economic reforms vigorously, particularly after 1995 in addition to the reforms of the Central Government. The growth of agricultural production in the state is said to be lower than that at the all-India level (Bandyopadhyay, 2001). The growth rate in foodgrains during 1990-91 to 1998-99 in the state was only 1.5 per cent per annum. After two decades of good performance, the state witnessed a deceleration in agricultural growth during the 1990s from 3.4 to 2.3 per cent per annum. The growth rates of yields of all the major crops declined during this decade in the state (Subrahmanyam and Satyasekhar, 2003). A large number of farmers committed suicide in the state during the later part of the 1990s (Rao, 2004b; Sarma, 2004). With this background, it was considered useful to study the variations in total factor productivity in agriculture of Andhra Pradesh. The specific objectives of the study were to find out the movements of the index of total factor productivity in the crop sector, foodgrain crops and non-foodgrain crops; and to measure the contribution of the total factor productivity in the state during the period 1980-81 to 1999-2000.

Concept of Total Factor Productivity Index

Index of total factor productivity (TFP) may be defined as the ratio of weighted combination of output to a weighted combination of inputs. Estimates of TFP indices are designed to provide an indication of the change in output per unit of total factor input. If outputs were homogeneous and there was a single homogeneous input, the estimation of TFP growth would

be straight-forward. It would be equal to the rate of growth of output minus the rate of growth of input. But in a multi-factor, multi-product case, the calculation of TFP raises many conceptual and empirical problems (Reddy, 1997). Various methods have been used for computing the TFP index (Christensen, 1975). Tornquist-Theil index is considered as a superior index for calculating total factor productivity (Rosegrant and Evenson, 1994).

The earlier literature assumed perfectly competitive product and factor markets as well as Hicks neutral (i.e. unbiased factor shares), disembodied technological change for TFP growth framework (Solow, 1957; Evenson and Jha, 1973; Dholakia and Dholakia, 1993). The Tornquist-Theil index provides consistent aggregation of inputs and outputs under the assumptions of competitive behaviour, constant returns to scale, Hicks neutral technical change and input-output separability. An additional advantage of this index is that it accounts for some changes in quality of inputs also. Because of the use of current factor prices in constructing the weights, quality improvements in inputs are incorporated to the extent that these are reflected in higher wages and rental rates (Desai, 1994).

Data and Methodology

The study was undertaken in Andhra Pradesh with 21 crop outputs and nine inputs during 1980-81 to 1999-2000. The period 1980-81 to 1990-91 was considered as the pre-reform period and 1991-92 to 1999-2000 as the post-reform period. Data pertaining to area under these crops and state domestic product were collected from the publications of A.P. Department of Economics and Statistics. The farm harvest prices were collected from CSO publications. The per hectare expenditures on seeds, pesticides, hired labour, land revenue and water charges were collected from the cost of cultivation data from the Cost of Cultivation Scheme of the Government of India. The quantities and prices of five fertilizers, viz. urea, ammonium sulphate, single super phosphate, di-ammonium phosphate and muriate of potash in the state were collected from the *Fertiliser Statistics*. The prices of decontrolled fertilizers for the later part of 1990s were collected from the records of Agriculture Department. The total number of energized pump sets and prices collected during this period were obtained from the Annual Reports of A.P. Transco. The number of tractors, pumpsets, and power sprayers were taken from the *Quniquennial A.P. Livestock Census* and the figures for the intervening years were worked out by interpolation. The amounts of credit disbursed and the rates of interest were collected from State Focus Papers of NABARD. Retail prices of diesel were taken from the unpublished records of A.P. Department of Economics and Statistics.

The weights or shares of individual output/ input in the total outputs/ inputs were calculated using the above data. The physical quantities of production of all the crops for all the years were collected and were multiplied with the respective farm harvest prices to get the value of production. All these were added to get the total value of production for each year. Then, the share of each output was its contribution in the total value of production. The value of these outputs at constant 1993-94 prices was obtained by dividing with the GSDP deflator.

