



## Productivity analysis of food industry in post-liberalization period from 1994-95 to 2010-11

Radhika Vyas<sup>1</sup>, Dr. Mahipal Singh Yadav<sup>2</sup>

<sup>1</sup> Research Scholar, Department of Regional Planning and Economic Growth, Barkatullah University, Bhopal, Madhya Pradesh, India

<sup>2</sup> Professor, Economics, Institute for Excellence in Higher Education, Bhopal, Madhya Pradesh, India

### Abstract

This paper analyzes productivity in Food Industry in the post-liberalization period with an aim to know the causes behind the trends in the productivity in the sample period which is 1994-95 to 2010-11. Based on the outcome, suggestions have been put forth that could bring positive difference in growth of Food Industry in India. Secondary data has been used in the paper sourced from the Annual Survey of Industries and website of Central Statistical Organization.

**Keywords:** productivity, food industry, post-liberalization, partial factor productivity, productivity ratios, inverse productivity ratios, production function, net-value added, net value of output, CAGR, principal characteristics of factory-level data

### Introduction

Firm level economics, like the nation-level economics, has one focus: growth. Growth comes from higher productivity that leads to more output with the same amount of inputs, or the same output with lesser amount of inputs. Eventually, more output would mean more profit which turns into more investments, more investments means expansion or growth. Higher output can be achieved through factor accumulation as well as through better productivity of factor inputs such as labour and capital. Since factor accumulation is subjected to diminishing marginal returns, better productivity is a more sought after option for achieving growth. India was grappling with sluggish economy when economic reforms were brought about in a phased manner in the early 1990s. Not only did the economy integrate with the world economy through globalization measures but non-performing public units were aimed to be privatized to improve their productivity. A yet more significant move came in form of economic liberalization that happened at the financial and trade level.

The major changes that financial liberalization entailed were: easing the entry of new private and foreign banks; liberalizing interest rate control; enhancing role of market forces and reduce state pre-emption of bank credit through reductions in reserve and statutory liquidity requirement, which together stood at more than 50% of assets in 1992 (Mrs. Poonam Gupta *et al.* (March 2011) [7]). The idea behind financial liberalization was to make credit availability easier to the private firms, thus facilitating capital to them which is believed to be a way to raise productivity. Trade liberalization, on the other hand, can be seen as policies that diminish restriction on the free international movement of goods and services. It is done through measures like bringing down import quotas, lowering of import tariffs, bringing down restrictions to exports, and lowering of export taxes. Trade liberalization brings economic efficiency through different ways: allocative efficiency, productive efficiency, dynamic efficiency and X-efficiency. Allocative efficiency happens when competition from lower

cost import sources drives market prices down and in this reduces the supernormal profits in monopoly. Productive efficiency is specializing and selling in larger markets lead to increasing returns to scale lowering long run Average Cost. Dynamic efficiency is when open economies experience more R&D and investment in human capital to raise productivity. X-efficiency will provide discipline in business to keep their unit costs under control to remain competition. In short, financial and trade liberalization help in better resource allocation and utilization. How the productivity in the Food Industry, of which India is the second biggest producer in the world, changed during the post-liberalization period is going to be the focus of this paper.

Food Industry is the umbrella term in which all types of industries related to food can be entailed such as simply cleaning, polishing, packaging raw food material to food processing, food transformation, food manufacturing and so on. This industry can be defined as an industry which processes biological materials produced by agriculture, horticulture, animal husbandry and fishery (Leniger and Beverloo, 2012) [4].

Food Industry is a consumer nondurable goods Industry producing products whose consumption is largely autonomous. It's growth is inevitable due to factors like increased urbanization; women population have also started working, families are now having bigger disposable income; greater variety of food materials available; change in tastes and preference of consumers towards processed food and so on, so the processed food is becoming a preference

