Growth And Performance Of Manufacturing Sector Of Punjab In Liberalization Era

Thesis submitted in partial fulfillment of the requirements for the award of the Degree of

Master of Philosophy
in
Economics

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JUNE, 2010

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DEDICATED TO

God,

And My Whole Family

Acknowledgement

It is my humble privilege to thank and express my deepest gratitude towards my worthy supervisor Dr (Ms) Ravi Kiran, Associate Professor, School of Management and Social Sciences, Thapar University, Patiala whose concrete and constructive suggestions, keen interest, unfailing and inspiring guidance as well as critical evaluation of entire manuscript made it possible for me to complete this work. I am deeply indebted to her outstanding theoretical knowledge and research insight.

My sincere thanks are also due to Dr (Ms) Santha Kumari, Associate Professor and Head, School of Management and Social Sciences, Thapar University, Patiala for providing me help and encouragement. I am grateful to all faculty members, non teaching staff of the department.

I find it difficult to express a short acknowledgement for my friend Pankaj, who have not only been giving me a continuous and constant encouragement but also had been actively assisting me in this venture. My parents morally supported me during the entire span of my study and I find myself wordless to express my appreciation towards them.

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CERTIFIACTE

I here by certify that the work which is being presented in this thesis entitled 'Micro Finance In India: A State Wise Analysis' in partial fulfillment of the requirements for award of the Degree of Masters Of Philosophy in Economics, submitted in School of Management and Social Sciences, Thapar University Patiala, is an authentic record of my work carried out under the supervision of Dr.(Ms)Ravi kiran, Associate Professor, School of Management and Social Sciences

The matter presented in this thesis has not been submitted for the award of any other degree of this or any other university

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ABSTRACT

Liberalization, privatization and globalization are the buzzwords today. The government of India introduced major reforms in July 1991. After the advent of Liberalization, Privatization and Globalization (LPG) the manufacturing sector in Punjab is in the throes of a very significant phase of transition with severe challenges and many new opportunities. To compete in this globalized world, productivity of manufacturing sector is a crucial factor. The significance of productivity in increasing national welfare is now universally recognized. In every country, industry or organization, the main source of economic growth is a result of an increase in productivity. Nowadays, it is widely accepted that productivity is a key performance benchmark for firm involved in the manufacturing sector. This is because improvement in productivity is related to increased profitability, lower costs and sustainable competitiveness. Productivity is defined as the efficient use of resources in the production of various goods and services. Rising productivity implies that either higher output is produced with the same amount of input, or that less input are required to produce the same level of output. The present comprehensive, in-depth study analyses the performance of Punjab manufacturing sector in terms of productivity.

The present analyses the trends in productivity for the Punjab manufacturing for the period 1991-2007. To examine the impact of LPG on the manufacturing sector of Punjab, the entire period is dividing into two sub-periods. Period I is 1991 to 1999, and period II is 2000 -07 which is the post-2000 period.

The study analyses the trends in output (value added), inputs (labour, capital), labour productivity, capital productivity and capital intensity for Punjab manufacturing sector at the disaggregate level for the entire period 1991-2007, as well as for sub-periods, period-I and period-II. An attempt has been made to trace the factors influencing total factor productivity for Punjab Manufacturing.

A detailed analysis for pre-2000 and post- 2000 period shows that in terms of performance of labour productivity and capital productivity three industries, namely Tanning and dressing of leather #19 and publishing, printing and reproduction of recorded media #22 and coke, refined petroleum record a higher growth rate. The lower performance is recorded by motor vehicles #34, woods and products of wood #20, followed by electrical machinery and

CHAPTER I

AN OVERVIEW OF INDIAN ECONOMY

1.1 Introduction

Globalization is shaping today's world. India is fast emerging as global manufacturing hub having all the requisite skills in product, process and capital engineering, thanks to its long manufacturing history and higher education system. India's cheap, skilled manpower is attracting a number of companies, spanning diverse industries, making India a global manufacturing power house. The Indian economy responding to the changes prevalent to the world economy was thrust into throes of rapid change in nineties by adopting the new economic policy. Liberalization, privatization and globalization became the three planks by which the Indian economy was propelled into a fusion. Thus the process has had maximum impact on manufacturing sector, as it has radically changed its business environment and future growth dynamics.

All the states of Indian union have been affected differently due to the structural changes. Manufacturing is considered as the economic backbone of an industrialized nation. Manufacturing provides a considerable employment for thousands of people. It is a vital part of Indian economy. Agriculture has been the main preoccupation of the bulk of Indian population. Manufacturing sector of India makes a significant contribution to the gross domestic product, employment, capital investment, research and development and export. The manufacturing sector growth rate increased from 5.3 percent in 2000-01 to 9.8 percent during 2007-08. The share of manufacturing sector in GDP increased from 15.1 percent during 2005-06 to 15.4 percent in 2006-07.The export orientation of manufacturing sector has also been on the rise. The manufactured exports as a percentage of GDP have increased from 2.5 percent in 1983-84 to 9.1 percent in 2006-07. (Kiran and Kaur, 2008).

1.2 Manufacturing Sector in Punjab

Punjab is a state in northwest. India is a land of expertise and endeavor. The state of Punjab has earned the distinction of being the "granary of India". Development experience in Punjab economy since 1947has remained quite impressive though there have been twists and turns. The economy of Punjab has experienced an accelerated economic growth and a steadily **rising per capita income** as compared to the growth experience of Indian economy in general and other states in particular. This remarkable achievement has been attributed to the planned development strategy adopted in Punjab.

Punjab is progressive state of India with an average growth rate of 10 percent; it has evolved into a land of boundless opportunities for investment, industry and employment. The percentage share of gross state domestic product (GSDP) of Punjab in gross domestic product of India is 3.18[Central statistical organization Delhi, 2006]. Services held the largest share of 39 percent in Punjab's SDP, followed by agriculture holding a share of 38 percent. The share of industrial sector is relatively small, accounting for a meager 23 percent of the SDP.

The state has been dominated by agricultural sector with a lower industrial output as compared to other states of India. A prominent feature of industrial sector of Punjab is its small sized industrial units. There are 600 large and medium scale industrial units and 2 million small scale units in Punjab. Punjab is now giving greater emphasis to development to its industrial sector as it is well recognized that industrial sector of state or a country at large serves as an index of its economic growth profile.

Economic policy reforms initiated in 1991 have differential impact across industrial economy of different states or regions. Some of the sates or regions registered high rate of growth comparable to newly industrializing countries, while other lagged behind. Before the new policy regime, Punjab had suffered due to the policy induced barrier and constrained private sector initiatives through allocation of licenses and public sector in industrial sector economy. It was expected that the reforms will enhance the FDI in the state and help in accelerating the economic growth. Import liberalization and reduction of tariff barriers

increase the competition to the small scale industry. Since the industrial sector of Punjab is a grooming ground for small scale industry, therefore external and domestic liberalization was expected to put substantive constraint on this sector.

The present study is an attempt to analyze the growth and performance of Punjab Manufacturing in the post liberalized period, i.e., 1991- 2007 period. The period has been divided into two sub periods, period I, 1991-2000 and period II, 2001 onwards. Period II is regarded as high growth period for Indian industry. The present study is an attempt to find whether the Punjab manufacturing also reported higher growth in the post- 2000 period. The study will make an attempt to analyze the inter-industrial growth rates to highlight the growing sectors of Punjab economy and the factors responsible for growth.

1.3 Research Methodology

1.3.1 Data Sources:

Keeping in view the broad objectives of the study, secondary data from published sources shall be obtained about various parameters of individual subsectors. The basic sources of data will be Annual Survey of Industries, Central statistical Organization New Delhi.

1.3.2 Data Analysis:

The data shall be analyzed to investigate the broad trends in productivity and growth. This shall cover the period of 1991 to 2007. The data shall be used to analyze the underlying adjustment of capital, labor, and output growth in response to changed environment. Tools like growth rates, regression analysis and other appropriate tools shall be used.

1.4 Chapterisation

The Thesis has been organised into the following five Chapters.

Chapter 1

The study of productivity is an important aspect of the analysis of development. Productivity study has particular significance in the formulation of policies at the state as well as at national level. Chapter-I covers the meaning of globalization and importance of productivity of industries. The outlines of the study along with its broad objectives, data source and brief methodology have also been covered in the chapter I.

Chapter II

Modern economists have emphasized that technological progress is a major determinant of economic growth. In the following chapter II, we discuss the review of literature on the different economy. The review helps to know emphasis and direction of research being done, the time periods of the studies, the scope and limitations of studies conducted, the methodology adopted for measuring productivity indices, the conclusions drawn from these studies the objectives fulfilled and the benefits accrued. An attempt has also been made to find out the observations based on the review. This chapter presents the objectives of the study.

Chapter III

In the subsequent chapter III, model and methodology has been discussed. This chapter outlines the objectives of the study. It also explains the hypotheses proposed for the study. This chapter also discusses the data sources of the present study. Finally the chapter explains the methodology adopted to achieve the objectives of the study.

Chapter IV

Chapter IV focuses on the trends in output and inputs. The chapter presents the trends in labour productivity, capital productivity, capital intensity and total factor productivity at the aggregate and also at the disaggregate level. For a complete view of productivity of Punjab Manufacturing, the study has also taken into account the factors affecting total factor productivity.

Chapter V

Finally, chapter V covers the conclusion of the study, major findings and policy implications. The chapter also explains the limitations of the study and identifies the future areas of research.

CHAPTER-2

REVIEW OF LITERATURE

2.1 Introduction

A lot of studies have been done on performance of Indian economy in the liberalized period. Most of these studies focus on the productivity performance. A few importance studies have been taken up for review. Studies focusing on the productivity performance are incomplete without reference to Goldar and Ahluwalia, who have contributed a lot to literature. Section 2.1 covers the introduction. Section 2.2 explains the review of studies on manufacturing sector. Observations based on the review are presented in Section 2.3. Finally section IV presents the summary results of the literature review.

2.2 Studies on Manufacturing Sector

Goldar's (1986) study covered the period 1951-79 has been divided in to two sub-periods 1951-65 and 1959-79. Goldar computed both partial and total factor productivity indices for manufacturing sector as a whole. Goldar's study uses Kendrick index, Solow index and translog index of total factor productivity. During the period 1951-65 the labor productivity and capital intensity showed an unprecedentedly trend. The capital productivity recorded a decline of 14% per annum. The average annual rate of growth was 1.27% per annum during 1951-79. In the second sub period Goldar has observed similarity in the results of partial productivity and capital intensity as in the first period.

Goldar's estimates of TFPG for a composite sector including a large scale registered manufacturing trend to be relatively higher than other estimates. The average annual rate of growth in the care of translog index was of the order of 1.31% per annum. Thus was also higher as compared with so low and Kendrick Indices, which was of the order of 1.29 and 1.06% per annum. Goldar's estimate for small scale registered manufacturing is very similar to that for large scale i.e. 12% per annum. Accordingly Goldar has concluded that

technological progress has contributed to output growth though marginally and growth in factor productivity is sluggish.

