Vol. 6 No. 2 March 2018 ISSN: 2319-961X UGC Approval No: 44192 Impact Factor: 3.104

PRODUCTIVITY MEASUREMENT IN THE AGRO-BASED INDUSTRIES OF INDIA

Article Particulars

Received: 23.02.2018 Accepted: 08.03.2018 Published: 27.03.2018

N.M.VARSHINI
Ph.D. Research Scholar, Avinashilingam Institute for Home Science and Higher Education for Women Coimbatore, Tamil Nadu, India

M.MANONMANI
Professor of Economics, Avinashilingam Institute for Home Science and Higher Education for Women Coimbatore, Tamil Nadu, India

Abstract

In this paper an attempt is made to measure partial and total factor productivity in the agro-based industries of India between the period 2004-05 and 2013-14. Statistical tools such as compound annual growth rate, partial factor productivity indices of labour and capital and solow indices of total factor productivity indices were used to analyze the data. It was found that industry-wise growth of labour productivity indices showed that from the beginning of the period to the end of the period it was maximum for textiles (3.13 fold). The annual trend rates calculated revealed that labour productivity growth rate was statistically significant excepting the manufacture of paper and paper products. It ranged between 2.7 percent and 11.9 percent across the agro-based industries. The partial factor productivity of capital across agro-based industries in India over the reference period indicated that across the period and across the industries changes were mixed (increasing / decreasing). The annual trend rates calculated showed that 4 out of 9 industries recorded positive growth rate. But it is a sorry state of affair that majority of these industries had shown insignificant growth rate. Across the years except during 2005-06, the total factor productivity indices had shown increase at the end of the period compared with initial period. It might be due to the provision of better infrastructural facilities developed in these years across the low technology industries.

keywords: *agro-based industries, annual trend rates, labour productivity growth rate, agricultural products, Cotton mills, village industries*

Introduction

Agro industry refers to an industry that adds values to agricultural raw materials through processing in order to produce marketable and usable products that bring forth profits and additional income to the producer. It is regarded as an extended arm of agriculture. The development of agro industry can help stabilise and make agriculture more lucrative and create employment opportunities both at the production and marketing stages. The broad-based development of the agro-products industry will improve both the social and physical infrastructure of India. The place of the agro-based industries in the development of India is widely recognized and needs no emphasis. They can provide vast employment opportunities at

comparatively low investment. The techniques of production adopted by the agro-based industries are simple and the machinery and equipment required by them is easily available. Developing competitive agro-industries is crucial for generating employment and income opportunities. It also contributes to enhancing the quality of, and the demand for, farm products. Agro-industries have the potential to provide employment for the rural population not only in farming, but also in off-farm activities such as handling, packaging, processing, transporting and marketing of food and agricultural products. There are clear indications that agro- industries are having a significant global impact on economic development and poverty reduction, in both urban and rural communities.

Nearly 70% of the population depends on agriculture and agro-based industries. Since it would cause diversification and commercialization of agriculture, it will thus enhance the incomes of farmers and create food surpluses. It is a well recognized fact across the world, particularly in the context of industrial development that the importance of agro industries is relative to agriculture increases as economies develop. It should be emphasized that food is not just produce but also encompasses a wide variety of processed products. It is in this sense that the agro-industry is an important and vital part of the manufacturing sector in developing countries and the means for building industrial capacities. The development of agro-based industries commenced during pre-independence days. Cotton mills, sugar mills, jute mills were fostered in the corporate sector. During the post-Independence days, with a view to rendering more employment and using local resources, small scale and village industries were favoured. In this context an effort is made in this paper to measure the productivity performance of these industries in India.