Despite the above-mentioned conducive factors for demand of food products, following statistic is revelatory about India's present and its potential: The Food Industry in India exported products worth around US\$ 5.8 billion in 1998 while the total world food export stood at US\$ 438 billion. This shows that although India is one of the biggest food producers in the world, it accounted for only 1.5% of the international trade in food as in 1998 (www. business.mapsofindia.com/food-

industry/). It has been found by a Subject Group on Food and Agro Industries under Prime Minister's Council (1998) that 20% of the food produced in India gets wasted and the cost of such wastage is six times the amount spent on subsidies by the government; annual post harvest losses account to 10% of the total food production; 25% of the fruits produced in India goes as 'wastage' (Mehta and George, 2003). India's exports in Food Products suffer a great deal on account of rejection from countries due to non adherence of quality, safety, labeling and packaging standards'. (www.m.rediff.com /business/report/). The above-mentioned factors explain what may have gone wrong with the export of food products' and also the domestic market despite the comparative advantage that India might enjoy in this industry. However, the missing points in the spectrum of the given situation cannot be understood until the firm-level productivity in the Food Industry is analyzed particularly in the post liberalization period, which was meant to facilitate growth in industries by bringing about high productivity and greater efficiency.

#### In the context of the above, the aim of this paper is to

1. Measure Partial Factor Productivity of Labour and Capital as well as Total Factor Productivity in the Food Industry from 1994-95 to 2004-05 and also analyze the cause behind it.
2. Explore changes required in the Food Industry on the basis of the factor input with highest factor elasticity.

#### Data Source and Methodology

This paper uses secondary data collected from the publication of Annual Survey of Industries for the period: 1994-95 to 1997-98. Data beyond 1998 has been collected from the website: www.csoisw.gov.in/ which presents the time series data on the Annual Survey of Industries. Selected characteristics of factory sector at 2-digit level of disaggregation have been taken which includes No. of Factories, Total Persons Engaged, Fixed Capital, Net Value Added and Net Value of the Output. The above-mentioned characteristics would be put to use to analyze the data to meet the following objectives two steps:

#### Objectives

1. Measurement of Partial Factor Productivity of Labour and Capital as well as Total Factor Productivity in the Food Industry from 1994-95 to 2004-05 and analyzing the causes behind it with the help of a few select productivity and inverse productivity ratios.
2. Estimating the predictor variable that has maximum marginal effect on the 'net value of output' through regression. Extending suggestions to optimize that variable and putting forth submissions to make insignificant

variables significant. Achieving the above-mentioned ends should expectantly bring the costs down and make Food products more competitive in domestic and foreign markets.

#### First Stage of Calculation

Measurement of Partial Factor Productivity of Labour and Capital as well as Total Factor Productivity in the Food Industry from 1994-95 to 2004-05 and analyzing the causes behind it:

Productivity in the sample period is found at two levels, labour and capital productivity and Total Factor Productivity which also depicts the 'technological progress' in the Food Industry. The reason why these three factors are stressed upon is that in the long run, the economy's supply of goods and services depends on its supplies of labour and capital as well as the available production technology to turn these capital and labour into goods and services (Joshua Gans *et al.*, 2018) [3].

Single Factor Productivity and Total Factor Productivity are calculated in the following way:

Labour Productivity or PFPL =

$$\text{Net Value Added to Output/Value of Labour}$$

Capital Productivity or PFPK =

$$\text{Net Value Added to Output/Value of Capital}$$

Total Factor Productivity =

$$\text{TFPI} = \sqrt{\text{PFPI (K)} \times \text{PFPI (L)}}$$

V (t) = index of value added for the year t

K (t) = index of capital employed for the year t

L (t) = index of Labour employment for the year t

The PFPL here would give the value added by each unit of labour; PFPK is the value added by each unit of capital. There are a couple of methods to calculate TFP. In the present study, the Direct Method has been chosen to calculate TFP. In this method, the square root of the product of partial factor productivity of labour and capital in terms of their respective value-added, would result in the Total Factor Productivity, i.e. it is the geometric average of the PFP indices.

The resultant values of productivity would be put adjacent to the inverse productivity ratios which will bring forth trends existing in the Food Industry.