Rao (1996) used (double -deflation) method for measuring TFP. The study suggests a rapidly declining TFP growth for manufacturing industries after 1981. Dholakia and Dholakia (1994) study TFPG for Indian manufacturing from 1970-71- 1988-89. The study reports that the annual growth of real value added in Indian registered manufacturing sector when measured through single deflation method shows remarkable acceleration during the 1980s as comparison to 1970 (from 3% to 8%).on the other hand, when the same is measured through double deflation compared to 1970s (3.55% to 11.2%) when the weights for the 19 input groups based on WPI (1970-71) are used. The study reports negligible growth during the 1980s as compared to 1970s (7.5% to 8.1%) when weights for whole manufacturing sector as considered by Balakrishnan and Pushpangandan (1994) are used.

Fikker and **Hasan** (1998) analyzed the returns to scale for a panel of selected Indian manufacturing industries for the pre liberalization period from 1976 to 1985 using a restricted cost function. Although these resources found large number of firms operating with increasing rate to return to scale, the results suggested that most of them were operating close to constant returns to scale. The study suggests that there are not significant gains in scale efficiency from the tentative steps in economic liberalization in the 1980's.Krishna and Mika (1998) show that there are increasing returns to scale in electronics, transport equipment and non-electrical industries and that there was an increase in exploitation of the scale economics after the economic liberalization.

Study by **Kusum Das** (1998) found that productivity response to the trade policy response to the trade policy reform is mixed. This study correlated the productivity growth with different measures of trade liberalization. However the results of this exercise show that in majority of the cases the trade liberalization variable has a statistically insignificant positive relationship with productivity growth. A Study on productivity trends in Indian manufacturing undertaken by Unel (2003) has concluded that total factor productivity (TFP) growth in aggregate manufacturing and many sub-sectors accelerated after the 1991 reforms.

Study by Sengupta (1998) examines the performance of in organic fertilizers industry in India. Analysis of cost functions and Cobb- Douglas and production function have been made to study the performance of the industries. The data has been collected from the AST and economic survey. The result of the study reveals that the fertilizer industry is subject to la of increasing costs. The findings get further support from the examination of the production function which reveals that the average productivity of labour exceeds its marginal productivity. Analysis of shifting cost functions further highlight that the firm belonging to this industry expand capacities, even before fully exploiting the existing capacities confirming to oligopolistic behavioral tendency of the firms belonging to fertilizers industry.

Study by **Hulten (1999)** shows that there is little evidence of any positive impact from the initial economic reforms on TFP growth of the Indian manufacturing industries. The study however found that there were other positive impacts on investment, labour productivity, and capital per worker from economic reforms.

Some of the studies have concentrated measuring the **impact of economic reforms** on the scale effects in the manufacturing industries in India. These are presented below:

Khare and Yadav (2001) examine the complete view of industrial development process by constructing a composite index of industrial development for different states in India. The composite index is based on 10 variables. These are:

i. Number of industrial worker per lakh population.
ii. Number of factories per lakh population
iii. Number of factories per hundred sq.km
iv. Invested capital per worker
v. Net value added per unit of capital
vi. Net value added per worker
vii. Gross output per unit of capital
viii. Percentage share of manufacturing in net state domestic product
ix. Gross output per lakh population

In this study the data for their variables are used from **ASI.** The time span under this study is for the year 1984-85(mid 80s) and 1994-94(mid 90s). On the basis of the index Maharashtra occupied first rank in mid (1980s) and Tamil Naidu second while Gujarat got third rank. The study shows that during mid 1990s Maharashtra occupied fourth position. Tamil Naidu got the first rank, Gujarat second and Punjab has been ranked third. The study highlights that during 1990s. Andhra Pradesh, Gujarat, Kerala, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Naidu and Uttar Pradesh recorded market improvement in the industrial development however some states like Haryana and Karnataka maintained their status of industrial development during 1990s.

Study by **Burange (2002)** reveals that since economic liberalization, the states in India are making concerted efforts to improve industrial performance in the state. The data is based on ASI (Annual survey of industries). The time span covered by the study is from 1980-81 to 1997-98. The rate of growth of employment in Haryana, Rajasthan, Punjab, Tamil Naidu, Andhra Pradesh, Karnataka, Kerala and Delhi was relatively poor during this period. The rate of growth of employment under NAGRIND is relatively high by Tamil Naidu, Rajasthan, Haryana, Punjab and Andhra Pradesh.

Following Desai ***et al.*** **(1991),** all agriculture related industries, NIC 30 to NIC 39 are clubbed together under NAGRIND. The study shows that the states like Bihar, Uttar Pradesh, Gujarat, West Bengal and Maharashtra has fall in employment in AGRIND. His study also reveals that in care of NAGRIND the performance is better in Andhra Pradesh, Karnataka, Gujarat and Punjab. West Bengal and Bihar registered a fall in employment in NAGRIND during this period. The study also highlights that during post-liberalization period in terms of growth of real output, better performance recorded by Haryana, Gujarat, Karnataka, Tamil Naidu, Rajasthan and Maharashtra. Assam, Bihar and West Bengal shared poor performance during 1980s and 1990s.

Surjit (2004) made an attempt to analyze the patterns of interdependence among **SCP** variables in three industries - food and beverages, chemicals and automobiles. The study reveals the emergence of conduct variables as the major determinants of structure and performance. The study also shows that profitability is not a crucial determinant of structure

of the industry rather it is cost efficiency and the size of the firm along with advertisement as conduct variable.

The study takes 17 industries. Span covered under the study is 1991-1998. The study uses thee equations simultaneous model representing *conduct, structure* and *performance* of the industry for estimation.

i. Concentration Equation
ii. Advertisement Equation
iii. Profitability Equation

Overall results of the study show that in market determined economy, where there is a cut throat competition, the role of efficiency is of crucial importance. In such a situation Indian firms should concentrate more on efficiency rather than on market power.

Study by Papola (2008) examines the related aspects of the current pattern of growth in manufacturing sectors. The time period covered by this study is from 1980-81 to 2006-07.The study explores how growth has been accompanied by a shift from agriculture to services, not to industry but a similar shift has not been seen in respect of the workforce, agriculture with only 18% of GDP employs 56 % of worker while services with 55% of GDP employ only 26% of the workers. Services consist of around 25% of the consumption basket of Indian population, 75% of their consumption consists of commodities. The study reveals that a high rate of economic growth without accelerated growth of industry.

Study by Kiran and Kaur (2008) explores the liberalization process in India initiated in 1990s with an objective to expose the economy progressively to market forces, had maximum impact on the manufacturing sector. The paper examines the changes growth and performance of Registered manufacturing sector of India by analyzing value added, labour and capital, partial productivity and total factor productivity for all India manufacturing i.e. at aggregative level as well as at dis-aggregative level, for the period 1980-81 to 2002-03.The study also analyses trends for two sub periods, period I, pre reform period 1980-81 to 1990-91 and period II, 1991-92 to 2002-03 i.e. the post reform period.

The study is divided in four sections. Section I contains the introduction. Section II deals with the aggregative analysis of the entire manufacturing, in section III an in depth analysis has been done at the dis-aggregative level for Sixteen two-digit Manufacturing Industries and Finally Section IV contains the conclusions.. For calculating total factor productivity growth (TFPG) Translog index has been used. The growth of value added and labour decreased in the post liberalized era, while the capital shows a higher growth in the same period. Analysis of the partial productivities depict a higher growth of labour productivity in the second period of analysis, while capital productivity is higher in the pre-liberalization phase in eleven out of sixteen sectors. Total factor productivity decelerates in the post reform period for the entire manufacturing as well as for various sectors. There is need for greater impetus on productivity in the Indian manufacturing sector.

2.3 Observations based on the Review

From the literature review, it can be seen that most of these studies focusing on performance of manufacturing in post liberalized era are done on Indian economy as a whole. Performance of Manufacturing in Punjab covering Output growth, input growth, capital and labour productivity growth is a field where very little work has been done. Moreover no study has covered the period 1991-2007, i.e. the entire post liberalized period. The studies focus on comparing performance and productivity in post 80s and post 90s. So there is enough scope of doing research in this area.

2.4 Summary Results of Literature Review

Author	About the study	Contribution
Goldar's (1986)	Highlights both partial and total factor productivity indices for manufacturing sector	Technological Progress has contributed to output growth though marginally and growth in factor productivity is sluggish
Rao (1996)	It used (double-deflation) method for measuring TFP. It highlights the annual growth of real value added in manufacturing sector	It reports negligible growth during the 1980's is compared to 1970's. When weights for whole manufacturing sectors as considered by Balakrishanan and Pushpangandan
Fikker and Hassan (1998)	Focus on the returns to scale for a panel of selected Indian manufacturing industries for the pre-liberalization period from 1976-1985 using a restricted cost function.	The study suggests that there are no significant games in scale efficiency from the tentative steps in economic liberalization in 1980's.
Kusum Das (1998)	Highlights the productivity growth with different measures of trade liberalization.	The study report that in the majority of the cases, the trade liberalization variable has a statistically in significant positive relationship with productivity growth.
Sengupta (1988)	It examines the performance in organic fertilizers industry and analysis the cost function and Cobb-Douglas production function to study the performance of the industries.	It report that the shifting cost functions analysis that the firm belonging to this industry expand capacity even before fully exploiting the existing capacities.
Hulten (1999)	It highlights there is little evidence of any positive from the initial economic reforms of TFP growth of Indian manufacturing industries.	The study suggests that there were other positive impact on investment, labour productivity and capital per worker from economic reform.
Khara and Yaday (2001)	It examines the complete view of industrial development process by constructing a composite index of industrial development for different states in India.	The study suggests some states recorded market improvement in the industrial development however other states like Haryana and Karnataka maintained their states after liberalization.
Burange (2002)	Focus on the state making concerted efforts to improve the industrial performance since liberalization.	It reports that during the post liberalization period in the terms of growth of real output, better performance was reported in some states whereas Bihar and W.B. shared poor performance.
Surjit (2004)	Focus on the emergence of conduct variables as the major determinant of structure and performance.	The study suggests that profitability is not a crucial determinant of structure of the industry rather it is cost efficiency and the size firm along with advertisement and conduct variable.
Papola (2008)	Highlights the related aspects of the current pattern of the growth in manufacturing sector reveals that the high rate of economic growth without accelerated growth of industry.	The study explores how growth has been accompanied by a shift from agriculture to service not to industry but a similar shift has not been seen in respect of workforce.
Kiran and Kaur (2008)	Highlights the changes in growth performance of registered manufacturing sector of India by analyzing value added, labour, capital, partial productivity and total factor productivity of all India manufacturing.	The study explores the need for greater impetus on productivity in the Indian manufacturing sector.

CHAPTER-III

MODEL AND METHODOLOGY

In this chapter the model and methodological issues in the measurement of the productivity have been discussed. The chapter is divided into five sections. Section 3.1 describes the objectives of the study. Section 3.2 explains the hypotheses proposed for the study. Section 3.3 describes the concept of productivity. Section 3.4 deals with the variables of the study. Section 3.5 deal with the data sources and section 3.6 discusses the methodology used in the present study. Finally Section 3.7 describes the determinants of productivity.

3.1) Objectives of the Study

The present study has been taken with the following objectives:

1. To analyze the trends in output growth and input growth (labour arid capital) in 1991-99 and post-2000 period.
2. To analyze the trends in growth rates of capital productivity in 1991- 99 and post-2000 period in different Manufacturing Industries.
3. To analyze the trends in growth rates of labour productivity in 1991-99 and post-2000 period in different Manufacturing Industries.

