FACTORS INFLUENCING TOTAL FACTOR PRODUCTIVITY ACROSS THE SOUTHERN STATES OF INDIA - AN APPLICATION OF DISCRIMINANT FUNCTION

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Abstract—In this paper an attempt is made to evaluate the major factors influencing total factor productivity in the aggregate manufacturing sector of southern states India-Tamil Nadu, Kerala Karnataka and Andhra Pradesh. The study covers the recent reference period between 2000-01 and 2011-12. This study was based on ASI data. The major objective of the study was to find out major determinants of total factor productivity across the southern states of India by applying discriminant function. It was found that labour productivity (LP), gross output (GVA) and capital intensity (K/L) were significant at 5% level in influencing total factor productivity across the states. The variable capital productivity (CP) alone was insignificant. Labour productivity, capital productivity had positive signs indicating that these variables had higher discriminating power in the period selected. The variable gross output and capital intensity K/L having negative sign implied that these variables acted as suppressor variables. Capital productivity was the first dominant factor to determine Total factor productivity and it alone contributed 79.72 percent and labour productivity contributed negatively.

Keywords—manufacturing, productivity.

I. INTRODUCTION

Disparities among different regions or world nations have become a concern to policymakers in most of the countries. As far as India is concerned, regional disparities are inheritance from the colonial past. During the pre-independence period, economic policies of the government were designed to protect the interests of the British economy rather than for advancing the welfare of Indians. It is widely acknowledged that lop-sided government policies led to the decline and decay of India's traditional industries. The trickling down effects of development of some regions of the union to hinterlands had also not been as effective as had been the case in developed countries. Also, the centralized planning that started in 1951 could not yield any significant dispersal of economic activities from the developed to the less or underdeveloped regions of the country. The first two five year plans that laid much stress on increased production or equitable distribution of resources virtually ended up in an effort to break the stagnation in the country. Accordingly, in the process of completing the projects for which the groundwork was already done in the pre-planning period or the projects that could be completed in the short span of time, allocation of outlays were made towards those states, which had a capacity to spend and achieve the targets period (Sharma, Manoj K. and Khosla, Rajiv, 2013).

In India major economic reforms has been undertaken since July, 1991 with the objective of increasing productivity and competitiveness of the Indian manufacturing sector. The economic reformed process heralded the liberalisation of Indian industrial sector from various controls and regulations. This also implied a movement towards the establishment of a competitive market system with optimum resource utilisation. Under this process the firms were exposed to international competition which forced them to introduce new methods of production, import quality inputs along with modern technology to improve their efficiency. In this era, productivity growth is recognised as a key feature of economic dynamism. The industrial growth driven mainly by input growth is inevitably subject to diminishing returns to scale and may not be sustainable in the long run. Therefore, the policymakers are now pursuing the industrial growth through improvement and productivity driven strategies that lay emphasis on enhancing total factor productivity growth rather that investment driven growth (Fulwinder Pal Singh, 2012)

Productivity, the main source of modern economic growth, has once again been discussed and debated in India in the context of recent economic reforms. With productivity growth and increasing competitiveness becoming the key issues in the industrial reform process, measurement of total factor productivity (TFP) has become a growing industry by itself. Different data sets and methodologies have been tried out culminating in the debate over the growth of TFP in the 2000-2012. Productivity gains are vital to the economy because they allow us to accomplish more with less. Capital and labor are both scarce resources, so maximizing their impact is always a core concern of modern business. Productivity enhancements
come from technology advances, such as computers and the internet, supply chain and logistics improvements, and increased skill levels within the workforce. Productivity is the ratio of output to inputs in production; it is an average measure of the efficiency of production. Efficiency of production means production’s capability to create incomes which is measured by the formula real output value minus real input value. Increasing national productivity can raise living standards because more real income improves people's ability to purchase goods and services, enjoy leisure, improve housing and education and contribute to social and environmental programs. Productivity growth also helps businesses to be more profitable.

The economy of southern region plays a significant role in achieving higher GDP growth rate of the country. The four southern states – Andhra Pradesh, Karnataka, Kerala and Tamil Nadu – contribute over 24.3 percent of the GDP of the country. They are emerging as the major destinations for industrialization. Further the southern states are gallapping much ahead of the poorest but populous northern states with higher economic growth rates. Hence attempt is made in this paper to analyse the growth and determinants of partial and total factor productivity in the aggregate manufacturing sector of southern states of India.

II. METHODOLOGY

The study was undertaken for the aggregate manufacturing industries in southern states of India. The reference period chosen for the study covers between 2001-02 and 2011-12. The data used for the study such as fixed capital, gross output and number of workers were collected from Annual Survey of Industries (ASI) published by Central Statistical Organization (CSO), Government of India. All the refereed 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.

III. TOOLS OF ANALYSIS

A. Partial factor productivity indices

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

B. Total factor productivity (TFP)

Total factor productivity (TFP) in a simple way, is defined as output per unit of inputs. It is the ratio of aggregate output index to aggregate input index and measures the efficiency of all inputs in a production process. In other words, TFP is the portion of output not explained by the amount of inputs used in production. This is known as a residual.