Methodology

Net Value Added (NVA) was taken as output, since trends are not affected significantly by the use of net value added. Also ambiguity in the calculation of depreciation can be overcome if net value added is taken as a measure of output. Labour input consisted workers directly involved in production. The gross fixed capital was taken into account as capital input. Wages included remuneration paid to workers. The basic data source of the study was Annual Survey of Industries (ASI) published by Central Statistical Organization (CSO), Government of India covering the period from 2004-05 to 2013-14. All the referred variables were normalized by applying Gross Domestic Product (GDP) deflator. The GDP at current and constant prices were obtained by referring to Economic Survey, published by Government of India, Ministry of Finance and Economic Division Delhi. The following statistical tools were used to analyse the data.

Compound Annual Growth Rate (CAGR)

In the present study, compound annual growth rate of labour productivity and capital productivity, total factor productivity was calculated. Symbolically it is represented as follows:

$Y = ab^t$

Where, Y = is the dependent variable (i.e. labour & capital productivity, total factor productivity), t = is the independent variable (i.e. time period), 'a' is constant and 'b' is the parameter. After getting b (coefficient) the following method is being used to estimate CAGR

CAGR = [Antilog b – 1] x 100.

Partial Factor Productivity (PFP) indices

Partial factor productivity measures the ratio of output to one of the inputs setting aside interdependence of use of other output. Labour productivity (NVA/L) is measured as a ratio of Net Value Added (NVA) to total number of persons employed (L). Capital Productivity (NVA/K) is measured as a ratio of value added to gross fixed capital (K).

- PFPL (NVA/L) = Partial factor productivity of labour
- PFPK (NVA/K) = Partial factor productivity of capital

Total Factor Productivity (TFP) indices of Solow

The index number approach, generally, does not proceed by specifying an explicit production (or a dual cost) function; rather its strategy is to compute separate input and output indices from observed prices and quantity data and use them for measurement of TFP.As a result of this, TFP by this approach is free from all the biases of explicit functional form. Multi factor productivity growth (or) Total factor productivity growth may be defined as the difference between the growth in output and the growth in aggregate inputs.

Solow's geometric index of TFP is given by the parameter A (t) in the multiplicative production function of the form:

$V=A(t)\, L^{\alpha}\, K^{\beta}$

Taking logarithmic and differentiating w.r.t. time we have:

$\Delta V'/V = A'/A + \alpha L'/L + \beta K'/K$

For discrete changes the above equation may be written as:

$\Delta A/A = \Delta - [\alpha(\Delta L/L) + \beta K/K]$

Where $\Delta A/A$ is the rate of change of TFP; $\Delta V/V$ is the rate of change of output; $\Delta L/L$ and $\Delta K/K$ is the rate of change of labour and capital; and are the share of labour and capital in total income. Thus, rate of change of TFP is the difference between the rate of change of output and the weighted sum of the rate of change of inputs. Under the assumption of constant return to scale we have $\alpha + \beta = 1$ and the

equation can be written as:

$V/L = A(t) . (K/L)^{\beta}$ and the TFP is given by:

$\Delta A/A = (\Delta V/L)/(V/L) - \beta(\Delta K/L)/(K/L)$

Thus, under the assumption of constant return to scale the rate of TFP is the difference between rate of change of output per unit of labour and rate of change of capital per unit of labour multiplied by capital share in output. Thus, Solow's geometric index assumes a more general neo-classical production function where the elasticity of substitution need not to be constant, but technical change is of Hicks- neutral type under the assumption that factor are paid according to their marginal products. Once computation of ΔA/A is done for different year with the help of the equation (2.19), an index of TFP {A (t)} for each year can be derived from the identity:

$A (t +1) = A(t)(1+\Delta A/A)$

Measuring cumulative effect of shift over time. A (0) is one by assumption representing base year technology.

Solow's model can also be used to separate the effect of technical progress and capital accumulation in TFPG. The basic procedure is to estimate the contribution made to growth in output by increase in inputs of labour and capital by multiplying the observed increase in factor price, and deducting the result from the overall growth in output. To decompose labour productivity change due to technological progress and due to capital intensity, the following equation is used:

$(\Delta V/L)V/L = \Delta A/A + (\Delta K/L)/(K/L)$.