3.2) Hypotheses of the study

The following hypotheses have been proposed for the study:

1. The growth of output in post-2000 period is higher than that of the 1991-99 onwards period.
2. The growth of labor productivity in the post-2000 period is higher than that of the 1991-99 onwards period.
3. The growth of capital productivity is in the post-2000 period is higher than that of the 1991-99 onwards period.

3.3) Conceptualization of Productivity

An essential prerequisite of a sound statistical analysis is that all terms involved in the interpretation are precisely defined and their scope is delimited. The term "productivity" has been used in such a variety of senses, that it is exceedingly difficult to find out whether the term 'productivity' is synonymous with 'efficiency' or 'overall effectiveness' of a productive unit: be it a plant, firm or a company. Productivity is an elusive concept that does not lend itself either to clear cut definition or easy computation. Productivity is a subject surrounded by considerable confusion people employ the same term and mean different things (Fabricant 1969). Productivity is a word which we use broadly to express the overall efficiency relating to performance of industries.

Smith, A. (1776) referred to efficiency and specialization, what in current nomenclature amounts to the concept of productivity. Although there is no consensus on the definition of productivity yet everyone accepts it to be a measure of performance. No amount of economic juggling can alter the fact that in the long run, our solvency depends on the efficiency of our industries. Productivity is the key feature of economic dynamism today. Kuznets (1966) had pointed out that rapid growth in industrial productivity was an essential element in the development and structural transformation of the newly developed economies. In a broad sense, productivity means goods and services produced in relation to the resources utilized in producing the same. Productivity means utilizing appropriate resources, avoiding wastage, producing more with same constituents while preserving quality. Thus, productivity becomes a path of process and raising productivity becomes a condition of material progress.

3.3.1) Partial Productivity

Productivity, when defined with respect to any one input ignoring other factors in the output-input ratio is termed as partial productivity. Partial productivity reflects the relative efficiency of the factor used; the effect of factor substitution as well as of changing productive efficiency.

Partial productivity is classifiable, according to factors, as:

a) Capital productivity;

b) Labour productivity.

3.3.1 (a) Capital Productivity

It is defined as the ratio of output to capital resources expended. In the determination of performance of the economy, of late, much attention has been paid to the value of capital-output ratios. The concept of capital used here relates to gross fixed capital. It includes plant, equipment, buildings and construction.

The ideas of capital consumption allowance, calculation regarding replacement amount of capital, average life of capital goods, net stock, gross stock, rates of depreciation, correction of historical costs of components, replacement, cost accumulated expenditure on investment etc. have come up from time to time to transform capital as an input measure, which can be used as meaningful denominator in productivity measurement. Moreover, the statistics available of capital input are not free from inherent defects and vary from one source to another, so much so that the results show a marked difference and often lead to dubious outcomes and misguide the researchers.

3.3.1 (b) Labour Productivity

Although a number of variables combine to affect changes in productivity, yet it is necessary that a particular yardstick of input factor be chosen that manifests in all type of production. It is generally believed that number of workers or man-hours worked should be used as an - input factor. When output is divided by number of workers or man-hours the result is termed as labour productivity.

Several points are made in defense of the choice of labour man hours or in defense of the number of workers employed in calculation of productivity. Labour force in any country is one of the most important resources. Adequate supply of skilled and efficient labour is a great asset. Another, but in no way less convincing argument in favor of this measure, is that labour time is more readily measurable than other input factors and that is possesses a universal element common to all plants, processes and industries. This universality provides

a common basis for measuring and comparing the relative productivity, not only in different units but also of different sectors of a country.

This definition, despite its simplicity and widespread usage, has not removed confusion either from analysis of interpretation and the reasons for it are manifold. It is difficult to dislodge the deep rooted notion from the mind of common man, inexperienced in the technique and methodology of productivity of analysis that labour productivity data measure the productivity of labour and not the productivity of all the combined input factors. Indeed, it would be difficult to visualize a situation in which a country can achieve higher standard of labour productivity despite its comparatively low standard of labour efficiency.

Seigal (1961) says, "Labour productivity indices do not reveal changes in the intrinsic efficiency of labour, but rather the changing effectiveness with which labour is utilized in conjunction with other factors". As such labour productivity is not a measure of specific contribution of labour or of any one factor of production: it reflects the cumulative influence of operation of a large number of interrelated influences such as technological improvements, the rate of operation, the degree of efficiency achieved in different processes, the availability of supply and the flow of materials and components,- as well as employer-employee relations, the skill and effort of workers as well as the efficiency of management. This is the reason to present study confines to measuring labour productivity and its determinants.

3.4 Variables of the Study

3.4.1) Measurement-of Output

Gross value added at constant prices is taken as the measure of output in the present work. The gross measure of value added is obtained from the value added and the depreciation data as given in Annual Survey of Industries. The data on gross value added is deflated using the industry specific wholesale prices (at 93-94 prices). In the measurement of output an important choice arises between value added and gross output. The former option leads to a notion of total productivity while the latter gives rise to the widely deployed measure of total factor productivity. The choice hinges on whether one believes the production function to be separable in material inputs and factor input. A majority of the earlier studies have preferred

the value added measure. Griliches and Ringstad (1971) advance the following arguments in its favor:

a) It facilitates comparison of results for different industries with different material intensities;

b) It facilitates aggregation of output across industries; and

c) Inclusion of 'material' as an argument in the production function leads to the problem of dominant variable. In such a formulation almost all variation in output tends to get explained by 'material' thereby obscuring relations of greater interest. Moreover, Dholakia (1994) points out that even if we consider the case where double deflation method is feasible with complete disaggregation available, the possibility of negative real value still remains.

3.4.2) Labour Input

Regarding the measurement of labour input there are three alternatives available: (a) man-hours; (b) workers and (c) employees. The present study uses the number of employee's data from Annual Survey of Industries for the period 1991-92 to 2006-07. Denison (1961) disfavors' in man-hours as a measure of labour input, as reduction in man-hours per week leads to an increase in labour input per hour. Thus, measuring labour by the number of persons is more satisfactory. Total employees as a measure of labour input include both workers and persons other than workers. Employees include supervisors, technicians, managers, clerks and other similar types of employees. It has been argued that such employees are as much important for getting the work done as the workers who operate the machines and therefore their services should be taken into account in the measurement of labour input. Data for employees after 1990 is reported in the Annual Survey of Industries, under the heading 'total persons engaged'. The share of total emoluments in value added is taken as the share of labour. Wholesale price index is used to deflate total emoluments. Assuming constant returns to scale, the share of capital is got as one minus the share of labour.

3.4.3) Capital Input

In spite of its important place in economic theory, capital is the most difficult concept to deal within empirical context. There are statistical and conceptual problems involved in its

measurement. The problem of defining and measuring capital is hardly settled as yet. Productivity analysis and growth would not be possible unless one agrees on some definition and method of measuring capital in practice. Considerable differences are observed with regard to the measurement of capital input. The difference in labour productivity estimates between studies may be attributed largely to the difference in capital estimates.

According to Du Plooy and Jackson (1995), capital is made up of many inputs - they include land and buildings, plant and equipments, and inventories. Capital is the stock of all the goods in a firm at any moment of time whether they are fixed assets like machines and buildings or circulating assets like consumable stores.

3.5) Data Sources

The basic data source for the present work is Annual Survey of Industries. This survey is being conducted every year since 1959 by National Sample Survey Organization and processed by Central Statistical Organization. Annual Survey of Industries relates to the registered sector of manufacturing. Registered factory is one which is registered under section 2 m (i) and 2 m (ii) of the factory Act 1948. The sections 2 m (i) and 2 m (ii) refer to any premises including the precincts thereof (a) wherein ten or more workers are working or were working on any day of preceding twelve months and in any part of which manufacturing process is carried on with the aid of power; or (b) wherein twenty or more workers are working or were working on any day of the preceding twelve months and in which or in any part of which a manufacturing process is carried on without the aid of power.

The National Industrial Coding (NIC) 1998 has been followed to classify factories from Annual Survey of Industries covering the period 1991-99 to 2000-07. It may be noted that till 1997-98 the classification of industries followed in the ASI was based on the national industrial classification 1987 (NIC-1987). The switch to the NIC-1998 from the year 1998-99 necessitated some matching of the NIC-1987 with NIC-1998. So for this purpose, a concordance is .made between NIC 1998 and NIC 1987 using the concordance table published by the CSO. In this study the NIC-1998 as the base and accordingly data adjustment at the two digits and three digit industries level has been carried out. Some

industries have to be merged (341+342+343) to build a comparable series for pre 1998 and post 1998 periods. Other industries have been adjusted using the procedure outlined in the CSO document (1998) to arrive at comparable series.

3.6) Research Methodology

The main objective of the present study is to analyse partial productivity trends in Punjab manufacturing industries for the period 1991-1992 and 2006-2007. Productivity at the aggregate level gives an overall picture. With the view to study inter industrial pattern of productivity growth, analysis is done at two digit level of disaggregation. For time series analysis secondary data have been obtained from various data bases relating to Indian manufacturing. Detailed data about registered manufacturing units have been compiled from Annual Survey of Industries (ASI). Data on suitable deflators have been obtained from index numbers of wholesale prices, (Ministry of Industry) and Indian Data Base: The Economy (Chandhok 1990). The gross measure of value added is obtained from net value added and depreciation data as given in ASI. Value added is deflated by industry specific deflators. Labour input is represented by total number of persons employed. Capital input is measured by estimates of gross fixed capital stock at replacement cost at constant prices. Perpetual Inventory method has been used for estimating capital series.

The capital stock at any year has been calculated as follow:

$$K_t = K_0 + \sum_{t=1}^{T} I_t$$

Where I, is investment in year t and Ko is capital stock for benchmark year, i.e., 1980-81.Investment figures are obtained using the formula:

$$I_t = (B_t - B_{t-1} + D_t) / R_t$$

Where B is book value of fixed capital, D is depreciation. For R Wholesale prices index of Machinery (base 1993-94=100) is used.

In the study the focus is on the empirical measurement of partial productivity. Partial factor productivities measure the ratio of output to one of the inputs setting aside interdependence of the use of other inputs.

Labour productivity (V/L): it is measured as a ratio of value added to number of persons employed.

Capital productivity (V/K: it is measured as a ratio of value added to gross fixed capital. Along with partial productivity, capital intensity has also been taken for analyses.

Capital Intensity (K/L): Ratio of gross fixed capital to wage share.

Growth rates will be calculated using log linear trends.

Total Factor Productivity: Total Factor Productivity has been calculated by Translog index.

$$\log V(T) - \log \bar{V}(T-1) = \bar{V}_K[\log K(T) - \log K(T-1)] + \bar{V}_L[\log L(T) - \log L(T-1)] + \bar{g}$$

Where

$$\bar{V}_K = 1/2[V_K(T) + V_K(T-1)]$$

And

$$\bar{V}_L = 1/2[V_L(T) + V_L(T-1)]$$

$\mathbf{V_K}$ and $\mathbf{V_L}$ are income shares of the factors capital and labour respectively.