The principal characteristics of the factory sector for the Food Industry that would be used for this paper are:

**Table 1:** Principal Characteristics in the Food Industry

| Year    | Number of Factories | Total Persons Engaged | Fixed Capital | Net Value-Added | Net Value of Output |
|---------|---------------------|-----------------------|---------------|-----------------|---------------------|
|         | Number              | Number                | (Rs. Lakh)    | (Rs. Lakh)      | (Rs. Lakh)          |
| 1994-95 | 21127               | 1232785               | 1272037       | 907578          | 6794897             |
| 1995-96 | 22878               | 1312071               | 1587007       | 921632          | 8248446             |
| 1996-97 | 22764               | 1271113               | 1673178       | 926463          | 9527041             |
| 1997-98 | 22802               | 1352148               | 2130156       | 1158000         | 10364006            |
| 1998-99 | 23854               | 1346825               | 2675618       | 1667492         | 13644188            |

|           |       |         |          |         |          |
|-----------|-------|---------|----------|---------|----------|
| 1999-2000 | 23942 | 1347418 | 3164234  | 1679182 | 14895868 |
| 2000-01   | 23988 | 1332588 | 3188659  | 1560827 | 14737032 |
| 2001-02   | 23485 | 1306677 | 3390701  | 1644731 | 15150429 |
| 2002-03   | 23816 | 1308335 | 3762747  | 1630158 | 17871240 |
| 2003-04   | 23839 | 1297074 | 3741169  | 1593394 | 18032536 |
| 2004-05   | 25363 | 1342925 | 4138787  | 1805955 | 20425524 |
| 2005-06   | 25725 | 1391616 | 4535666  | 2345568 | 22849381 |
| 2006-07   | 25729 | 1476352 | 5745985  | 3488800 | 28431320 |
| 2007-08   | 26220 | 1505246 | 6833484  | 3500225 | 33739019 |
| 2008-09   | 25854 | 1439618 | 6812392  | 3160261 | 33517413 |
| 2009-10   | 26164 | 1473989 | 8406328  | 3661336 | 41310198 |
| 2010-11   | 34023 | 1547516 | 10134235 | 4744966 | 54372569 |
| CAGR %    | 2.51  | 1.43    | 13.85    | 10.89   | 13.88    |

Source: Annual Survey of Industries (Factory Sector), CSO, New Delhi

**Table 2:** PFP and TFP of Food Industry and their Compound Annual Growth Rates from 1994-2009

| Year                           | PFP(Labour) | PFP(Capital) | Total Factor Productivity |
|--------------------------------|-------------|--------------|---------------------------|
|                                | 1           | 2            | 3                         |
| 1994-95                        | 0.74        | 0.71         | 0.72                      |
| 1995-96                        | 0.7         | 0.58         | 0.64                      |
| 1996-97                        | 0.73        | 0.55         | 0.64                      |
| 1997-98                        | 0.86        | 0.54         | 0.68                      |
| 1998-99                        | 1.24        | 0.62         | 0.88                      |
| CAGR in %                      | 13.88       | -3.33        | 4.92                      |
| 1999-2000                      | 1.25        | 0.53         | 0.81                      |
| 2000-01                        | 1.17        | 0.49         | 0.76                      |
| 2001-02                        | 1.26        | 0.49         | 0.78                      |
| 2002-03                        | 1.25        | 0.43         | 0.73                      |
| 2003-04                        | 1.23        | 0.43         | 0.72                      |
| CAGR in %                      | 0           | -5.35        | -2.89                     |
| 2004-05                        | 1.34        | 0.44         | 0.77                      |
| 2005-06                        | 1.69        | 0.52         | 0.93                      |
| 2006-07                        | 2.36        | 0.61         | 1.2                       |
| 2007-08                        | 2.33        | 0.51         | 1.09                      |
| 2008-09                        | 2.2         | 0.46         | 1.01                      |
| CAGR in %                      | 13.03       | 1.54         | 7.13                      |
| 2009-10                        | 2.48        | 0.44         | 1.04                      |
| 2010-11                        | 3.07        | 0.47         | 1.2                       |
| CAGR of the entire period in % | 9.33        | -2.6         | 3.19                      |

Source: Annual Survey of Industries (Factory Sector), CSO, New Delhi

**Table 3:** Average of Productivity Ratios of Food Industry on a sub-period basis:

|                 | O/L  | O/K  | K/L  | K/O  | ICOR  |
|-----------------|------|------|------|------|-------|
| 1994 -1999      | 0.86 | 0.60 | 1.45 | 1.69 | 17.02 |
| 1999-00-2004-05 | 1.23 | 0.47 | 2.62 | 2.13 | -4.17 |
| 2004-05-2008-09 | 1.98 | 0.51 | 3.9  | 2    | 20.04 |

