CAPITAL-LABOUR SUBSTITUTION AND CONCENTRATION IN ORGANISED MANUFACTURING SECTOR (1980/81 to 2007/08): An Analysis of Odisha and Its Neighbouring States

Dissertation submitted to the Jawaharlal Nehru University in

partial fulfillment of the requirement for the award of

the degree of

MASTER OF PHILOSOPHY

BIKASH KUMAR MALICK

CENTRE FOR THE STUDY OF REGIONAL DEVELOPMENT

SCHOOL OF SOCIAL SCIENCE

JAWAHARLAL NEHRU UNIVERSITY

NEW DELHI- 110067, INDIA

2012

CAPITAL-LABOUR SUBSTITUTION AND CONCENTRATION IN ORGANISED MANUFACTURING SECTOR (1980/81 to 2007/08): An Analysis of Odisha and Its Neighbouring States

Dissertation submitted to the Jawaharlal Nehru University in

partial fulfillment of the requirement for the award of

the degree of

MASTER OF PHILOSOPHY

BIKASH KUMAR MALICK

CENTRE FOR THE STUDY OF REGIONAL DEVELOPMENT

SCHOOL OF SOCIAL SCIENCE

JAWAHARLAL NEHRU UNIVERSITY

NEW DELHI- 110067, INDIA

2012

जवाहरलाल नेहरू विश्वविद्यालय
JAWAHARLAL NEHRU UNIVERSITY
Centre for the Study of Regional Development
School of Social Sciences
New Delhi-110067

CERTIFICATE

It is certified that dissertation entitled "**CAPITAL LABOUR SUBSTITUTION AND CONCENTRATION IN ORGANISED MANUFACTURING SECTOR (1980/81-2007/08): An Analysis of Odisha and Its Neighbouring States"** submitted by BIKASH KUMAR MALICK is in partial fulfillment of the requirements for the award of the degree of Master of Philosophy of this University. This dissertation has not been submitted for the award of any other degree in this University or any other University and is his own work. We recommend that this dissertation may be placed before the examiners for evaluation.

Prof. Amaresh Dubey
Supervisor

Prof. P.M. Kulkarni
Chairperson

Tel.: 26704463, Gram : JAYENU Fax : 91-11-26742586, 26741504

To my grandmother...

CAPITAL- LABOUR SUBSTITUTION AND CONCENTRATION IN ORGANISED MANUFACTURING SECTOR (1980/81 to 2007/08): An Analysis of Odisha and Its Neighbouring States

Abstract

This study examines the disparities of the manufacturing growth and state domestic product; at what extent the spread of manufacturing occurred; and the values of possibility of substitution of labour for capital in individual manufacturing groups for Odisha and all its neighbouring states over a time period. To reach at the objectives, data from Annual Survey of Industries (ASI) are taken for the time period 1980/81- 2007/08 for 13 organized manufacturing groups in two digit level with the help of national industrial classification 1998. The variables taken from ASI to observe the manufacturing performances of studied states are net value added (output), wage, total number of employees and fixed capital. All the variables are deflated by suitable whole sale price indexes except number of employees while wage is deflated by consumer price index for workers. Semi log linear model is used to find out the compound annual growth rate of variables. The coefficient of variation is used to show the disparities among states. Location quotient and Grossack's measure are found suitable to calculate manufacturing location and their spatial spread. Grossack's index is known as a measure to catch up the monopoly power among manufacturing groups. Significant gains or losses by regions and manufacturing groups can also be found by this measure. Capital labour substitution production function is used to estimate the substitution between labour and capital of manufacturing groups in Odisha and its neighbouring states. This method has been found suitable to show which industries are capable to absorb labour at what rate of substitution.

The result indicates that regional disparities have declined in terms of real gross state domestic product over the period of time 1980-2008. But in terms of per capita real gross state domestic product, the disparities are higher although there is an evidence of declining trend over the same period. The share of agriculture sector has declined while the share of industry has shown an increasing trend over the studied time period. But, Service sector is found as the engine of growth, the share of service sector is very high in comparison to agriculture and industry in these studied time period. But the performances of organized manufacturing groups' within industries have increased tremendously in terms of its indicators and this sector has witnessed an important role in terms of employment. Coming to the variation in indicators of manufacturing sector, disparities in wage are found higher for manufacturing of Odisha. There is not an evidence of considerable differences in variation in respect of net value added, fixed capital and number of employees for Odisha and its neighbouring states manufacturing. But, it does not necessarily imply that there exists equality among Odisha and its neighbouring states.