The shares of all the nine inputs for all the years were calculated by arriving at the total expenditure under all these items put together and then taking the contribution of each individual item as the weight. The per hectare expenditure on seeds was available from the Cost of Cultivation Scheme data. This crop-wise per hectare expenditure was multiplied with the respective crop areas and the expenditure on seeds on all the crops was aggregated. The same procedure was followed for pesticides, human labour, land revenue and water charges.

The total quantities used in the state of the selected five chemical fertilizers, i.e. urea, ammonium sulphate, single super phosphate, D.A.P and muriate of potash during all the years were multiplied by the respective prices. By adding up all this, the total expenditure during each year was obtained. The total quantity of short-term and long-term credits disbursed to the agriculture sector by all scheduled commercial banks and cooperative institutions was multiplied by the respective rates of interest to obtain expenditure due to interest rate. This was done for all the years in the study period. The total number of energized pump sets was collected for all the years and multiplied by the slab-rate in each year to get the total expenditure on electricity to agriculture in each year. The numbers of tractors, diesel pump sets and power sprayers were collected for all the years. Diesel requirements of these equipments were arrived at by the following criteria: a tractor consumes 3 litres/hour and works for an optimum of 1000 hours per annum; a diesel pump set consumes one litre/hour and works for an optimum of 1100 hours per annum (Singh, 1989); and a power sprayer consumes 0.154 litre/hour and works for an optimum of 500 hours per year. The total diesel requirement in each year was multiplied by the per litre price of diesel in the respective year to get the total expenditure incurred on diesel for agriculture. The expenditures on all of the above items were added to compute the total expenditure incurred on purchase of intermediate items for agriculture during a year. Then, the contribution of each individual item in the total expenditure was its share. The expenditure on all these items at 1993-94 prices was obtained by dividing with GSDP deflator.

The TFP growth is measured from the Tornquist-Theil TFP indices (Desai, 1994). Expressed in logarithmic form, the Tornquist-Theil TFP index is given by Equation (1):

$$\ln (TFP_t/TFP_{t-1}) = \tfrac{1}{2} \sum_j (R_{jt}+R_{jt-1}) \ln (Q_{jt}/Q_{jt-1}) - \tfrac{1}{2} \sum_i (C_{it}+C_{it-1}) \ln (X_{it}/X_{it-1}) \quad \ldots(1)$$

where,

R_{jt} = Share of output 'j' in revenues in the year 't'

Q_{jt} = Output 'j' in the year 't'

C_{it} = Share of input 'i' in total input cost in year 't'

X_{it} = Input 'i' in period 't'

R_j and C_i are in current prices, and

Q_j and X_i (which are in monetary values) are in 1993-94 prices

This index was computed as the ratio of an index of aggregate outputs to an index of aggregate inputs. Specifying the index equal to 100 in a particular year (1980-81 in the present study) and accumulating the measure based on Equation (1) provides the TFP index. This index was calculated for the crop sector as a whole and also for foodgrain crops and non-foodgrain crops, separately. While calculating indices of TFP for foodgrains and non-foodgrains, the same total input index of crops was used. The quantity of inputs used could not be disaggregated due to lack of crop-wise data in the case of seeds, electricity, interest rate, and diesel. This is a limitation in measuring the indices of TFP of foodgrains and non-foodgrains.

Results and Discussion

The cost shares of different inputs show that wages paid to human labour account for the major portion, followed by chemical fertilizers, diesel, pesticides and interest charges (Annexure I). The share of human labour and chemical fertilizers was 58 and 20 per cent in 1980-81 and it came down to 49 and 19 percent, respectively in 1999-2000. During the study period, viz. 1980 to 1999, the share of human-labour charges showed a declining trend and that of water charges and interest charges, an increasing trend. The shares of foodgrains and non-foodgrains in the value of crop-output at constant prices indicate that the share of non-foodgrain crops increased considerably during the study period in the state (Annexure II). It increased from 51 per cent during 1980-1985 to 58 per cent during 1991-1995 and on the whole, it increased from 53 per cent during the pre-reform period to 57 per cent during the post-reform period. Among the foodgrain crops, paddy was the major crop accounting for 72 per cent of the value of