The returns of labour are measured by the total of wages, salaries and benefits (total emoluments) and returns to capital are measured as value added minus the returns to labour on the assumption that returns to two factors of production exhaust the value added in the process of production.

3.7) Determinants of Total Factor Productivity

Total Factor productivity depends on the ability of worker, the willingness, capital intensity, the system of wage-payment; all these influence the efficiency of labour and capital and hence total factor productivity. The worker's attitude and behavior are influenced partly by the system and partly by his morale, feeling of responsibility, general outlook to life and

trade union practices and attitudes. The system of wage payments undoubtedly exerts an important influence on the worker's urge to produce more.

The relationship of total factor productivity with all the variables can be represented by an equation of the form:

$$Y=F(X_1, X_2, X_3, X_4, X_5, X_6)$$

Where X_1 is output-growth;

X_2 is capital intensity;

X_3 is investment;

X_4 is growth in number of factories;

X_5 is scale variable and

X_6 is total emoluments.

The present study uses ordinary least square regression and step wise regressions to fit in the above mentioned model. The time period for the analysis is 1991-92 to 2006-07. The dependent variable is labour productivity growth. Labour productivity is a comprehensive measure of productive efficiency. In this chapter an effort is made to explain the factors affecting labour productivity growth. The variables used in the model are discussed below:

1) Rate of Growth of Output

Rate of growth of output is an important determinant of productivity as productivity is measured as a ratio of output to input. So, higher rate of growth of output should lead to higher labour productivity of the industry. The movements in labour productivity have normally a specific relationship with movements in output. Verdoom (1949) examined the empirical relationship by estimating the equation of the form:

$$\mathbf{P = a + IQ}$$

Where P is the productivity growth and Q is the output growth and a and P are parameters. The equation was later popularized as Verdoorn's law. Verdoorn observed a constant long run relationship between output growth and productivity growth. Kennedy (1971) observed a strong correlation coefficient between output growth and productivity growth for Irish manufacturing industry for the period (1946-66).

2) Capital Intensity

Capital Intensity is the capital-labour ratio of the industry. The most immediate factor affecting output per worker is the amount of machinery available. The influence of technology on labour productivity has been captured by capital intensity. It is quite evident that the worker helped by machine will produce more than the workers operating with little or no machinery. The need to employ more or less machinery is determined by a number of factors such as size of the plant, the nature and character of products, the size of the market, the state of technological advancement, the availability of capital and human resources and the possibility of substituting one by the other. The quality, size (type, efficiency, etc) of the machinery, as well as the application of modem technique in general is of equal importance.

3) Investment

Composition of capital affects productivity. Investment is taken as the change in the capital stock. Investment figures have been obtained using the formula:

Where B is the book value of fixed capital, D is the depreciation and R is an appropriate deflator for fixed capital. For R wholesale price index of machinery (base 1993-94 = 100) has been used.

$$I_t = (B_t - B_{t-1} + D_t) / R_t$$

4) Growth in Number of Factories

The next variable is growth in number of factories over the period. Ahluwalia's (1991) study reveals that the growth of factories in an industry is negatively related to total factor productivity growth. This probably reflects an adverse impact on productivity growth of the phenomenon of fragmentation stemming from the policies of protection of the small scale sector. In this study an effort has been made to find the relation between labour productivity and growth in number of factories.

5) Scale Variable

Scale variable (SC) is measured as the capital stock per factory (an average of two points of time during the period). Ahiuwalia's (1991) scale variable; 'capital stock per factory' is an average of the value for two points (1959-60 and 1975-76) during the period (1959-60 to

1979-80). Ahluwalia's study uses scale variable for finding the factors affecting productivity. Scale variable has been used in this study as average of two points of time (1992-93 and 2002-03).

6) Total Emoluments

Wages, salaries and incentives to the workers influence the workers' ability and efficiency. The system of wage payments has an important influence on the workers' urge to produce more. The source of data for this variable is Annual Survey of Industries.

CHAPTER IV

GROWTH AND PRODUCITIVITY OF PUNJAB MANUFACTURING

4.1) Introduction

In the present chapter, productivity of capital and labour has been analyzed. The study covers a period seventeen years from 1991-92 to 2006-07. Productivity trends are calculated at the disaggregate level for manufacturing sector of Punjab for two digit Industries. The growth rates of inputs (Capital, labour) and output (value added) has also been analyzed. To analyze the trends in productivity the entire period has been divided into two periods, Period I , the post-reform from1991-1999 and Period II, post-2000 period, from 2000-07.

This chapter is divided into two parts. Section 4.1 covers the introduction of this chapter. In section 4.2, the findings of all level of aggregate data are discussed. The analysis of growth rate of factor inputs (labour, capital), output (value added), productivity of labour and capital and capital intensity is carried out for aggregate as well as disaggregate manufacturing sector for the entire period 1991-92 to 2006-07 as well as for the sub period, i.e., post-reform period and post-2000 period is discussed in detail in this section.

4.2 Sector wise Analysis

Table 4.2 shows the growth rates of value added of Punjab manufacturing at the disaggregate level for the time period 1991-92 to 2006-07. A comparison has been made between the performance of Period 1, 1991-1999 and Period II, the post-2000 period to see whether there has been an increase in productivity growth of manufacturing sector in the post-2000 era.

4.2.1 Trends in Growth of Value Added

Table: 4.1: Growth Rates of Value Added				
Industry Code	**Industry Name**	**Entire Period 1991-07**	**Period-I 1991-99**	**Period-II 2000-07**
15	Manufacture of Food Products	4.77	3.07	2.92
17	Manufacture Textile	2.35	2.06	1.12
18	Wearing Apparel	11.90	5.80	13.90
19	Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	6.63	3.61	2.91
20	Wood and Products of wood and Cork, except furniture; Articles of Straw and Plating Materials	2.35	2.06	1.12
21	Paper and Paper Products	1.51	1.54	0.87
22	Publishing, Printing and Reproduction of Recorded Media	5.37	4.12	2.97
23	Coke, Refined Petroleum Products and Nuclear Fuel	6.27	3.22	2.15
25	Rubber and Plastic Products	6.00	2.18	3.01
29	Machinery and Equipment N.E.C	2.89	2.58	3.11
30	Manufacture of Officer, Accounting and Computing Machinery	1.46	1.40	1.03
31	Electrical Machinery and Apparatus N.E.C.	5.13	3.95	1.81
32	Radio, Television and Communication Equipment and Apparatus	1.64	1.10	1.34
33	Medical, Precision and Optical Instruments, Watches and Clocks	6.26	3.39	2.69
34	Motor Vehicles	1.89	1.65	2.70
35	Other Transport Equipment	2.99	2.66	-.90
36	Manufacture of Furniture	2.28	2.25	1.58

The growth rates of value added has grown at a rate of 3.07 per cent annum in period I against 2.92 per cent per annum in the post-2000 period for the manufacture of Food products # 15 sector. The rate of growth of value added is 4.77 per cent per annum for the entire period.

An analysis of manufacture textile # 17 highlights that the growth of value added has been 1.12 percent per annum in period II as against 2.06 percent per annum in period I. The growth rate of value added is higher I n the post 2000 era. The rate of growth for entire period is 2.35 per cent per annum.

An analysis of wearing apparel; dressing and dyeing of fur Sector # 18 is indicative of the fact that there has been a decline in the value added from 11.20 per cent in period-I to 5.80 percent annum in period-II. Value added grows at a rate of 13.90 per cent per annum for the entire period.

The growth rate has become 3.61 per cent in the post-1990 period while it is 2.91 per cent per annum in the post-2000 period. The growth rate of entire period is 6.63 per cent annum in the training and dressing of leather, luggage, hangs/handbags saddlery, harness and footwear # 19.

In the wood and cork, except furniture; articles of straw and plating material sector # 20 growth rate of value added has been 2.06 per cent per annum in period I. The growth rate for entire period has been 2.35 per cent per annum. The growth rate of the sector; wood and products of wood and cork, except furniture; articles of straw and plating material sector shows a deceleration from 2.06 per cent per annum in period I to 1.12 per annum in period-II.

Paper and Paper Products #21 recorded an overall growth of 1.51 percent per annum. The growth rate in period I is 1.54 and is higher than that of period II, where it is 0.87 per cent per annum.

Value added of publishing printing and reproduction of recorded media # 22 has grown at a rate of high pace of 5.37 per cent per annum for the entire period. The growth rate of value added shows a decline in period II, the post-2000 onwards era.

Coke, refined petroleum products and nuclear fuel #23 records positive of growth for the entire period as well as for both the periods. It also shows a decline in the post-2000 era.

Value added has been 6.27 per cent per annum for the entire period. It has 2.15 per cent per annum in the post-2000 period and 3.22 per cent per annum in the period I.

Rubber and plastic products # 25 has increased at an annual rate of 6.00 per cent annum in the value added growth. On splitting the period, it is found that the rate of growth of value added is 2.18 per cent annum in period I and increases to 3.01 cent per annum in the post-2000 period.

An analysis of machinery and equipment N.E.C. # 29 shows that value added growth rate for the entire period is 2.89 per cent annum. The growth rate is 2.58 percent annum the period I, and it increases to 3.11 per cent annum in the post-2000 period.

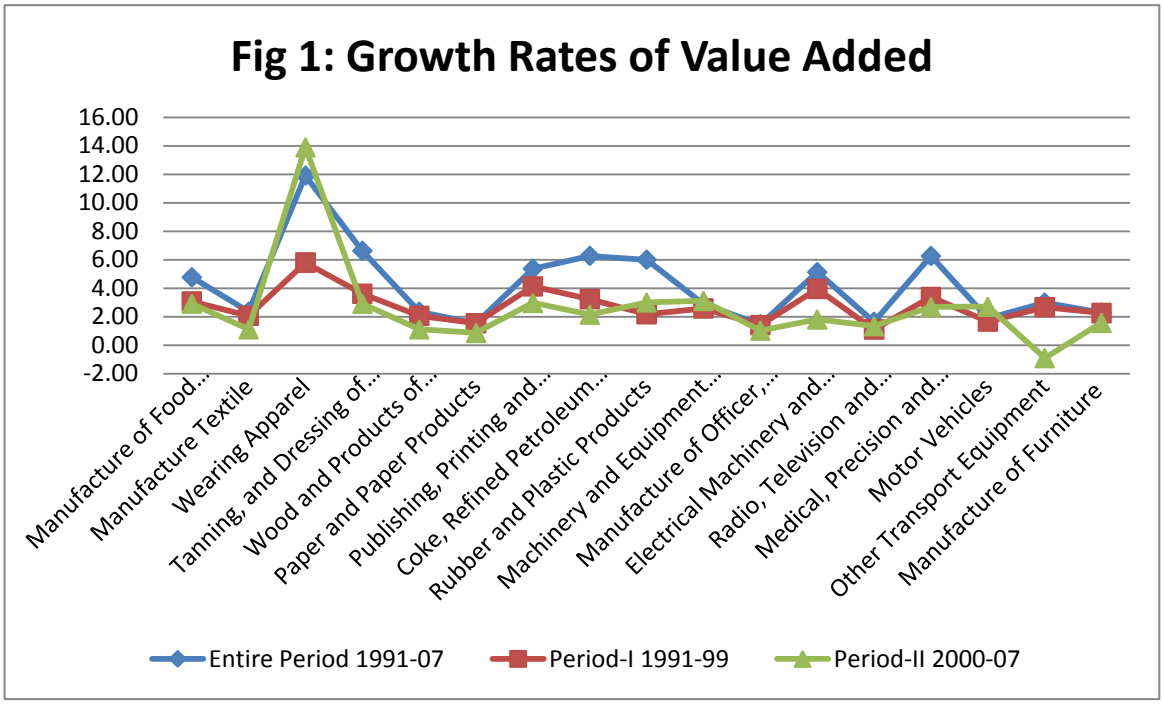
In the electrical machinery and apparatus N.E.C. Sector#31 value added has grown at the rate of 5.13 percent per annum for the entire period. The rate of growth of 3.95 per cent per annum in the nineties onwards era, and is much higher than 1.81 per cent per annum in post-2000 phase.