However, this is a clear indication of the less manufacturing inequality among these states over the period of time in terms of these manufacturing indicators.

There is an evidence of higher disparities among individual manufacturing groups of Odisha and its neighbouring states. The best basic manufacturing groups are found as wood products (27), rubber and plastic products (31), non metallic mineral products (32), basic metal and alloys (33) and transport equipment (37) for Odisha over the period of time. The overall manufacturing of Odisha has shown a tendency towards dispersal for 1980-2008. These dispersions has taken place may be because of either evidences of the lost of share of larger locations to each other or in between the larger manufacturing groups. The maximum dispersion is found 18 percent in terms of net value added in respect of overall manufacturing of Odisha. With the help of fixed capital and number of employees the dispersion is 12 and 5 per cent respectively. All these are explained by the regression coefficient (b), correlation coefficient (r) and a product moment of regression analysis $(b/r)^2$ as explained by Grossack (1965).

Values of capital labour substitution indicate that Odisha manufacturing has a good response and capability to absorb labour force and to enhance employment growth. The higher growth of employment is possible in respect of textile products (26), paper and paper products (28), rubber and plastic products (31) basic metal and alloys (33) in comparison to all manufacturing groups in Odisha. Evidences are slightly different for its neighbouring states in this respect. Two important equations such as Capital labour substitution production function (equation 13 in this study) and some of its developments (equation 14) are used to find out the values of capital labour substitution. Equation 14 is found to be good fit for all manufacturing groups in Odisha and its neighbouring states in comparison to equation 13. The hypothesis of unitary substitution is clearly rejected in most of the manufacturing groups in Odisha and its neighbouring states. This study is also agreed with the previous suggestions of researchers that the labour intensive techniques should be encouraged rather than capital intensive techniques in manufacturing industries. Because this study finds an evidence for manufacturing which are capable enough to absorb more labour. Hence, the production structure should be flexible and designed in such a way that will permit labour for capital.

Manufacturing groups like textile products (26), paper and paper products (28), rubber and plastic products (31) non metallic mineral products (32) and basic metal and alloys (33) are found important industries contributing economic growth in Odisha. These manufacturing groups have shown evidences that these industries are basic in nature. It implies that these industries have the capability to produce an extra unit of output after meeting the local demands. And it is interesting to note in this study is that these basic industries have more capable to absorb labour over the period of time. Hence, a flexible production process in these industries should be fixed by which employment growth can take place and the standard of living of the people of Odisha can be enhanced.

Key Words: *Manufacturing growth, Spatial Spread, Grossack's Index, Elasticity of Substitution, Capital- Labour Substitution Production Function*

Table of Contents

List of Tables

Table **Page No**

List of Figures

Figure **Page No**

Acknowledgements

I have a great pleasure to acknowledge my debt of gratitude to Prof. Amaresh Dubey, my Supervisor, from whose wise guidance, helpful criticisms, incisive comments and affectionate encouragement, I have benefited immensely. He was kind enough to spare his time for a series of brain storming sessions in his office room.

I am equally indebted to Prof. P.M. Kulkarni, the Chairperson of Center for the Study of Regional Development. His silent support has become my strength for purposeful work. I am grateful to Mr. Varghese, the system analyst, CSRD, who technically has showed me the path for progressivity in my research. I am also thankful to Mrs. Siskaur (Computer Center) and all staffs of my center as well as all staffs of Central Library and EXIM Library of JNU for their timely cooperation. I would like to extend my respectful regards to the teachers of Social Science department of Fakir Mohan University and all other staffs and students associated to this university, especially thanks to all the staffs of HKM Library. Balasore has played a vital role in my life and career. Thanks to University Grants Commission for the financial support and all staffs for their friendly attitude. I would also like to thank all the staffs especially all mess cookers and workers of my hostel (Tapti) for providing good food, hygienic environment and positive response.