Table 1. Indices of TFP measured and outputs and inputs considered

TFP index	Outputs considered	Inputs considered
TFP index for crops	Paddy, jowar, bajra, maize, ragi, korra, red gram, black gram, green gram, horse gram, bengal gram, castor, groundnut, cotton (kapas), sugarcane, tobacco, onions, chillies, turmeric, mesta, sesamum	Seeds, chemical fertilizers, pesticides, hired labour, interest rates, electricity, diesel, land revenue and water charges
TFP index for foodgrains	Paddy, jowar, bajra, maize, ragi, korra, red gram, black gram, green gram, horse gram, bengal gram	Seeds, chemical fertilizers, pesticides, hired labour, interest rates, electricity, diesel, land revenue and water charges
TFP index for non-foodgrains	Castor, groundnut, cotton (kapas), sugarcane, tobacco, onions, chillies, turmeric, mesta, sesamum	Seeds, chemical fertilizers, pesticides, hired labour, interest rates, electricity, diesel, land revenue and water charges

foodgrain production in the triennium ending 1999-2000 (Annexure III), from 65 per cent in the triennium ending 1982-83. The shares in the value of production of maize, red gram and black gram increased, while those of jowar, bajra, ragi, and korra declined. Groundnut, sugarcane, cotton and chillies accounted for more than 70 per cent in the value of production of non-foodgrain crops in the state during the study period (Annexure IV). Among the non-foodgrains, the shares in value of production of cotton, and chillies increased, while those of groundnut and mesta decreased.

The trends in total output index, total input index and total factor productivity indices in Andhra Pradesh in the crop sector as a whole are shown in Table 2. During the pre-reform period, the total output index was more than the total input index in five years, resulting in a total factor productivity index of more than 100. In 1990-91, though the total output index was higher than 100, the input index was still higher, resulting in a lower total factor productivity index. On the other hand, during the post-reform period, there were only two such years, when the total output index outstripped total input index. The total input index (TII) outstripped total output index (TOI) in many of the post-reform years, leading to a lower factor productivity in the reform period in Andhra Pradesh agriculture. The average TFP index during the post-reform period was 96 as against

101 during the pre-reform period. Though the total input index remained almost the same during the two periods, the total output index declined from an average of 105 during the pre-reform period to 100 during the post-reform period. These trends are depicted in Figure 1.

Table 2. Total factor productivity indices of crops in Andhra Pradesh based on Tornquist-Theil index

Year	Total output index	Total input index	Total factor productivity index	Triennium averages		
				Total output index	Total input index	TFP index
1980-81	100.00	100.00	100.00			
1981-82	120.62	109.97	109.69			
1982-83	91.82	107.42	85.47	104	106	98
1983-84	115.03	93.24	123.38	109	104	106
1984-85	83.43	100.63	82.91	97	100	97
1985-86	93.61	94.45	99.11	97	96	102
1986-87	87.67	96.28	91.06	88	97	91
1987-88	125.62	108.81	115.45	102	100	102
1988-89	123.29	115.13	107.09	112	107	105
1989-90	96.26	93.59	102.85	115	106	108
1990-91	113.8	116.68	97.53	111	108	102
1991-92	102.54	104.73	97.91	104	105	99
1992-93	78.7	94.99	82.85	98	105	93
1993-94	111.24	91.84	121.12	97	97	101
1994-95	95.89	110.76	86.57	95	99	97
1995-96	112.82	111.48	99.41	107	105	102
1996-97	96.13	110.93	86.66	102	111	91
1997-98	78.66	90.82	86.6	96	104	91
1998-99	141.17	114.33	123.47	105	105	99
1999-2000	84.25	100.64	83.71	101	102	98
1980-81 to 1985-86	101	101	100	102	102	101
1986-87 to 1990-91	109	106	103	106	104	102
1991-92 to 1995-96	100	103	98	100	102	98
1996-97 to 1999-00	100	104	95	101	106	95
Pre-reform period	105	103	101	104	103	101
Post-reform period	100	103	96	101	104	97