Which shows that labour productivity is compounded of two elements (i) changes in capital intensity and (ii) changes in technical progress. To find out how much of change in labour productivity is due to technical progress it is preceded as follows:

- Total rise in labour productivity is calculated by:
  $\Delta V/L= (V/L)t - (V/L)0$
- (ii) The labour productivity in year t is deflated by A (t) of the same year. This is net of technical change and attributable to capital intensity. Symbolically: $\Delta V/L_{K/L} =[(V/L)t/A (t) - (V/L)0]$
- Here, V/L is the increase in labour productivity solely due to capital intensity (K/L ratio).
- The remainder of the change in labour productivity and changes due to capital intensity give the rise in labour productivity due to technical progress. Symbolically:
  $(\Delta V/L)_{tp} =\Delta V/L - \Delta V/L_{K/L}$
- \ Thus, Solow index can be used to decompose the effect of increased per capita capital and the technical progress on labour productivity.

Results and discussion

Trends in partial factor productivity indices of labour is shown in table-1

Table 1 Trends in Partial Factor Productivity Indices of Labour (Pfpl)

Industry	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Constant (A)	Parameter (β)	R^2
Food products and beverages	100	99	97	105	132	188	182	203	212	260	77.020* (12.836)	11.9* (9.473)	0.918
Textiles	100	114	117	128	153	162	173	157	212	313	87.399* (11.570)	10.3* (7.416)	0.873
Tobacco products	100	123	125	132	142	173	183	249	213	270	91.124* (17.407)	10.5* (11.394)	0.942
Paper and paper products	100	117	116	117	148	153	139	177	143	104	111.666* (8.339)	2.7 (1.386)	0.194
Tanning and dressing of leather, luggage, hand bags, Saddler harness and foot wear	100	95	108	106	125	145	137	148	195	169	86.026* (17.723)	7.4* (8.164)	0.893
Wood and wood products, cork except furniture	100	114	123	116	201	126	196	168	249	206	93.828* (8.277)	8.9* (4.556)	0.722

Source: Calculations are based on ASI data

Foot Note: *Significant at 1% level

Industry- wise growth of labour productivity indices showed that from the beginning of the period to the end of the period it was maximum for textiles (3.13 fold) followed by tobacco products (2.70 fold), food products and beverages (2.60 fold), Wood and wood products, cork except furniture (2.06 fold), Tanning and dressing of leather, luggage, hand bags, saddler harness and foot wear (1.69 fold), and paper and paper products (1.04 fold). The annual trend rates calculated revealed that labour productivity growth rate was statistically significant excepting the manufacture of paper and paper products. It ranged between 2.7 percent and 11.9 percent across the agro-based industries. The significant growth rate of labour productivity excepting paper and paper products (2.7 percent) in all the industries might be due to reduction in working time, high minimum wage which stimulates labourers to work more in less time, keeping less productive persons out of employment and advancement in technology. The co-efficient of determination (R^2) ranged between 0.194 and 0.942 across the agro-based industries. The maximum R^2 was recorded for the manufacture of tobacco products implying the fact that more than ninety percent (94.2 percent) of the variation in the growth of labour productivity in these industries were due to the influence institutional factors and the remaining 5.8 percent was incidental. Trends in partial factor productivity indices of capital is presented in table-2.

Table 2 Trends in Partial Factor Productivity Indices of Capital (PFPC)

Industry	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Constant (A)	Parameter (β)	R^2
Food products and beverages	100	89	88	90	107	125	105	104	91	94	95.335* (12.654)	0.6 (0.501)	0.030
Textiles	100	112	112	116	123	102	105	85	100	14	170.005** (2.613)	-12.3** (-2.000)	0.333
Tobacco products	100	107	100	111	114	105	99	136	84	130	101.453* (10.195)	1.1 (0.682)	0.055
Paper and paper products	100	96	112	110	122	117	117	108	69	104	111.534* (8.683)	-1.2 (-0.652)	0.050
Tanning and dressing of leather, luggage, hand bags, Saddler harness and foot wear	100	93	104	94	111	123	107	98	109	112	96.928* (18.191)	1.4 (1.591)	0.240
Wood and wood products, cork except furniture	100	103	104	96	162	74	126	75	104	61	118.436* (5.382)	-3.6 (-1.211)	0.155