My family members are entitled to special forms of gratitude for their unconditional support. They have made believe on me and hold up my hand whenever I am pulled towards difficult situations. My parents, my younger brothers have rendered me immense back up to come to the fore in my career. My Grand Mother has encouraged me in every walk of my life since my childhood and she has always warned me to emphasize and implement the works which are entitled to me in present keeping the future in mind incorporating the lessons from the past. Without the values, love and humanity they have embedded in me I could not have reached this stage. I also equally pay my deep respect to all my close relatives, villagers and childhood teachers. It is believed that "Lord Basudev" has played a vital role as almighty in my heart and soul.

I would be failing in my duty if I do not extend my thanks to my friends Khirod, V. Saibaba, Debashis, Madhu, Nitu, Dipak, Jata, Manash, Subrat, Bhabesh, Devi, Saroj and all other. Thanks to all my classmates who they have directly or indirectly encouraged my work. Rajesh bhaiya, Anjan bhaiya Bharat bhaiya,and Pradeep bhaiya are entitled to peculiar bond of thanks whose initial support has helped me to sustain at JNU.

Last but not least, I would like to herald my heartfelt appreciation to "Vandana" who has become the citadel of my struggled life and has inspired me to move ahead beyond the barriers. She has immensely devoted her time and stood by alone to encourage me at every step of my life. She was always there, as and when needed. This dissertation is an outcome of all these contributors, named or not; any remaining faults are solely mine.

Bikash Kumar Malick

Chapter-1

Introduction: Issues and Concerns

1.1 Introduction

Various studies on industrial growth have been emphasizing on manufacturing growth in recent decades in India. The interest is with the deceleration in the manufacturing growth since mid sixties and the revival thereafter. It is argued not only for the acceleration and deceleration of the manufacturing growth but also it is dragged towards the timings of the stagnation and revival of industrial growth. The average annual growth of three decades (1950s to 1980s) was only 3.6 percent. During the 1980s, the GDP growth rate accelerated to 5.6 percent and after economic reforms in the 1990s it is further accelerated to 6.0 percent. When this debate extended towards an examination between pre and post reform, the result indicates that the growth rate has improved only marginally in the post reform period and the regional disparity has widened much more drastically. In the post reform period industrial states are growing much faster than the backward states and there is no evidence of convergence of growth rates among states (Bhattacharya and Sakthivel, 2004). The reform of the eighties resulted in an upward shift in growth rate of the Indian economy and in particular it was of industrial and manufacturing sector while comprehensive reforms of the nineties gained a wide publicity (Ahluwalia, 1991). The revival of the manufacturing sector growth may be the phenomenon of either seventies or eighties or during the post reform periods but, this debate has contributed to the policy recommendations of the manufacturing development immensely (Roy, 1984). The issue is that the discourse on the manufacturing growth and its other dimensions, are vastly leaned towards national level.

Before proceeding to the core of this study, it is necessary to come with some stylized facts of industrial sector, in particular that of manufacturing sector. The average share of the manufacturing sector of the real GDP has marginally increased from about 13 percent during 1970-75 to 15.6 percent in 2007-08 (Bhattacharya and Sakthivel, 2004). The position of manufacturing sector of some developed states like Tamil Nadu and Gujarat consistently ranks high while states like Bihar and West Bengal declines in terms of both output and employment generation. There is a large regional variation in manufacturing industries in India.

Despite the emphasis of the manufacturing sector in India's planning process, the contribution of this sector, at best, is modest. It needs to increase so as to absorb more workers and to improve standard of living. The employment and output generation within the manufacturing sector exhibits a major imbalance (Trivedi, *et al.*, 2011).

So, the concern here is that there is an urgency of transparent attention on literature of manufacturing growth, and its spatial spread as well as its capital-labour substitution of regional dimensions. It is because regional disparity has remained a serious problem in India (Bhattacharya and Sakthivel, 2004). The presence of homogenous development or otherwise over regions making up countries could well provide important analysis on disparities across nations. The first step is to establish whether the regions in questions are truly diverse from economic point of view (Dasgupta, *et al.*, 2000). However, it is felt that a proper investigation for these issues can address the problems and prospects of the industrial sector from the regional point of view enacting policy recommendations, formulations and its implementations for individual states in India. Also, it may be helpful to discover the facts and figures of Odisha and its neighbouring states present condition in manufacturing sector and to address the inevitable macro perspective of regional imbalances.