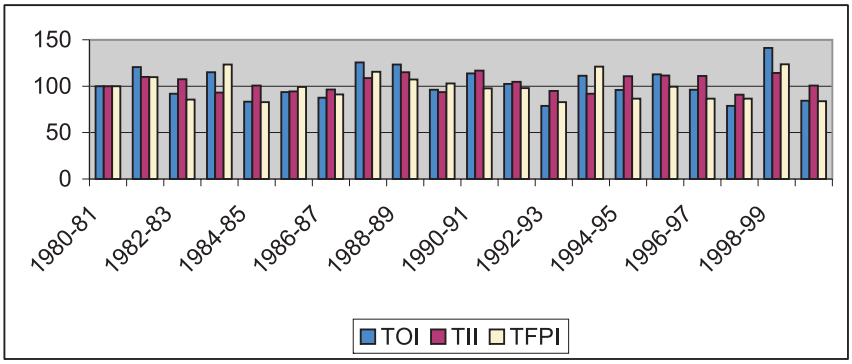

Figure 1. Trends in the indices of total output, total input and total factor productivity in Andhra Pradesh agriculture during 1980-81 to 1999-2000

Foodgrain Crops

The movement of indices of total output, input and total factor productivity for foodgrain crops in the state shows that the TFP index started declining during the latter part of 1980s and continued during the 1990s before picking up slightly in the late-1990s (Table 3). The average annual TFP index which was 99 during 1986-1990, declined to 96 during 1991-1995 and then increased to 102 during 1996-1999. There were six favourable years during the pre-reform period and only three favourable years during the post-reform period in the state. On the whole, the average annual TFP index declined from 99 during the pre-reform period to 98 during the post-reform period.

Non-foodgrain Crops

The TFP index of non-foodgrains decreased more drastically (8.65 per cent) during the post-reform than pre-reform period. It decreased from 104 during the pre-reform period to 95 during the post-reform period (Table 4). The TFPI of non-foodgrains in the pre-reform period (104) was higher than that of the AP crop sector as a whole (101) and also that (96) in the post-reform period. While the average annual total input index remained the same (103) during the pre- and post-reform periods in the state for the non-foodgrain crops, the average annul total output index declined from 107 to 99. The TFI index was highest during the latter part of 1980s and then declined gradually. Whereas TFP index for foodgrain crops showed an upward trend during the latter part of 1990s, for non-foodgrain crops it declined drastically. This seems to explain the distress of cultivators of non-foodgrain crops, especially of cotton and groundnut during the late-1990s, when many of these farmers committed suicides in the state.

Table 3. Total factor productivity indices of foodgrain crops in Andhra Pradesh based on Tornquist-Theil index

Year	Total output index	Total input index	Total factor productivity index	Triennium averages		
				Total output index	Total input index	TFP index
1980-81	100.00	100.00	100.00			
1981-82	113.27	109.97	103.00			
1982-83	98.82	107.42	91.99	104	106	98
1983-84	106.59	93.24	114.32	106	104	103
1984-85	71.55	100.63	71.10	92	100	92
1985-86	110.35	94.45	116.84	96	96	101
1986-87	85.18	96.28	88.47	89	97	92
1987-88	112.36	108.81	103.26	103	100	103
1988-89	134.91	115.13	117.18	111	107	103
1989-90	93.86	93.59	100.28	114	106	107
1990-91	102.07	116.68	87.72	110	108	102
1991-92	100.06	104.73	95.54	99	105	95
1992-93	86.91	94.99	91.08	96	105	91
1993-94	103.02	91.84	112.17	97	97	100
1994-95	102.88	110.76	92.88	98	99	99
1995-96	98.12	111.48	88.02	101	105	98
1996-97	112.04	110.93	101.00	104	111	94
1997-98	74.93	90.82	82.50	95	104	91
1998-99	141.70	114.33	123.94	110	105	102
1999-2000	99.90	100.64	99.27	106	102	102
1980-81 to 1985-86	100	101	100	100	102	99
1986-87 to 1990-91	106	106	99	105	104	101
1991-92 to 1995-96	98	103	96	98	102	97
1996-97 to 1999-00	107	104	102	104	106	97
Pre-reform period	103	103	99	103	103	100
Post-reform period	102	103	98	101	104	97

Total Factor Productivity

The contribution of total factor productivity to the output is responsible for increasing the output at the same level of input-use. In other words, it can shift the production function to a higher level and enable the farmer to get higher output at the same level of input. It is well documented that this increased contribution of the total factor productivity consequent to the green revolution made achievement of higher growth rates possible in the agricultural production of the country. In the specific context of Andhra Pradesh, the contribution of total factor productivity in the crop sector as a whole and for foodgrain and non-foodgrain crops are shown in Table 5.