This was calculated by making use of the formula as follows.

\[ \text{TFPDM} = \sqrt{\text{PFPK}} \cdot \sqrt{\text{PFPL}} \]

C. Discriminant function

To identify the major determinants of total factor productivity (TFP) of manufacturing sector of southern states (Tamil Nadu, Kerala, Karnataka and Andhra Pradesh), discriminant analysis was applied by taking total factor productivity (TFP) as dependent variable and capital productivity (CP), labour productivity (LP) gross output (GVA) and capital intensity as independent variables. Selected variables were used to find out relative contribution in discriminating the groups. Wilk’s lambda and ‘F’ value were used to find out whether the means of the two periods differ significantly. Using canonical discriminant function, coefficient of selected variables in discriminating the groups was found out. The functional form is represented as follows.

\[ Z = L_1 X_1 + L_2 X_2 + L_3 X_3 + L_4 X_4 \]

\[ Z = \text{Discriminant total scores of total factor productivity across the states (zero for below average and one for above one)} \]

\[ X_1 = \text{Labour productivity}, X_2 = \text{Capital productivity}, X_3 = \text{Gross output}, X_4 = \text{Capital intensity} \]

IV. RESULTS AND DISCUSSION

The first step in the discriminant analysis was the estimation of univariate F-statistic and Wilks lambda. If the Wilks lambda approaches 0, it indicates significant mean difference between the pre and post liberalization period. If it approaches 1, it indicates absence of mean difference. Table 1 shows the estimated F-value and Wilks lambda.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Wilk’s lambda</th>
<th>F-value</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour productivity(LP)</td>
<td>.550**</td>
<td>37.598</td>
<td>.000</td>
</tr>
<tr>
<td>Capital productivity(CP)</td>
<td>.790</td>
<td>12.227</td>
<td>.960</td>
</tr>
<tr>
<td>Gross output(GVA)</td>
<td>.922**</td>
<td>3.879</td>
<td>.000</td>
</tr>
<tr>
<td>Capital intensity(K/L)</td>
<td>.943**</td>
<td>2.801</td>
<td>.000</td>
</tr>
</tbody>
</table>

Note: ** significant at 5 percent level.

It is very clear that the Wilks lambda for labour productivity (LP), gross output and Capital intensity (K/L) were significant at 5 percent level. The variable capital productivity (CP) alone was insignificant. Hence the above said factors excepting capital productivity (CP) were capable to determine total factor productivity of the selected state under study.
A. CANONICAL DISCRIMINANT CO-EFFICIENTS

To identify the significant factors determining the level of total factor productivity canonical discriminant co-efficients were calculated. The magnitude of canonical discriminant coefficients indicates the degree of contribution which is presented in table-II

<table>
<thead>
<tr>
<th>Variables</th>
<th>Canonical discriminant coefficients</th>
<th>Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour productivity(LP)</td>
<td>.022</td>
<td>1</td>
</tr>
<tr>
<td>Capital productivity(CP)</td>
<td>.000</td>
<td>2</td>
</tr>
<tr>
<td>Gross output(GVA)</td>
<td>-.001</td>
<td>3</td>
</tr>
<tr>
<td>Capital intensity(K/L)</td>
<td>-.008</td>
<td>4</td>
</tr>
</tbody>
</table>

Based on the standardized canonical discriminant function which represented a linear composition of the data variability the group variability was estimated as follows.

\[ Z(TFP)=.022LP+.000CP-.001GVA-.008K/L \]

In the above function the variables such as labour productivity (LP), capital productivity (CP) had positive signs indicating that these variables had higher discriminating power in the period. In other words these variables distinguished level of productivity period. The variable gross output (GVA) and capital intensity(K/L) having negative sign implied that these variable acted as a suppressor variables.

B. RELATIVE CONTRIBUTION OF VARIABLES

The relative contribution of selected independent variables were calculated and presented in table -III.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Relative contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour productivity(LP)</td>
<td>-1.73835</td>
</tr>
<tr>
<td>Capital productivity(CP)</td>
<td>79.72574</td>
</tr>
<tr>
<td>Gross output(GVA)</td>
<td>20.18384</td>
</tr>
<tr>
<td>Capital intensity(K/L)</td>
<td>1.830772</td>
</tr>
</tbody>
</table>

Capital productivity was the first dominant factor to determine the total factor productivity and it alone contributed 79.72 percent. Capital intensity K/L was the least dominant factor to determine productivity and it contributed 1.83 percent, and labour productivity contributed negatively.

V. CONCLUSION

Industrial development is believed to hold the key to rapid and sustained economic growth in southern states of India. While this was well-recognized by policy-makers at an early stage as reflected in various planning documents, the approach to the problem has changed considerably over time. The issue of sustainable growth raises questions about what policies can help to achieve this objective. Focusing on productivity of manufacturing sector would be the issue for encouraging further growth of the sector.

REFERENCES