During 1950-51, Odisha's real per capita income was about 90 percent of the national average, but, in 2002-03 it came down to about 61 percent of the national average. This long term in real per capita income since 2004-05 has not only be arrested, but reversed as well. Odisha's per capita income are higher than that of Bihar, M.P. Odisha is kept as a focal point of this study, because it has achieved a high industrial growth as well as GDP growth rate in recent decades. But, the other neighbouring states like Andhra Pradesh and West Bengal have stood higher in this measure in 2006-07 Odisha. In real terms of per capita income, Odisha has lagged behind the national average since independence (Odisha Economic Survey, 2010-11). Hence, an attempt to study the regional dimensions of manufacturing sector may be an additional observation to the literature. To be more specific, an effort to study organized manufacturing of Odisha and its neighbouring states may be a supplementary to the existing debate.

Odisha is an emerging state in terms of manufacturing growth, raw materials for manufacturing production and natural resources in spite of high unemployment and poverty situation. Similar to other states, Odisha's economy is undergoing structural changes; the industrial sector is accounted for 28 percent of the Gross Domestic Product. The high growth

recorded by the state in the first decade of the century comes mainly from the industrial sector and manufacturing constitute in real terms about 62 percent of the industrial sector. It is interesting to note that the share of the registered manufacturing sector is higher among overall manufacturing and increasing over time. It was 79.41 percent of the whole manufacturing of 2004-05 and 84.44 percent in 2007-08. Odisha is receiving heavy investments in recent years. It is argued that the recent two decades high growth path in Odisha is due to the achievement in industrial sector and that to share of the organized sector in industry is high (Odisha Economic Survey, 2010-11). So, an examination of the organized manufacturing sector in Odisha may reveal an answer to the existing problems. These problems should be addressed through worthy examination for this state economy in comparison to its neighbouring regions and all India.

Earlier it is discussed for the acceleration and deceleration of industrial growth of Indian economy for sixties, seventies, eighties as well as pre and post reform period respectively. More results can be found for this literature from a regional point of view examining the economy of Odisha with some more facts and figures as per the studies taken previously. The annual average growth rates of the number of factories witnessed an increase in 1970s in comparison to 1960s. The annual average growth rate of employment has fallen during this time period. In the 1980s, the annual growth rate of factories witnessed a decline in comparison to the earlier decades while other indicators except value added recorded marked improvement in the annual average growth rates. During the period 1966-1989, the number of employees and the number of factories in Odisha grew at 3 percent for each while fixed capital and value added grew at 8.61 percent and 19.22 percent respectively. Highest real growth was noticed in 1970s both in capital and labour productivity; during the period of 1966-1989 the labour productivity grew at the average annual rate of 8.29 percent, capital productivity at 6.87 per cent and capital intensity at the rate of 3.51 per cent (Vyasulu and Arun Kumar, 1997).

It is found that Odisha's per capita net state domestic product, a measure of average income, stood at Rs.20200 for 2006-07 which falls behind the national average by about 35 percent. Odisha reported an annual average growth rate of 9.51 percent during 10^{th} plan against the target of 6.20 percent. The 11^{th} plan witnessed an annual average growth rate of 8.73 percent in the first three years though this was the period of global economic slowdown. Odisha grew at 6.65 percent in 2008-09 and 8.35 percent in 2009-10 (Panda, 2008).

The state per capita income has started rising and the gap with the average national per capital income is reducing steadily. The share of the industrial sector has increased to 28 percent and that of the agriculture sector has come down to 18 percent of GSDP (Gross State Domestic Product) in 2009-10. Within the industrial sector, the manufacturing plays a vital role while the share of registered manufacturing is high as 86 percent within the manufacturing and increasing over time, but it is observed that this sector has undergone major growth fluctuations and regarded as the least stable among the three subsectors of Industries in Odisha (Orissa Economic Survey 2009-10). This is an important issue regarding growth structure of manufacturing of Odisha which needs to be examined in comparison to its neighbouring states. Moreover, the gross domestic product of the state grew at a less rate than many other states for a long time despite its natural resource reserves. Odisha's real GSDP has grown by an average annual rate of 4.8 percent on a long term basis during 1980-81 to 2006-07 in comparison to 6 percent for the same period for the nation as a whole. Drawing on the experiences of several states as well as that of India, various studies stated that economic growth in general and industrial growth in particular are the most critical factors for reduction of incidence of poverty in the state (Panda, 2008).