Table 4. Total factor productivity indices of non- foodgrain crops in Andhra Pradesh based on Tornquist-Theil index

Year	Total output index	Total input index	Total factor productivity index	Triennium averages		
				Total output index	Total input index	TFP index
1980-81	100.00	100.00	100.00			
1981-82	129.66	109.97	117.00			
1982-83	85.20	107.42	79.31	105	106	99
1983-84	124.16	93.24	133.17	113	104	110
1984-85	94.41	100.63	93.82	101	100	102
1985-86	81.86	94.45	86.67	100	96	105
1986-87	90.06	96.28	93.54	89	97	91
1987-88	137.30	108.81	126.19	103	100	102
1988-89	114.68	115.13	99.61	114	107	106
1989-90	98.36	93.59	105.09	117	106	110
1990-91	123.62	116.68	106.24	112	108	104
1991-92	104.24	104.73	99.54	109	105	104
1992-93	73.28	94.99	76.79	100	105	94
1993-94	117.62	91.84	128.07	98	97	101
1994-95	91.16	110.76	82.30	94	99	96
1995-96	120.70	111.48	108.27	110	105	106
1996-97	86.32	110.93	77.81	99	111	89
1997-98	81.55	90.82	89.79	96	104	92
1998-99	140.81	114.33	123.16	103	105	97
1999-2000	72.68	100.64	72.21	98	102	95
1980-81 to 1985-86	103	101	102	105	102	104
1986-87 to 1990-91	113	106	106	107	104	103
1991-92 to 1995-96	101	103	99	102	102	100
1996-97 to 1999-00	95	104	91	99	106	93
Pre-reform period	107	103	104	106	103	103
Post-reform period	99	103	95	101	104	97

A perusal of Table 5 reveals that the contribution of total factor productivity to output growth declined from 31 per cent in the pre-reform period to (-) 37 per cent in the post-reform period in the crop sector as a whole in Andhra Pradesh. At the disaggregate level, the situation was alarming in the case of non-foodgrain crops where the contribution of TFP decreased from 41 per cent in the pre-reform period to (-) 240 in the post-reform period. Desai (1994) found the contribution of TFP in the Indian agriculture to be 38 per cent during 1980-81 to 1984-85 and 30 per cent during 1985-86 to 1989-90. Therefore, the results of the present study for the pre-reform period, viz. a TFP contribution of 31 per cent are broadly in

Table 5. Trend growth rates in total output index, total input index and total factor productivity in Andhra Pradesh agriculture

Period	Total output index	Total input index	Total factor productivity
		Crops	
Pre-reform	0.78	0.54	0.23
	(100)	(69)	(31)
Post-reform	0.46	0.63	-0.17
	(100)	(137)	(-37)
		Foodgrain crops	
Pre-reform	0.51	0.54	-0.02
	(100)	(106)	(-6)
Post-reform	1.51	0.63	0.91
	(100)	(42)	(58)
		Non-foodgrain crops	
Pre-reform	0.91	0.54	0.41
	(100)	(59)	(41)
Post-reform	-0.45	0.63	-1.06
	(-100)	(140)	(-240)

Note: Figures within the parentheses are respective contributions of outputs, inputs and total factor productivity
Trend growth rates were calculated with semi-log trend equation

line with his findings. The present study found a negative (-37) contribution of TFP in the post-reform period, it could be due to excessive usage of inputs. This negative contribution of TFP might be one of the main reasons for the distress among the farmers of the state, in general and farmers of non-foodgrain crops, in particular. The drastic absolute decline of the contribution of TFP to output growth in non-foodgrains was a more serious problem due to the increasing area under these crops during the 1990s, as shown in Annexure II.