Value added in radio, television and communication equipment and apparatus # 32 group depicts an annual growth rate of 1.46 percent annum for the entire period. An analysis of sub periods shows that the rate of growth of value added is higher 1.40 per cent per annum during former period. The growth rate is 1.04 per annum in the post-2000 period which is lower than the earlier period.

The rate of growth of value added is 6.26 per cent annum for medical, precision and optical instruments, watches and clocks # 33. The growth rate shows higher growth, i.e., 3.39 percent annum in period I, against 2.69 per cent per annum in post-2000 period.

The growth rate of value added for other transport equipment industry # 35 is 1.89 per cent per annum for the entire period. It is 1.65 per cent per annum in period I, as compared to 2.70 per cent per annum in post-2000 period.

Value added in manufacture of furniture sector # 36 grows at a rate of 2.28 percent annum for the entire period. The growth rate is 2.25 per cent annum in the earlier period and is 1.58 per cent per annum post-2000 phase.



Four sectors record higher growth in period II. Highest growth is recorded by wearing apparel#17, followed by Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear# 19. Lowest growth in value added has been by Paper and Paper Products# 21.

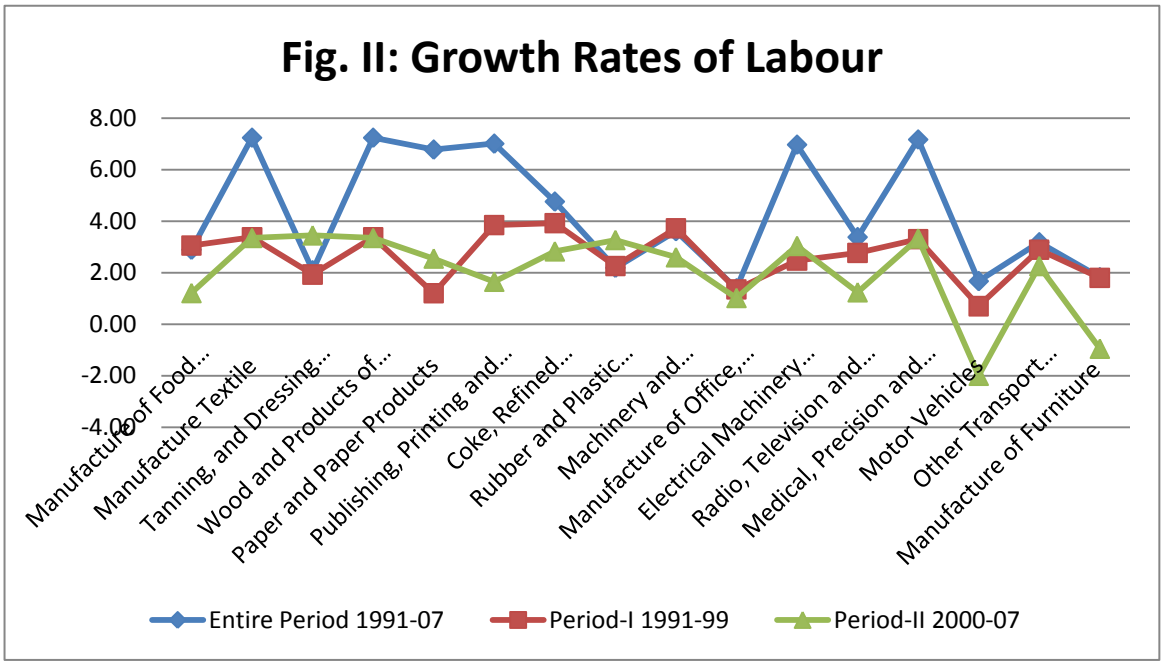
4.2.2 Trends in Growth of Labour

Table 4.2: Growth Rates of Labour				
Industry Code	**Industry Name**	**Entire Period 1991-07**	**Period-1 1991-99**	**Period-2 2000-07**
15	Manufacture of Food Products	2.89	3.05	1.21
17	Manufacture Textile	7.24	3.37	3.35
19	Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	2.09	1.93	3.45
20	Wood and Products of wood and Cork, except furniture; Articles of Straw and Plating Materials	7.24	3.37	3.35
21	Paper and Paper Products	6.78	1.20	2.55
22	Publishing, Printing and Reproduction of Recorded Media	7.01	3.85	1.65
23	Coke, Refined Petroleum Products and Nuclear Fuel	4.76	3.92	2.83
25	Rubber and Plastic Products	2.19	2.26	3.27
29	Machinery and Equipment N.E.C	3.61	3.72	2.60
30	Manufacture of Officer, Accounting and Computing Machinery	1.39	1.35	1.02
31	Electrical Machinery and Apparatus N.E.C.	6.97	2.47	3.04
32	Radio, Television and Communication Equipment and Apparatus	3.38	2.77	1.24
33	Medical, Precision and Optical Instruments, Watches and Clocks	7.17	3.30	3.33
34	Motor Vehicles	1.67	.70	-2.00
35	Other Transport Equipment	3.18	2.89	2.26
36	Manufacture of Furniture	1.82	1.80	-0.95

Above table (4.2) presents growth rates of labour in all two digit industries of Punjab manufacturing sector during 1991-92 to 2006-07 and also for sub- periods, period I,1991-2000 and period-II, 2006-2007. An analysis of this is indicative of the fact that there has been a varied growth in the labour in different two digit industries for the period under consideration. Highest growth has been recorded for Wood and Products of wood and Cork,

except furniture; Articles of Straw and Plating Materials # 20 and Manufacture Textile#17 both having a growth rate of 7.24 percent per annum. Lowest growth has been recorded by Manufacture of Office, Accounting and Computing Machinery#30.

Sector wise analysis depicts that in terms of labour the growth rate for manufacturing sector is higher for eleven industrial groups in the period I, while during 2001-07 while only five groups depicts higher growth.



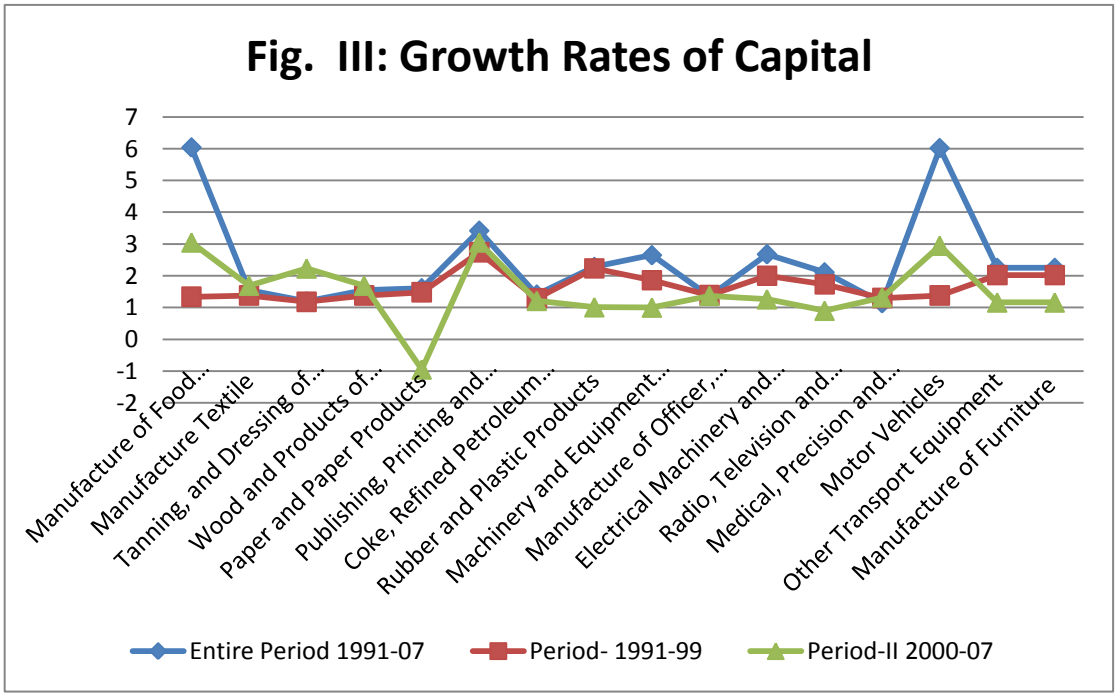
Overall analysis as depicted in Figure: II highlights that there has been a deceleration in the growth rate of labour in the post-2000 period. There are two industries reporting negative rate of growth in this period.

4.2.3 Trends in growth of Capital

Table 4.3 : Growth Rates of Capital				
Industry Code	**Industry Name**	**Entire Period 1991-07**	**Period-1 1991-99**	**Period-2 2000-07**
15	Manufacture of Food Products	6.04	1.34	3.05
17	Manufacture Textile	1.55	1.38	1.69
19	Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	1.19	1.18	2.23
20	Wood and Products of wood and Cork, except furniture; Articles of Straw and Plating Materials	1.55	1.38	1.69
21	Paper and Paper Products	1.61	1.48	-.95
22	Publishing, Printing and Reproduction of Recorded Media	3.42	2.74	3.05
23	Coke, Refined Petroleum Products and Nuclear Fuel	1.41	1.29	1.21
25	Rubber and Plastic Products	2.28	2.23	1.01
29	Machinery and Equipment N.E.C	2.65	1.86	1.00
30	Manufacture of Officer, Accounting and Computing Machinery	1.36	1.39	1.37
31	Electrical Machinery and Apparatus N.E.C.	2.68	2.00	1.26
32	Radio, Television and Communication Equipment and Apparatus	2.11	1.73	.90
33	Medical, Precision and Optical Instruments, Watches and Clocks	1.14	1.30	1.32
34	Motor Vehicles	6.02	1.38	2.95
35	Other Transport Equipment	2.25	2.02	1.16
36	Manufacture of Furniture	2.25	2.02	1.16

Table 4.3 presents wide variation in growth rates of capital. The rate of growth ranged between 1.41 per cent per annum to 6.04 per cent per annum. This table presents growth rates of capital in all two-digit industries of Punjab manufacturing sector during 1991-92 to 2006-07. An analysis of this is indicative of the fact that there has been a rapid growth in the capital for eight sectors in period II. Highest rate of growth of capital, i.e., 6.04 per cent per

annum has been reported for Manufacture of Food Products # 15. This is followed by Motor Vehicles # 34 recording growth of 6.02 per cent per annum.