Second, the issue of location of industry is very important to understand the development potential of spatial units in India. In a developing economy, where industrialization is taking place slowly, the approach is to understand the location of different industries, the tendency towards dispersion or concentration over time rather than optimality (Seth and Gulati, 1974). The above discussions are major concerns among academics and regional policy makers over the years. Industrialisation is a complex process and the location concentration is a general feature of the dynamic process. Industrial activities started in a certain place at some point owing to natural, historical and political reasons. After some point it took place in other regions. However, the success or failure of a region is not determined entirely by the location factors for industrialization, but it is the result of a set of complex factors comprising of some market forces and some political economy forces (Saikia, 2011). If there is an examination of the spread of manufacturing sector in India, it shows a collection of a few isolated geographical centers of manufacturing with respect to evolution, structure, labour organization, technology use, and pattern of resources (Roy, 1984). It will be relevant making a note on Odisha and its neighbouring states manufacturing share to all India.

It is because all the neighbouring states of Odisha considered as a more concentrated state in India in its manufacturing share. Manufacturing share of West Bengal, Bihar, Andhra Pradesh and Madhya Pradesh in 1980 was 10.36, 5.31, 5.04, and 4.07; in 1990 it was 6.27, 5.57, 5.74, and 5.48; in 2000 it was 4.46, 3.63, 6.36, and 5.62; in 2007 it stood at 4.26, 3.58, 5.67, and 5.24 percent to all India respectively (Fernadese and Sharma, 2012). So, the concern to find out the relevant results regarding concentration and spread of manufacturing sector for individual Indian states are rather more interesting to address the problems of regional inequality. It will be quite relevant to study the regional dimensions of manufacturing concentration and spread, if there is an aim to achieve regional balance and economic equality in secondary sector among individual states in India.

Next, the existence of high unemployment can be better understood through the estimation of the substitution between labour and capital. It is an issue in recent research in manufacturing industries. It is argued that the near zero elasticity of substitution between labour and capital are responsible for the existence of the high rate of unemployment (Khan and Rafiq, 1993). The higher values of elasticity of substitution could lead to the substitution of abundant or the faster growing factor of production (labour) for the scarce or slow growing factor (capital) (Singh and Singhal, 1985).

So, the knowledge of the value of the elasticity of substitution between labour and capital in the manufacturing sector is relevant to understand and address the growing unemployment problem (Khan and Rafiq, 1993). This measurement has also an important role in both theoretical and empirical problems of unemployment. Relative changes in quantity demanded of labour in response to changes in real wage rate are focal point in employment theory. In a developing country like India, the measurement centers around the failure of the manufacturing sector to absorb substantial quantities of labour into its fold of productive employment. The modern techniques of manufacturing of industrial sector did not permit enough substitution between labour and capital. There is a doubt on the ability of industrial sector in providing employment. To reverse this process, the production technique should be flexible enough to allow easy substitution between labour and capital (Dhananjayan and Mutuluakshmi, 1989). It is contended that large scale unemployment exists because the elasticity of substitution between labour and capital is close to zero (Khan and Rafiq, 1993).

At the same time several attempts intended that the elasticity of substitution between labour and capital is considerably greater than one in the premise to overcome the unemployment problem (Laumaus and Williams, 1981). As a result, these attempts to estimate growth structure, spatial concentration and an estimation of the value of the elasticity of substitution, may contribute to the literature for policy making and to combat the diversification of regional inequality in an emerging industrial state like Odisha and its neighbouring states in the era of the 21st century (Bhattacharya and Sakthivel, 2004).