The negative contribution of TFP does not seem to have been reported before in any state for the aggregate agriculture in the country. However, in a study conducted by Praduman Kumar with the cost of cultivation data for different crops during early 1970s to mid-1990s, it was found that TFP was negative for different crops in Madhya Pradesh, Bihar, Orissa, Karnataka and Punjab; and that the TFP was neither positive nor negative, i.e. it was constant for many crops in Andhra Pradesh (Jha, 2001). A study conducted in the former Soviet Republics for the period 1965-1990 using Tornquist-Theil Index method has reported a negative contribution of TFP for different Republics (Lerman *et al*., 2003). Another study on productivity growth in Pakistan's Punjab during 1971-1994 using Tornquist-Theil Index has also

found a negative TFP growth for wheat-rice system, which the authors have attributed to the deterioration in the quality of land and water (Ali and Byerlee, 2002). The negative growth rates of yield were reported in some states like Punjab (Singh and Singh, 2002).

The distress in the state agriculture was manifested mainly in the form of suicides. A large number of farmers have committed suicide in the state since 1997 and most of them were the cultivators of cotton and groundnut (Sarma 2004; Rao, 2004b). An Expert Committee concluded that the farmers in the state were using higher quantities of chemical fertilizers, and pesticides, and were also incurring higher expenditure on human labour and seeds compared to other states. Also, the cost of production per unit of output in the case of all foodgrains and non-foodgrains was the highest in A.P. amongst all Indian states (GOAP, 2002). The use of modern inputs like chemical fertilizers, pesticides and expenditure on hired labour in the state far exceeded those for other states in cotton (Rao, 2004b). The research and extension intensities are far less than those at the all-India level. The state invested 0.26 per cent of GSDP in agriculture in agricultural research and education, while it was 0.49 per cent at the all-India level during 1992-94. In the case of agricultural extension, the state invested only 0.02 per cent of GSDP in agriculture as against the all-India average of 0.15 per cent (Pal and Singh, 1997). In this background, the negative contribution of total factor productivity during the post-reform period in the state in the crop sector as a whole and non-foodgrains in particular, seems quite substantiated.

The declining total factor productivity in the state can be linked to the reform process, as the capital formation in agriculture declined sharply due to the decreased public investment on irrigation, and agricultural research and extension during the reform period. The gross capital formation in agriculture as a percentage of gross state domestic product in agriculture declined from 7.45 per cent during 1980-81 to 1990-91 to 5.56 per cent during 1991-92 to 1999-2000. The same at the all-India level declined from 7.36 to 6.38 per cent during the corresponding period and was higher than that in the state during the post-reform period. Both the public as well as private capital formation declined in the state during this period (Rao, 2003). This seems to explain the steep decline of total factor productivity during the reform period in the state. At the all-India level, the rural infrastructure has been found to have a major impact on agricultural productivity (Bhatia, 1999) and non-price factors have been more important in determining the TFP than the price-related factors (Desai and Namboodiri, 1997).

Conclusions

The average annual index of total factor productivity during the post-reform period has been found five per cent less than that during the pre-reform period in A.P. in the crop sector as a whole. In the case of non-foodgrains, it has been found nine per cent less than that in the pre-reform period. In the case of foodgrains, TFP index has been observed to be less than 100 during both the periods. The contribution of TFP to yield growth has been computed as 31 per cent in the pre-reform period. An absolute decline (-37) has been noted during the post-reform period in the crop sector of the state. The declining total factor productivity in the state may be due to the declining gross capital formation in the state during the reform period. The absolute decline in the contribution of technical change has been drastic in the case of non-foodgrain crops in the state during the post-reform period. This absolute decline in total factor productivity seems to be the main reason for the distress of farmers in the state, which manifested in the form of suicides.