Sector-wise analysis depicts (Fig.III) that in terms of capital the growth rate for manufacturing sector is higher for eight industrial groups in the period I during 1991-2000. Eight groups depict higher growth in period II.

4.2.4: Trends in growth of Labour Productivity

After analysis of growth rate of value added and inputs (labour and capital) analysis has been done for labour productivity. Highest performance in Labour productivity of 6.75 per cent per annum has been reported for Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear #19. This followed by Coke, Refined Petroleum Products and Nuclear Fuel # 23 recording growth of 6.73 per cent per annum.

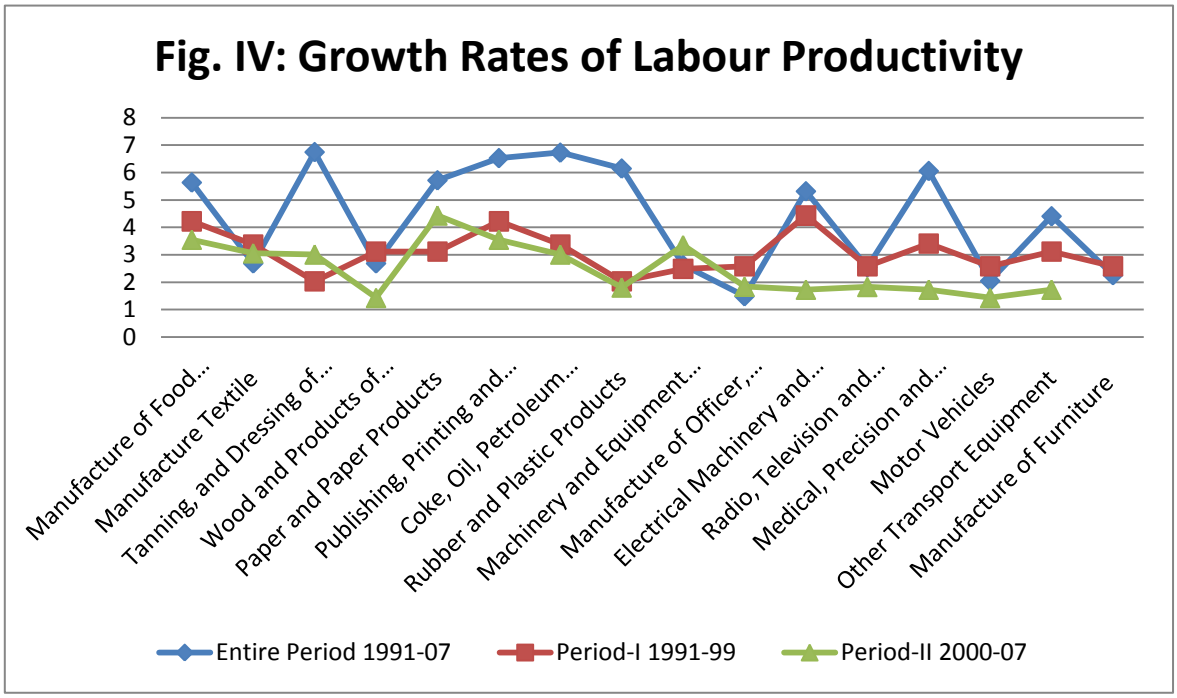
The lowest performance in labor productivity is reported by: manufacture of office, accounting and computing machinery #30, which indicates negative growth of 1.49 per cent annum for the entire period during 1991 to 2007 for both the sectors.

Sector wise analysis highlights that labour productivity for manufacturing sector is higher for ten industrial groups in the post-reform phase during 1991-00 while twelve groups depict higher growth in post reform 2000 the phase.

Table: 4.4: Growth rates of Labour Productivity

Industry Code	Industry Name	Entire Period 1991-07	Period-1 1991-99	Period-2 2000-07
15	Manufacture of Food Products	5.64	4.22	3.55
17	Manufacture Textile	2.69	3.37	3.05
19	Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	6.75	2.03	3.01
20	Wood and Products of wood and Cork, except furniture; Articles of Straw and Plating Materials	2.69	3.12	1.43
21	Paper and Paper Products	5.72	3.12	4.43
22	Publishing, Printing and Reproduction of Recorded Media	6.53	4.22	3.55
23	Coke, Refined Petroleum Products and Nuclear Fuel	6.73	3.37	3.01
25	Rubber and Plastic Products	6.15	2.03	1.81
29	Machinery and Equipment N.E.C	2.63	2.49	3.35
30	Manufacture of Officer, Accounting and Computing Machinery	1.49	2.58	1.84
31	Electrical Machinery and Apparatus N.E.C.	5.32	4.43	1.73
32	Radio, Television and Communication Equipment and Apparatus	2.55	2.58	1.83
33	Medical, Precision and Optical Instruments, Watches and Clocks	6.06	3.41	1.73
34	Motor Vehicles	2.05	2.58	1.43
35	Other Transport Equipment	4.41	3.12	1.73
36	Manufacture of Furniture	2.26	2.58	2.69

Most of the sectors have performed better in terms of labour productivity in Period I. In terms of labour productivity only four sectors have reported higher growth in the second period of analysis. The results indicate (as shown in Figure IV) poor performance of the manufacturing industries in labour productivity from in the post-2000 era. This calls for an action to take steps to enhance productivity of labour.

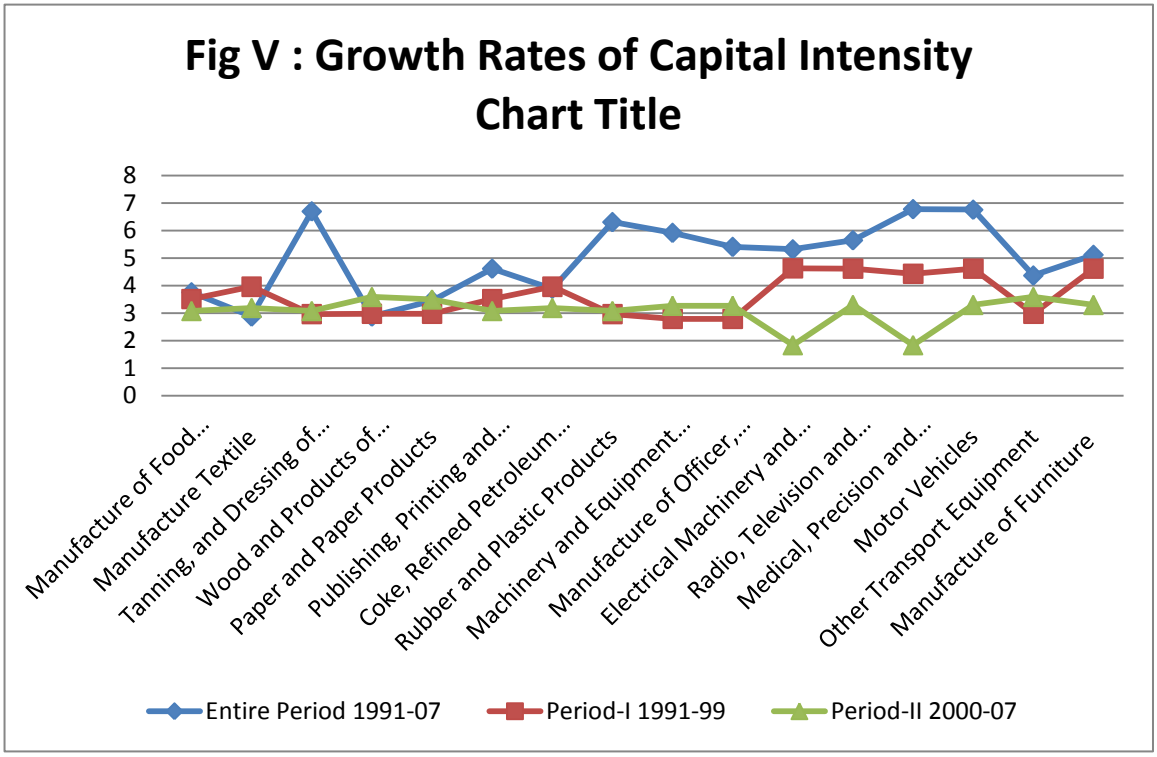


4.2.5: Trends in Growth of Capital Intensity

The results highlight an improvement in capital intensity in seven sectors in the post-2000 era. Table 4.5 presents capital intensity of all two-digit industries of Punjab manufacturing sector during 1991-07.

Table 4.5: Growth Rates of Capital Intensity				
Industry Code	**Industry Name**	**Entire Period 1991-07**	**Period-1 1991-99**	**Period-2 2000-07**
15	Manufacture of Food Products	3.76	3.51	3.08
17	Manufacture Textile	2.88	3.96	3.19
19	Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	6.70	2.97	3.08
20	Wood and Products of wood and Cork, except furniture; Articles of Straw and Plating Materials	2.88	2.98	3.59
21	Paper and Paper Products	3.46	2.98	3.50
22	Publishing, Printing and Reproduction of Recorded Media	4.62	3.51	3.08
23	Coke, Refined Petroleum Products and Nuclear Fuel	3.89	3.96	3.19
25	Rubber and Plastic Products	6.31	2.97	3.08
29	Machinery and Equipment N.E.C	5.92	2.79	3.27
30	Manufacture of Officer, Accounting and Computing Machinery	5.41	2.79	3.27
31	Electrical Machinery and Apparatus N.E.C.	5.32	4.63	1.84
32	Radio, Television and Communication Equipment and Apparatus	5.65	4.62	3.30
33	Medical, Precision and Optical Instruments, Watches and Clocks	6.78	4.43	1.84
34	Motor Vehicles	6.76	4.62	3.30
35	Other Transport Equipment	4.37	2.98	3.59
36	Manufacture of Furniture	5.12	4.62	3.30

High capital Intensity, i.e., 6.78 per cent per annum has been reported for Medical and optical instrument # 33. This is followed by motor vehicle # 34 recording productivity of 6.76 percent per annum and dressing and dyeing of leather # 19 i.e., 6.70 per annum for the entire period. The lowest performance 15 recorded by Textile #17 at a rate of 2.88 percent per annum for the entire period.