The above two tables, Table 2 and 3 can be interpreted accordingly: In the Table 2 Compound Annual Growth Rate of productivities of labour, capital along with the Total Factor Productivity (technical progress) are given on a sub-period basis as well as for the whole of the sample period. On a sub-period basis, time between 1994-98 or the first sub-period, it is seen that labour productivity is as high as 13.88, while capital productivity is negative at -3.33, while the TFP is 4.92. Coming to the second sub-period, it is seen that the labour productivity has become zero, capital productivity has slid further down from -3.33 to -5.35 and TFP has become negative, finally; in the third sub-period, labour productivity is 13.03, capital productivity is 1.54 and TFP is 7.13. Clearly,

the third sub-period is looking most positive from the perspective of productivity. The cause behind this trend can be found by knowing the cause behind negative productivity of factors which is when the value of output falls in relation to the amount spent on factor inputs. The labour productivity gets negative when there is too much of labour and the output they produce is proportionately lesser due to diminishing marginal returns. On the other hand, capital productivity is negative when the value of output declines in relation to the amount spent on units of capital either due to under-utilization of the available capital or due to depreciated capital or capital without the new-technology embedded into it as a result of which marginal efficiency of capital declines. Since TFP here is the square root of the product of labour productivity and capital productivity, its value is bound to be a reflection of the productivities of the two factor inputs. In this case, since CAGR of productivity is taken that shows the rate of change in productivity from the start to the end of sub-period. Looking at the first sub-period, it is clear that the high growth rate of productivity of labour especially when the growth of

productivity of capital is so low could only be attributed to efficiency of labour who are working at very low wages and whatever technical progress is happening could only be due to efficiency of labour. Second sub period is the time when labour productivity growth has become zero. In other words, it seems that the advantage in terms of low cost labour has dwindled and the investments in the industry have come further down. Capital under utilization does not appear to be the case here since if the capital had been sufficient, the labour productivity would not have been zero. With zero labour productivity growth and negative capital productivity growth, TFP is bound to be negative in the second sub-period. In the third sub-period, labour productivity growth rate has again reached a double digit, and capital productivity has also become positive, this time the labour productivity seems more due to availability of capital or rationalization of excess labour in the Industry or loss of excess labour-intensity. Capital productivity growth is less but atleast positive which means that there's some upgradation in the capital of the industry. Technical growth is positive at 7.13. For the overall sample period, CAGR of the labour productivity has been highest followed by growth rate of TFP which is at 3.19 and finally the capital productivity which remains negative at -2.6.

Table 3 which takes into account of mean of productivity and inverse-productivity ratios, shows that there is a continuous improvement in the labour productivity through the sub-periods but it is not due to better capital since capital productivity seems low and erratic through the sub-periods, instead labour productivity is growing due to slow yet steady growth in capital intensity. Capital-output ratio is low in the beginning of the sample period and then it has risen in the second sub-period and come down somewhat in the third sub-period which means that the cost of production has seen a rise from the time of beginning of sample period. ICOR is quite high in the first and third sub-period with clear indications of lacking infrastructure in the Industry.

#### **Inferences Drawn from the Calculations Done So Far are**

1. Rise in wages in the post-reform period and/or labour leaving the industry, both could be reason behind falling labour intensity.
2. Capital productivity in this period remained largely negative which means technology was grossly missing in the capital.
3. Technical progress has been negligible.
4. Level of capital deepening is very low which keeps labour productivity average low.
5. Food Industry is in imperative need for basic infrastructure to keep its cost of production under check.

#### **Second Stage of Calculation**

##### **Changes required in the Industry**

Economic thought at various times have suggested the vital role that the technical progress plays in industrial growth. It has also been suggested time and again, the role that value-addition plays in structural change of an industry since more value-addition in the product of an industry would make the industry more productive which would be manifested in form of higher TFP since TFP is the residual that explains the value-added after accounting for labour and capital (OECD,

Perspective on Global Development 2014).