It is not claimed that there are no studies for the above objectives, but the studies filing the facts for individual Indian states and their comparison are countable. It is very scarce for Odisha. Given the inter-regional diversities, this study tries to incorporate the regional dimensions of manufacturing growth, spatial spread and its possibility of capital labour substitution in Odisha vis-a-vis neighbouring states as more relevant to be examined in India. Therefore, an attempt to study the trends of industrial growth, spatial spread of some indicators of manufacturing over a period of time and estimating the possibilities of capital-labour substitution for the economy of Odisha, may look into the problems. This may be helpful for policy making and also be an additional to the existing literature. Also, it may be necessary to address the regional output and unemployment inequality.

Keeping all these previous works in mind, this study aims to estimate industrial growth, spatial spread as well as the constant elasticity of substitution production function for 13 major manufacturing industries that contributes a large proportion (more than 95 percent) to the total value added in manufacturing. There is consideration of both cross sectional and time series data for our analysis using 2-digit level manufacturing data from Annual Survey of Industries considering Odisha and other four of its neighbouring states.

First, there is an attempt to examine the previous literatures on the growth, spatial spread and capital labour substitution of the individual regions in India as well as other than India. This chapter is started with the previous literature on growth perspective at first, back to spatial spread and capital-labour substitution. At the end, the rational for the study with its proper objectives and hypotheses are given.

1.2 Literature related to growth

Hoffmann (1958) studied whatever may be the relative amounts of factor of production, the location factors, the state of technology; the structure of the manufacturing pattern of the economy has always followed a uniform pattern. He found that the consumer goods industries always develop first during the process of industrialization.

Chenery and Talyor (1968) found the pattern of growth using cross section regression analysis, for a large number of countries, of the output of the various industrial sectors as a function of a number of independent variables. Chenery was concerned with three major changes in economic structure as industrialization proceeds.

i. A rise in the relative importance of manufacturing industries.
ii. A change in the composition of industrial input.
iii. Changes in production techniques and sources of supply for individual commodities.

He estimated a linear logarithmic regression equation in which per capita value added depends upon per capita income and population. The regression for value added on per capita in the manufacturing sector and whole of the industrial sector have high coefficients of determination, 0.93 for manufacturing and 0.963 for industry. The growth elasticity for manufacturing was 1.44 and for all industry 1.36.

Sutcliffe (1971) mentioned whatever may be the output growth through industries. It is difficult to mention a country as industrialized. So the study has tentatively taken a measure that one country can be said industrialized if it assumes 25 percent of GDP from industrial sector, out of this 60 percent should come from manufacturing and that to 10 percent of total labour force should be employed in the industry sector. This may be an arbitrary definition, but It is empirically verified that the countries passing through these gateways have higher national income per head than almost all the countries.

All these above debates tried to show the pattern of industrial growth in a macro scenario and it reveals that whatever may be the pattern and definition of industrialization, a proper measure of industrial growth, and contribution of manufacturing and that to employment in the industrial sector are considered as important. Since the time of the pre independence era and the debate of seventies for measuring industrial growth, the role of manufacturing and the employment scenario in a macro perspective have attracted the attention. As it is already noted, studies focusing on

regional dimension have not been given appropriate care. But there are some interesting work on this regard attracts attention and need to be noted.

Dhar *et al.* (1969) has taken power consumption as an indicator of industrial growth. His study showed that interstate disparities of industrial output have declined between 1951 and 1961 by calculating and comparing the coefficient of variation. The most impressive rates of increase were observed in the states in Odisha, Punjab, Andhra Pradesh and Madhya Pradesh, but all these states have slender bases to begin with. Lahiri (1960) used another indirect measure wherein a comparison between the percent population with percent industrial employment for two time period to infer the interstate disparities in levels of industrialization that have declined.

Both these studies apart from the proxies they are employed is that both the studies are comparisons between two points of time and cannot hence be considered indicative of the moment of disparities over time.