Source: Calculations are based on ASI data

Foot Note: *Significant at 1% level

The partial factor productivity of capital across agro-based industries in India over the reference period indicated that across the period and across the industries changes were mixed (increasing / decreasing). In other words much variation was not observed at the end of the period over the base period. The annual trend rates calculated showed that 4 out of 9 industries recorded positive growth rate. But it is a sorry state of affair that majority of these industries had shown insignificant growth rate. A trend in total factor productivity indices of is presented in table-3.

Table 3 Trends in Total Factor Productivity Indices (TFP)

Industry	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Constant (A)	Parameter (β)	R^2
Food products and beverages	100	94	92	97	119	153	138	145	139	156	85.640* (13.788)	6.3* (5.353)	0.782
Textiles	100	113	114	122	137	129	135	116	146	66	121.793* (6.170)	-1.8 (0.375)	0.017
Tobacco products	100	115	112	121	127	135	135	184	134	187	96.266* (14.034)	5.8* (5.054)	0.761
Paper and paper products	100	106	114	113	134	134	128	138	99	104	111.557* (10.864)	0.7 (0.492)	0.029
Tanning and dressing of leather, luggage, hand bags, Saddler harness and foot wear	100	94	106	100	118	134	121	120	146	138	91.344* (20.247)	4.4* (5.558)	0.794
Wood and wood products, cork except furniture	100	108	113	106	180	97	157	112	161	112	105.392* (6.697)	2.6 (1.091)	0.129

Source: Calculations are based on ASI data **Foot Note:** *Significant at 1% level

The total factor productivity indices were found to be increasing from the beginning of the period to the end of the reference period excepting the textile industry. The estimated growth rates in the manufacture of food products and beverages, tobacco products, paper and paper products, tanning and dressing of leather, luggage, hand bags, Saddler harness and foot wear, and wood and wood products, cork except furniture were statistically significant. Statistically insignificant growth rates were found in the manufacture of textiles, Paper and paper products, and wood and wood products, cork except furniture. Across the years except during 2005-06, the total factor productivity indices had shown increase at the end of the period compared with initial period. It might be due to the provision of better infrastructural facilities developed in these years across the low technology industries.

Conclusion

Variation in the growth of labour productivity may be due to the influence institutional factors. The varying levels of magnitude of total factor productivity trends explained the fact that across the industries the significant growth rate might be due to the provision of better infrastructural facilities available to these industries. The significant growth rate of labour productivity in 5 out of 4 agro-based industries might be due to reduction in working time, high minimum wage which stimulates labourers to work more in less time, keeping less productive persons out of employment and advancement in technology. Among agro-based industries the annual trend rates calculated showed that it was mixed.

References

1. Lakshmi Kantha Reddy, C. and Rathna Kumari, S. (2014), "Performance of Agro-Based Industries in India: A Critical Analysis", Journal of Economics and Finance, Vol. 2, No. 4, Pp. 15-25.
2. Venkaiah, V. (1987), "Impact of Agro-Based Industries on Rural Economy", Himalaya Publishing House, Bombay.
3. Annual Survey of Industries, Central Statistical Organisation, New Delhi. (Different issues)
4. Kar, G.C and Mishra, S.N. (2004), "Agro industries & Economic Development", Deep& Deep publications pvt. Ltd.
5. Manjappa, D.H. and Mahesha, M. (2008), "Productivity Performance of Selected Capital- Intensive and Labour–Intensive Industries in India during Reform Period: An Empirical Analysis", ICFAI Journal of Industrial Economics, Vol. 5, No.4, Pp.57-65.