The next step aims to explore what role does value-added plays in the 'net value of output' in the Food Industry. According to the pivotal role value-added has in the value of output, as explained above, growth rate of net value-added should make a substantial impact on the growth rate of TFP, however as seen in the Table 4, even though the highest growth rate of value-added is in first sub-period, TFP growth rate as already seen in Table 2, is highest in the third sub-period. This is the period when the fixed capital growth rate is the highest. The question whether capital is making the maximum impact on the value of output can be found by finding factor elasticities where output can be explained by labour, capital and net value-added. It is done in Table 5. Table 5 shows that P-value of the F-ratio is less than .05% which means the probability of null hypothesis being true is not present. When elasticities of predictor variables are seen, coefficients of labour and value-added turn out to be insignificant and the only significant and large coefficient is of capital which is 4.73. The outcome confirms that capital is by far the most important factor in deciding the value of output.

Consumer non-durables require much lesser capital than the heavy consumer durable goods industry. According to M. Dawam Rahardjo (Kenneth James and Akrasenee, 1988) <sup>[5]</sup>. Of all the industries, the value of average assets for food processing firms is by far the lowest, indicating that, on an average, the capital needed to establish a food processing enterprise is relatively small. This capital requirement is more of a one-time investment such as the infrastructural facilities and knowledge capital. Infrastructure, as found earlier, in the studies is largely missing in the Food Industry in form of storage, warehouses, distribution medium and network etc. As for, knowledge capital, which is an intangible capital asset means that food businesses deal with many kinds of food and this requires much manipulation and expertise along with all procedures in order to produce safe food. According to Henson and Trail (1993), as the inverse of the food risk i.e. the probability that there is no damage by consumption of a food, it has become crucial in the food chain (Turner Geoff, 2011) <sup>[9]</sup>. The insignificance of value-added can be explained in Food Industry by virtue of very little addition done in the Food products in India through processing. In India, most food is consumed in fresh form and only a small quantity is processed for value addition ([www.technopak.com/](http://www.technopak.com/)). India's processing sector is small and processing of food to consumable standard has reached only 10% recently. India's share in exports of processed food in World trade has remained at about 1.5 percent or \$3.2 billion (Surendra P Singh *et al.* (March, 2012) <sup>[14]</sup>). Units are operating at very low working capital which suggests that they exist in form of small units that cannot support high value-additions in the Food Products as they lack adequate technology. Labour is insignificant in explaining the net value of output, could be due to their limitations in transforming the agro-products owing to capital and technology gap.

While evaluating the role of 'net value-added' in the Food Industry, definition of 'value added' is referred which says that the components of value added consist of compensation of employees, taxes on production and imports less subsidies, and gross operating surplus. Another way of putting it is that

the value added equals the difference between an industry's gross output (consisting of sales or receipts and other operating income, commodity taxes, and inventory change) and the cost of its intermediate inputs (including energy, raw materials, semi-finished goods, and services that are purchased from all sources. (www.bea.gov/faq/). As per this definition, when the difference is less between net value-added and net value of output, most part of a product's price is the summation of productivities of all factor inputs that have added value to the product, along with the profit margin which comprises less part of the product's price. However, in the

Food Industry when we subtract 'net value-added' from 'net value of output, it is seen that the difference is quite high which may indicate that the value-addition in the products of Food Industry may not very high, however, the prices had risen manifolds in the sample period, hence, there is a possibility that these prices may be high due to high prices of agricultural products which is the primary and most important raw material for the Food Industry. When the agricultural productivity is low, the output is less but the prices are high since the demand for primary products is inelastic.

**Table 4:** Compound Annual Growth Rate of Factor Inputs in the Food Industry through three sub-periods:

| Year      | Total Persons Engaged<br>Number | CARG% | Fixed Capital<br>(Rs. Lakh) | CAGR% | Net Value-Added<br>(Rs. Lakh) | CAGR% |
|-----------|---------------------------------|-------|-----------------------------|-------|-------------------------------|-------|
| 1994-95   | 1232785                         |       | 1272037                     |       | 907578                        |       |
| 1995-96   | 1312071                         |       | 1587007                     |       | 921632                        |       |
| 1996-97   | 1271113                         |       | 1673178                     |       | 926463                        |       |
| 1997-98   | 1352148                         |       | 2130156                     |       | 1158000                       |       |
| 1998-99   | 1346825                         | 2.24  | 2675618                     | 20.43 | 1667492                       | 16.42 |
| 1999-2000 | 1347418                         |       | 3164234                     |       | 1679182                       |       |
| 2000-01   | 1332588                         |       | 3188659                     |       | 1560827                       |       |
| 2001-02   | 1306677                         |       | 3390701                     |       | 1644731                       |       |
| 2002-03   | 1308335                         |       | 3762747                     |       | 1630158                       |       |
| 2003-04   | 1297074                         | -0.95 | 3741169                     | 4.28  | 1593394                       | -1.30 |
| 2004-05   | 1342925                         |       | 4138787                     |       | 1805955                       |       |
| 2005-06   | 1391616                         |       | 4535666                     |       | 2345568                       |       |
| 2006-07   | 1476352                         |       | 5745985                     |       | 3488800                       |       |
| 2007-08   | 1505246                         |       | 6833484                     |       | 3500225                       |       |
| 2008-09   | 1439618                         | 1.75  | 6812392                     | 13.27 | 3160261                       | 15.01 |