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Annexure I

Changes in the cost share of inputs in Andhra Pradesh agriculture (Crops)

Year	Wages paid	Chemical fertilizers	Diesel	Pesticides	Water charges	Interest rates	Seeds	Land revenue	Electricity
1980-81	0.58	0.20	0.08	0.05	0.02	0.04	0.01	0.02	0.007
1981-82	0.56	0.20	0.09	0.05	0.02	0.05	0.01	0.02	0.007
1982-83	0.58	0.18	0.08	0.07	0.01	0.05	0.01	0.01	0.007
1983-84	0.56	0.18	0.09	0.07	0.01	0.05	0.01	0.01	0.007
1984-85	0.50	0.21	0.08	0.11	0.02	0.06	0.01	0.01	0.002
1985-86	0.55	0.20	0.09	0.07	0.01	0.07	0.01	0.01	0.002
1986-87	0.55	0.22	0.08	0.04	0.01	0.07	0.01	0.01	0.003
1987-88	0.56	0.15	0.07	0.10	0.01	0.07	0.01	0.01	0.002
1988-89	0.59	0.21	0.06	0.05	0.02	0.05	0.01	0.01	0.002
1989-90	0.56	0.24	0.06	0.05	0.01	0.06	0.02	0.01	0.002
1990-91	0.59	0.21	0.07	0.06	0.01	0.04	0.01	0.01	0.000
1991-92	0.59	0.21	0.06	0.07	0.01	0.04	0.01	0.01	0.000
1992-93	0.58	0.18	0.06	0.08	0.01	0.05	0.01	0.01	0.004
1993-94	0.60	0.18	0.06	0.06	0.01	0.07	0.01	0.01	0.004
1994-95	0.55	0.21	0.06	0.05	0.05	0.06	0.01	0.00	0.004
1995-96	0.51	0.21	0.05	0.07	0.09	0.06	0.01	0.00	0.002
1996-97	0.51	0.18	0.05	0.06	0.10	0.06	0.01	0.02	0.008
1997-98	0.48	0.20	0.07	0.06	0.09	0.07	0.01	0.01	0.008
1998-99	0.51	0.19	0.05	0.06	0.08	0.07	0.01	0.01	0.006
1999-2000	0.49	0.19	0.08	0.06	0.08	0.08	0.01	0.01	0.006

Annexure II

Shares of foodgrains and non-foodgrain crops in Andhra Pradesh

Year	Foodgrains	Non-foodgrains
1980-81	0.5192	0.4808
1981-82	0.4869	0.5131
1982-83	0.5247	0.4753
1983-84	0.486	0.514
1984-85	0.4182	0.5818
1985-86	0.4917	0.5083
1986-87	0.4777	0.5223
1987-88	0.427	0.573
1988-89	0.4682	0.5318
1989-90	0.4566	0.5434
1990-91	0.4095	0.5905
1991-92	0.3998	0.6002
1992-93	0.4412	0.5598
1993-94	0.4095	0.5905
1994-95	0.4388	0.5612
1995-96	0.3887	0.6113
1996-97	0.4495	0.5505
1997-98	0.4287	0.5713
1998-99	0.432	0.568
1999-2000	0.5104	0.4896
1980-81 to 85-86	0.49	0.51
1986-87 to 90-91	0.45	0.55
1991-92 to 95-96	0.42	0.58
1996-97 to 99-00	0.46	0.54
Pre-reform period	0.47	0.53
Post-reform period	0.43	0.57