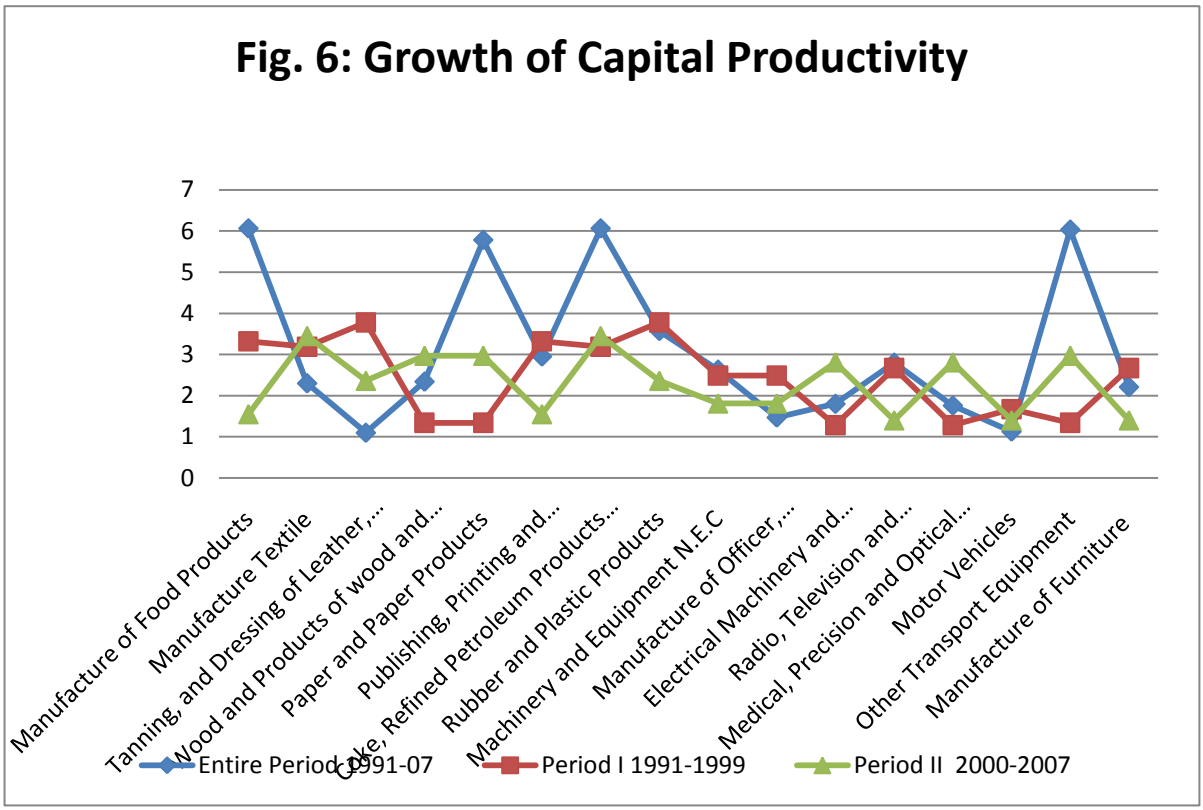


The above Figure V shows sector wise analysis of Capital intensity. Sector wise analysis depicts that in terms of capital Intensity is higher for nine industrial groups in period I and seven groups depict lower growth in period II.

4.2.6 Trends in Growth of Capital Productivity

Table: 4.6: Capital Productivity				
Industry Code	**Industry Name**	**Entire Period 1991-07**	**Period-1 1991-99**	**Period-2 2000-07**
15	Manufacture of Food Products	6.06	3.32	1.55
17	Manufacture Textile	2.30	3.19	3.45
19	Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	1.10	3.78	2.36
20	Wood and Products of wood and Cork, except furniture; Articles of Straw and Plating Materials	2.34	1.34	2.97
21	Paper and Paper Products	5.78	1.34	2.97
22	Publishing, Printing and Reproduction of Recorded Media	2.95	3.32	1.55
23	Coke, Refined Petroleum Products and Nuclear Fuel	6.06	3.19	3.45
25	Rubber and Plastic Products	3.57	3.78	2.36
29	Machinery and Equipment N.E.C	2.63	2.49	1.81
30	Manufacture of Officer, Accounting and Computing Machinery	1.47	2.49	1.81
31	Electrical Machinery and Apparatus N.E.C.	1.80	1.28	2.81
32	Radio, Television and Communication Equipment and Apparatus	2.80	2.67	1.40
33	Medical, Precision and Optical Instruments, Watches and Clocks	1.76	1.28	2.81
34	Motor Vehicles	1.13	1.67	1.40
35	Other Transport Equipment	6.03	1.34	2.97
36	Manufacture of Furniture	2.21	2.67	1.40

Table 4.6 presents the productivity of capital in all two-digit industries of Punjab manufacturing sector during 1991-00 to 2006-07. The results highlight that there has been a rapid change in the capital productivity for the entire period. Higher capital productivity has been reported for Manufacture of Textiles #17 and Coke, Refined Petroleum Products and Nuclear Fuel#23. Lowest performance is recorded by Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear #19.



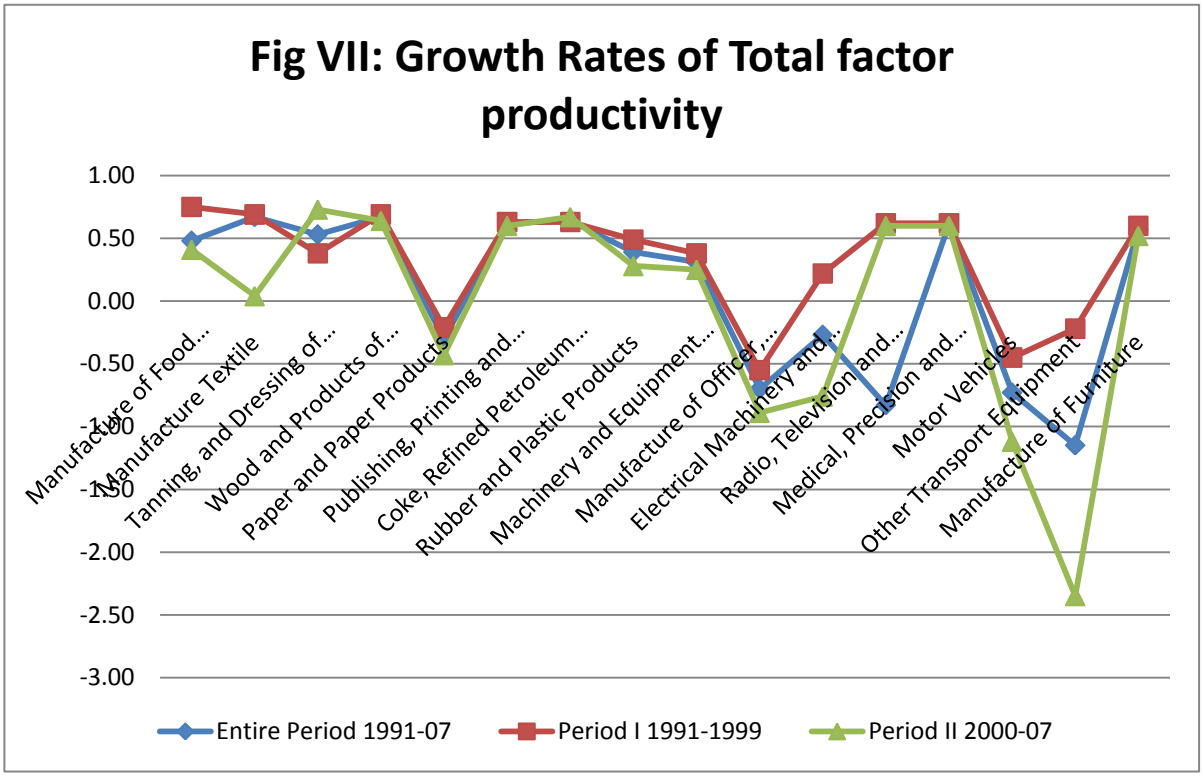
The above Figure.VI depict that out of seventeen industries depict seven industries depict higher growth in Period II.

Table: 4.2.7: Total Factor Productivity

Table: 4.7: Total factor productivity				
Industry Code	**Industry Name**	**Entire Period 1991-07**	**Period-1 1991-99**	**Period-2 2000-07**
15	Manufacture of Food Products	0.48	0.75	0.41
17	Manufacture Textile	0.67	0.69	0.04
19	Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear	0.53	0.38	0.73
20	Wood and Products of wood and Cork, except furniture; Articles of Straw and Plating Materials	0.67	0.69	0.64
21	Paper and Paper Products	-0.30	-0.21	-0.43
22	Publishing, Printing and Reproduction of Recorded Media	0.62	0.63	0.60
23	Coke, Refined Petroleum Products and Nuclear Fuel	0.64	0.63	0.67
25	Rubber and Plastic Products	0.39	0.49	0.28
29	Machinery and Equipment N.E.C	0.31	0.38	0.25
30	Manufacture of Officer, Accounting and Computing Machinery	-0.70	-0.55	-0.89
31	Electrical Machinery and Apparatus N.E.C.	-0.27	0.22	-0.76
32	Radio, Television and Communication Equipment and Apparatus	-0.83	0.62	0.60
33	Medical, Precision and Optical Instruments, Watches and Clocks	0.61	0.62	0.60
34	Motor Vehicles	-0.73	-0.45	-1.12
35	Other Transport Equipment	-1.15	-0.22	-2.35
36	Manufacture of Furniture	0.57	0.60	0.52

Above table (4.7) presents total factor productivity in all two-digit industries of Punjab manufacturing sector. Total factor productivity is highest, i.e. 0.64 per cent per annum for woods and products of wood and corks # 20, followed by publishing, printing and reproduction of Rec. Media # 22, and Manufacture of textile # 17 i.e., 0.64 and 0.62 percent per annum for the entire period. Lowest performance is recorded by Other Transport Equipment with growth rate of -1.15. Manufacturing of office and accounting #30, Electrical

machinery and Apparatus N.E.C#31., Radio, television and communication equipment and apparatus # 32 and paper and paper product#21 shows negative T.F.P percent per annum.



When T.F.P of both periods is compared, only two sectors depict higher productivity in post -2000 eras. The above results highlight that TFP of Punjab manufacturing is very low and effort needs to be put to improve the productivity.

4.2.8: Factors Influencing Total Factor Productivity

The present study uses ordinary least square regression and stepwise regression techniques to fit in the above mentioned model. The dependent variable is total factor productivity growth.

i. **Growth of output**: Output/Input

It is generally stated that Higher rate of growth of output leads to higher labour productivity of the industry.

ii. **Capital intensity**: The most important factor affecting output per worker is considered to be the amount of machinery available. To know that whether performance of labour improve with technology. So for this capital intensity will be used.

Capital intensity = Capital/ Labour

iii. **Investment:** Investment is taken as the change in the capital stock.

iv. **Growth in number of factories**: Ahluwalia's study reveals that the growth of factories in an industry is negatively related to total factor productivity growth. This study has also used this factor to find the influence of this on Total factor productivity.

v. **Scale variable**: Scale variable is measured as the "capital stock per factory".

vi. **Total emoluments**: wages, salaries and incentives to the workers influence the worker's ability and efficiency. This factor has been used to find out whether the system of wage payments has an influence on the worker's urge to produce more.

$$Y= 0.47a + 0.006x_1^{**} - 1.007x_2^{**} + 0.007x_3 - 0.006x_4 + 0.008x_5 + 0.006x_6^{**}$$

t =(2.244) (3.378) (-5.122) (-0.795) (-0.066) (1.936) (5.831)

$\mathbf{R^2} = 0.87$ **Adj.** $\mathbf{R^2} = 0.74$

X_1 is output growth; X_2 is capital intensity; X_3 is investment; X_4 is growth in number of factories; X_5 is scale variable and X_6 is total emoluments.

Total factor productivity is positively related to output, investment, scale variable and total emoluments and is negatively related to capital intensity and growth in the number of factories.

Output, capital intensity, scale variable and total Emoluments are statistically significant at 1 percent level. The model explains 74 percent of variations in total factor productivity.