**Table 5**

| Summary Output               |              |                |            |         |                |             |
|------------------------------|--------------|----------------|------------|---------|----------------|-------------|
| <b>Regression Statistics</b> |              |                |            |         |                |             |
| Multiple R                   | 0.996268974  |                |            |         |                |             |
| R Square                     | 0.992551869  |                |            |         |                |             |
| Adjusted R Square            | 0.990833069  |                |            |         |                |             |
| Standard Error               | 1242349.142  |                |            |         |                |             |
| Observations                 | 17           |                |            |         |                |             |
| <b>Anova</b>                 |              |                |            |         |                |             |
|                              | DF           | SS             | MS         | F       | Significance F |             |
| Regression                   | 3            | 2.67385E+15    | 8.9128E+14 | 577.47  | 0.00           |             |
| Residual                     | 13           | 2.00646E+13    | 1.5434E+12 |         |                |             |
| Total                        | 16           | 2.69391E+15    |            |         |                |             |
|                              | Coefficients | Standard Error | t Stat     | P-value | Lower 95%      | Upper 95%   |
| Intercept                    | 3765853.69   | 15478438.54    | 0.24       | 0.81    | -29673279.72   | 37204987.10 |
| X Variable 1                 | -3.93        | 12.81          | -0.31      | 0.76    | -31.61         | 23.75       |
| X Variable 2                 | 4.73         | 0.60           | 7.85       | 0.00    | 3.43           | 6.03        |
| X Variable 3                 | 1.24         | 1.85           | 0.67       | 0.52    | -2.76          | 5.24        |

#### On the Basis of the Above Text, Following Suggestions Can Be Put Forth

1. Capital emerged to be the highest and the only significant factor input in defining 'net value of output.' Since Food industry does not consume a lot of working capital, it may be surmised that the capital here means the establishment of proper infrastructure and knowledge capital. Knowledge capital may mean expertise to bring the food products to the required level of quality, safety and hygiene standards, at the same time making it better than other countries by working on its uniqueness. Technological gap, which is

quite evident through low TFP and low capital productivity indicates possibility of very small units operating in the Food Industry. Such industries lack infrastructural facilities and prove to be unviable due to lack of scale economies. Establishment of growth poles and administrative support to the Food Industry can be worked upon more rigorously.

2. Agriculture sector has seen marginalization in the last few years as the economy has gone in pursuit of greater development of other sectors. In a country like India with extremely large population base, it is simply a very

expensive mistake to not keep agricultural sector constantly buoyant since good agriculture growth rate would mean reasonable prices of food which is not only beneficial for domestic consumers but can provide comparative advantage in trade into food products for India; a large part of the population is still dependent directly or indirectly on agriculture, good agriculture would mean creating a large consumer base in the farmers' community for products from various industries.

### Conclusion

Even though liberalization, both at the level of finance and trade may have opened gates for higher investments and new technology in Indian manufacturing sector, numbers suggest this change has clearly not manifested in the Food Industry in the study period. Food Industry has a tremendous market not only in the country but also outside. Knowledge capital has to be built and made use of for creating a standing of Indian Food products. India needs to work on its unique food items complying with highest level of safety guidelines to not just sustain but grow exponentially. Food Industry is also in dire need for infrastructural facilities to bring down the cost of production. However, the basic focus should remain to keep up the agricultural productivity; it is the backbone of the Food Industry, the single largest raw material coming from agriculture.

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