Annexure III

Shares of foodgrain crops in Andhra Pradesh

Year	Paddy	Jowar	Bajra	Maize	Ragi	Korra	Redgram	Black gram	Green gram	Horse gram	Bengal gram
1980-81	0.64	0.11	0.03	0.06	0.02	0.017	0.01	0.02	0.04	0.009	0.04
1981-82	0.65	0.13	0.03	0.05	0.02	0.031	0.01	0.02	0.04	0.010	0.01
1982-83	0.66	0.13	0.02	0.06	0.02	0.013	0.01	0.03	0.05	0.010	0.00
1983-84	0.70	0.09	0.03	0.04	0.02	0.020	0.02	0.03	0.04	0.009	0.00
1984-85	0.65	0.12	0.02	0.03	0.02	0.013	0.01	0.06	0.05	0.008	0.00
1985-86	0.68	0.10	0.02	0.04	0.02	0.012	0.02	0.05	0.05	0.008	0.00
1986-87	0.66	0.10	0.02	0.05	0.02	0.011	0.02	0.08	0.03	0.008	0.00
1987-88	0.65	0.10	0.01	0.05	0.01	0.013	0.02	0.07	0.06	0.006	0.00
1988-89	0.75	0.05	0.01	0.04	0.01	0.007	0.01	0.08	0.03	0.004	0.01
1989-90	0.70	0.07	0.01	0.05	0.01	0.010	0.02	0.09	0.03	0.004	0.01
1990-91	0.73	0.06	0.01	0.04	0.01	0.007	0.02	0.08	0.03	0.005	0.01
1991-92	0.71	0.07	0.01	0.05	0.01	0.005	0.03	0.06	0.04	0.005	0.01
1992-93	0.71	0.07	0.01	0.05	0.01	0.005	0.02	0.06	0.05	0.004	0.01
1993-94	0.73	0.06	0.01	0.05	0.01	0.006	0.02	0.05	0.04	0.003	0.02
1994-95	0.70	0.05	0.01	0.06	0.01	0.004	0.02	0.08	0.03	0.004	0.03
1995-96	0.67	0.05	0.01	0.06	0.01	0.002	0.03	0.10	0.05	0.004	0.01
1996-97	0.70	0.05	0.01	0.07	0.01	0.003	0.03	0.07	0.04	0.005	0.02
1997-98	0.73	0.05	0.01	0.09	0.01	0.003	0.02	0.04	0.04	0.005	0.02
1998-99	0.73	0.04	0.01	0.08	0.01	0.002	0.03	0.05	0.04	0.003	0.02
1999-2000	0.71	0.05	0.01	0.08	0.01	0.002	0.03	0.07	0.04	0.003	0.02

Annexure IV

Shares of non-foodgrain crops in Andhra Pradesh

Year	Castor	Ground nut	Cotton kapas	Sugarcane (*gur*)	Tobacco	Onions	Chillies	Turmeric	Mesta	Sesamum
1980-81	0.01	0.25	0.11	0.27	0.14	0.01	0.09	0.02	0.10	0.01
1981-82	0.01	0.31	0.11	0.22	0.14	0.01	0.09	0.01	0.10	0.01
1982-83	0.01	0.30	0.11	0.18	0.19	0.01	0.08	0.03	0.08	0.01
1983-84	0.02	0.36	0.16	0.15	0.10	0.01	0.07	0.04	0.10	0.01
1984-85	0.01	0.26	0.13	0.15	0.09	0.00	0.15	0.03	0.16	0.01
1985-86	0.01	0.32	0.10	0.18	0.11	0.01	0.13	0.05	0.09	0.01
1986-87	0.01	0.40	0.11	0.15	0.11	0.01	0.10	0.03	0.07	0.01
1987-88	0.02	0.47	0.06	0.14	0.08	0.01	0.13	0.03	0.03	0.01
1988-89	0.01	0.41	0.07	0.13	0.12	0.01	0.18	0.01	0.05	0.00
1989-90	0.01	0.41	0.11	0.15	0.09	0.01	0.12	0.03	0.07	0.00
1990-91	0.01	0.43	0.11	0.12	0.11	0.01	0.13	0.03	0.05	0.01
1991-92	0.01	0.35	0.17	0.12	0.11	0.01	0.15	0.03	0.04	0.01
1992-93	0.01	0.35	0.13	0.16	0.12	0.01	0.13	0.05	0.04	0.01
1993-94	0.01	0.38	0.16	0.15	0.07	0.03	0.09	0.05	0.05	0.01
1994-95	0.01	0.28	0.24	0.16	0.07	0.01	0.14	0.04	0.06	0.01
1995-96	0.01	0.34	0.18	0.12	0.07	0.02	0.14	0.04	0.07	0.01
1996-97	0.01	0.30	0.21	0.15	0.09	0.02	0.15	0.06	0.01	0.01
1997-98	0.01	0.20	0.19	0.20	0.15	0.02	0.16	0.01	0.06	0.00
1998-99	0.01	0.27	0.15	0.17	0.11	0.03	0.17	0.06	0.04	0.01
1999-2000	0.01	0.17	0.19	0.21	0.09	0.01	0.16	0.08	0.07	0.01