Stepwise Regression

Y= 0.46a + 0.006x1** -1.047x2** + 0.008x5** + 0.006x6**

t =(11.405) (3.846) (-5.836) (3.331) (7.630)

R^2 = 0.84 Adj. R^2 = 0.72

Step wise regression has yielded output growth, capital intensity, and scale variable and total emoluments as predictors of the model explaining 72 percent of variation.

CHAPTER V

CONCLUSIONS

The basic purpose of this study has been to investigate the growth and performance growth and labour productivity in manufacturing sector of Punjab for the period 1991to 2007 and for sub periods, i.e., period-I 1991-99 and period –II (2000-07). This chapter discusses the conclusions, policy implications of the study and finally gives recommendations for future work.

The present study uses secondary data from ASI. The study analyses the trends in labour productivity, capital productivity and capital intensity at two digit level for Punjab manufacturing. An attempt has been made to examine the growth rates of output (value added) and input (labour and capital). The analysis has been done for the time period 1991-1999 to 2000-07. The entire period has been divided into two sub-periods, period-I, 1991 to 1999 and period-II, 2000-07. An attempt has also been made to isolate the determinants of productivity growth in Punjab manufacturing.

5.1) Major Findings of the Study

For Punjab manufacturing the analysis has been done for value added, labour and capital of Punjab manufacturing at the disaggregate level for sixteen industries for the time period 1991to 2007 and also for two sub-periods, i.e., period-I (1991-99) and period-II (2000-07). A comparison has been made between pre-2000 period and post-2000 period to see whether there is an improvement in performance of manufacturing sector of Punjab in post 2000 era.

For Punjab manufacturing the analysis has been done for value added, labour and capital of Punjab manufacturing at the disaggregate level for sixteen industries for the time period 1991to 2007 and also for two sub-periods, i.e., period-I (1991-99) and period-II (2000-07). A comparison has been made between pre-2000 period and post-2000 period to see whether there is an improvement in performance of manufacturing sector of Punjab in post 2000 era.

The growth rate of value added has been higher for most of the sectors in period-I, i.e., 1991-00 and for four industries for the period-II during 2001-07. Four sectors record higher growth in period II. Highest growth is recorded by wearing apparel#17, followed by Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear# 19. Lowest growth in value added has been by Paper and Paper Products# 21.

Highest growth of labour has been recorded for Wood and Products of wood and Cork, except furniture; Articles of Straw and Plating Materials # 20 and Manufacture Textile#17 both having a growth rate of 7.24 percent per annum. Lowest growth has been recorded by Manufacture of Office, Accounting and Computing Machinery#30. Sector wise analysis depicts that in terms of labour the growth rate for manufacturing sector is higher for eleven industrial groups in the period I, while during 2001-07 while only five groups depicts higher growth.

Highest rate of growth of capital, i.e., 6.04 per cent per annum has been reported for Manufacture of Food Products # 15. This is followed by Motor Vehicles # 34 recording growth of 6.02 per cent per annum. Sector-wise analysis depicts that in terms of capital the growth rate for manufacturing sector is higher for eight industrial groups in the period I during 1991-2000. Eight groups depict higher growth in period II.

After analyzing the trends in inputs and output effort has been seen to see the performance on productivity front. Trends in labour productivity Labour productivity of 6.75 per cent per annum has been reported for Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear #20. This followed by Coke, Refined Petroleum Products and Nuclear Fuel # 23 recording growth of 6.73 per cent per annum.

The lowest performance in labor productivity is reported by: manufacture of office, accounting and computing machinery #30, which indicates negative growth of 1.49 per cent annum for the entire period during 1991 to 2007 for both the sectors.

Sector wise analysis highlights that labour productivity for manufacturing sector is higher for ten industrial groups in the post-reform phase during 1991-00 while twelve groups depict higher growth in post reform 2000 the phase.

The results of capital productivity highlight that there has been a rapid change in the capital productivity for the entire period. Higher capital productivity has been reported for Manufacture of Textiles #17 and Coke, Refined Petroleum Products and Nuclear Fuel #23. Lowest performance is recorded by Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear #19. Seven industries depict higher growth in Period II as compared to period I.

Sector wise analysis depicts that in terms of capital Intensity is higher for nine industrial groups in period I and seven groups depict lower growth in period II. High capital Intensity, i.e., 6.78 per cent per annum has been reported for Medical and optical instrument #33. This is followed by motor vehicle # 34 recording productivity of 6.76 percent per annum and dressing and dyeing of leather # 19 i.e., 6.70 per annum for the entire period. The lowest performance 15 recorded by Textile #17 at a rate of 2.88 percent per annum for the entire period.

Total factor productivity is highest, i.e., 0.64 per cent per annum for woods and products of wood and corks # 20, followed by publishing, printing and reproduction of Rec. Media # 22, and Manufacture of textile # 17 i.e., 0.64 and 0.62 percent per annum for the entire period. Lowest performance is recorded by Other Transport Equipment with growth rate of -1.15. Manufacturing of office and accounting #30, Electrical machinery and Apparatus N.E.C#31., Radio, television and communication equipment and apparatus # 32 and paper and paper product#21 shows negative TFP percent per annum.

Regression results of factors affecting TFP suggest that Total factor productivity is positively related to output, investment, scale variable and total emoluments and is negatively related to capital intensity and growth in the number of factories. Output, capital intensity, scale variable and total Emoluments are statistically significant at 1 percent level. The model

explains 74 percent of variations in total factor productivity. Stepwise regression results depict that Step wise regression has yielded output growth, capital intensity, scale variable and total emoluments as predictors of the model explaining 72 percent of variation.

Revisiting the Hypotheses

The present study has been taken with the following objectives to analyze the trends in output growth and input growth (labour arid capital) in 1991-99 and post-2000 period, to analyze the trends in growth rates of capital productivity in 1991- 99 and post- 2000 period in different Manufacturing Industries and to analyze the trends in growth rates of labour productivity in 1991-99 and post-2000 period in different Manufacturing Industries.

The following hypotheses have been proposed for the study:

H_1: The growth of output in post-2000 period is higher than that of the 1991-99 onwards period.

Results of output growth, i.e. growth in value added of various sectors don't support this. The growth rate of value added has been higher for most of the sectors in period-I, i.e., 1991-00 and for four industries for the period-II during 2001-07. Four sectors record higher growth in period II. Highest growth is recorded by wearing apparel#17, followed by Tanning, and Dressing of Leather, Luggage, Handbags Saddlery, Harness and Footwear# 19. Lowest growth in value added has been by Paper and Paper Products# 21. Thus this hypothesis has not been accepted.

H_2: The growth of labor productivity in the post-2000 period is higher than that of the 1991-99 onwards period.

Trends in labour productivity highlight that labour productivity for manufacturing sector is higher for ten industrial groups in the post-reform phase during 1991-00 while twelve groups depict higher growth in post reform 2000 the phase. Thus this hypothesis has not been accepted.

H3: Capital productivity in the post-2000 period is higher than that of 1991-99 onwards period.

Seven industries depict higher growth in Period II as compared to period I. Thus this hypothesis has also not been accepted.

Total factor productivity also has been higher in period I as compared to Period II. Thus the results highlight that period II, 2000- onwards period is reporting a deceleration in growth. Hence effort has to be made to improve performance on productivity front.

5.2) Policy Implications

The findings of this study have significant policy implications for the Punjab manufacturing firms and other related firms. Based on the study findings, the following policy implications can be offered.

The Punjab manufacturing sector is using higher inputs but still the performance in terms of productivity is low and needs to be improved. Most of the industries use more of capital input. Focus has to be concentrated on efficient use of capital. The growth of capital in the production, suggests that many manufacturing industries are moving towards more capital intensive production. This calls for steps to use capital judicially along with labour. The efficient usage of capital could make important productive contribution to the industrial sector of Punjab.

The study suggests that specific guidelines are required to increase labour productivity in industries in Punjab. Industries with low labour productivity require the introduction as well as better implementation of new frontier technology. Government policy should encourage investments which can lead to the introduction of new production technology. The cost and quality of products has to be considered as essential factors for increasing productivity. Policy formulation *and* implementation in infrastructure and competition have also to be considered crucial.

Besides this the incidence of employee training is to be enhanced for Punjab manufacturing to improve productivity. Large firms conduct more training than small firms and most training goes to skilled workers and managerial level officers. Focus should be laid on organizing suitable training programs for all levels of workers to help the use of new technology efficiently. Training has a substantial effect upon labour productivity and increased training call result in higher productivity performance. The firms can take steps to improve productivity by imparting proper training to labour to equip them with new technical skills.

Punjab manufacturing is dominated by small scale enterprises. Small firms are constrained by available resources that can be allocated for adoption of new technologies. In fact, the level of technology used in these industries is quite low, which results in low productivity and poor quality of products, thus leading to competitive disadvantage both in domestic and global markets. These small scale firms have to be supported by the government to acquire new technology. These firms need to *realize the* benefits of new technologies for surviving the competition. Thus up-gradation of technology is essential for most of the small scale industrial units. Credit facilities made available to the firms at low rates of interest will help solve this problem. Need based financing for technology up gradation, and meeting standards etc. should be allowed at low term deposit rates.

The research and development facilities available in the Punjab manufacturing are inadequate and investment in R&D is very low. The firms have to *realize that* R & D is the drive towards higher productivity. Investment in R&D should be increased to enhance productivity.

Besides this, new innovations can keep the countries on edge. The firms have to realize that R&D is necessary for survival as it creates and differentiates the products from competitors. The firms are not able to compete with low skilled products and higher labour cost. To survive, the firms have to compete in capital-intensive products, in which new R&D and skills are needed. Investment in R&D will result in improved quality of goods and increased range of goods. Hence the number of research centers, expenditure on R&D and-percentage of employees in R&D activities should be increased.

5.3) Recommendations for Further Research

The present study deals with organized manufacturing sector and can be extended over to the unorganized manufacturing sector. Detailed analysis can be undertaken at primary level to see the impact of technology, especially technology adoption and technology adaptation on Punjab manufacturing. Investigations of impact of technology adoption along with the findings in this study will not only deepen the understanding of motivators and facilitators of technology adoption but also provide mare detailed directions for future research. By including extensive factors, a comprehensive framework of technology adoption and its rigor can be built. It would be useful to concentrate future research on determining the contribution of foreign capital and technology to the productive performance of the Punjab manufacturing industries. The firm level analysis can be taken up to see the impact of reforms especially by taking into account R&D intensity, investment climate and foreign direct investment.
An extensive survey based analysis along with the secondary analysis can be covered for in depth analysis of the subject analysis to analyze the state wise performance.

5.4) Significance of the Study

The present study will contribute in academic literature existing in the current field. The study has helped in analyzing the high performers and low performers of Punjab manufacturing as well as determinants of labour productivity. Thus the study can help in taking adequate steps by Punjab manufacturing to enhance productivity and thus improve the performance of manufacturing sector as a whole.

5.5) Limitations of the Study

The limitations of the present study originate mainly from the database and the methodology used. Estimates of output and input in the present study are not free from certain biases. There are conceptual problems in the measurement of capital and these are very difficult to overcome. The standard methodology used in this study also has certain limitations. The measures of labour productivity growth based on certain assumptions have been frequently questioned in literature.

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