Ahluwalia (1986) analyzed the trends of industrial growth since the mid fifties and examined the factors that contributed to industrial slowdown after the mid sixties. More specifically, this study focused on the organized sector as well documented the broad trends in the unorganized sector. This studies time period is divided into several parts, the mid sixties as the dividing point explaining as a decade of changes of the Indian industry while the subsequent decade and a half reflected by contrast a remarkable degree of the stability of the structure. Finally the mid sixties witnessed a number of external stressed as well as a few latent stresses in the process of development. The former resulted from two severe agriculture droughts in success of a sharp declining on foreign trade. Based on her empirical analysis, Ahluwalia concluded that the four indicators responsible for deceleration are: (i) slow down in public investment and resulting inadequate infrastructure investment, (ii) poor management of the infra-structure sector, (iii) slow growth in agricultural incomes and the resulting slow growth in demand for industrial products, and (iv) restrictive industrial and foreign trade policies leading to high-cost industrial structure. Ahluwalia finds no empirical support for the important hypothesis that deceleration was due to deterioration in income distribution and for the hypothesis of wage goods constraint stifling industrial growth**.**

Roy (1984) studied to understand the regional dimensions and disparities in India since mid sixties. His findings observed the interstate industry variation in the rates of growth and examined the factors that are responsible the differences in rates of growth change from one

period to another. The study found during the period 1965-74, regional differentiation of patterns cannot be adequately explained through agricultural growth and structural factors. But again it is found that the sharp interstate differentiation within each industry in terms of rates of growth. The growth rates in states have moved in different direction. The nature of these movements can be understood in terms of relative stability in certain product groups notably chemicals.

Goldar and Seth (1989) analyzed changes in the growth rate of industrial output in terms of net value added in registered manufacturing over the periods 1960-61 to 1965-66, 1965-66 to 1975-76, and 1975-76 to 1985-86 for 12 states using kinked exponential model claiming, it is methodologically superior to the method commonly used for this purpose. Comparing growth after the mid sixties, this study found a sharp fall in the rate of industrial growth occurred in Odisha, West Bengal, Kerala and Rajasthan. Andhra Pradesh and Maharashtra experienced only a marginal diminution in the rate of industrial growth. There was a recovery in the rate of industrial growth after the mid seventies. The states in which there were sharp increases in the rate of industrial growth are of Odisha, Bihar, West Bengal and Uttar Pradesh. These changes in pattern may be due to structure or productivity. These studies make a strategically silence on this issue.

There are several attempts made to examine the impact of structural change on output growth. Alagh *et al.* (1971) made a study on this issue. Using location coefficients and specialization co-efficient, for each of the 15 states regarded as region, he tried to examine the industrial structure of the regions and the changes in inter-regional diversification between 1956 and 1965. This study reported a remarkable stability in the level of industrial diversification. But the growth rates were not associated with the increasing level of diversification. Perhaps the rate and pattern of output growth in the less diversified regions was such that the structure of industrialization continued to be a rudimentary nature. It needs to be noted that the analysis was confined to the end points alone.

Sen Gupta (1993) attempted a quick review of the genesis and process of growth in Indian manufacturing during the eighties. The emphasis is on exploring, in facts and figures, the broad inter-linkages between growth and the various aspects that impinge on it, like demand, productivity, costs and prices, investment and employment, structural change and balance of commodity trade. Of the possible general explanations for the healthy growth in manufactured ex-ports in the eighties, two seem prima facie, more important than the others. The growth in

output itself could have stimulated growth in exports. Secondly, there was a substantial fall in the foreign ex-change value of the rupee especially during the second half of the decade and this might have increased the motivation and competitiveness of Indian exporters.

1.3 Literature related to Productivity

Researchers have estimated the partial productivity of manufacturing sector which is confined to the analysis of labour and capital productivity. Later they came with analysis of individual industry performance, inter-industrial and inter-regional comparisons of productivity change with the help of multi-factor productivity analysis.

Dholakia (1989) stated that the labour productivity can be defined as the multiplication of capital per worker and capital productivity.

$$Y/L = (K/L)* (Y/K)$$

Where Y, K and L are income, capital and labour respectively. Thus (Y/L) is labour productivity; (K/L) is capital per worker and (Y/K) is capital productivity.

Abramovitz (1956) observed the growth of output occurring due to factors other than an increase in inputs. Solow (1957) measured total factor productivity (TFP) as a shift in the production function. Since then there are increasing number of studies on TFP. Productivity growth is a crucial factor in determining growth of an economy.

Tinbergen (1942) explained both of the labour and capital productivity as first one is the output per unit of labour and second is the output per unit of capital. It is useful to have a composite measure of productivity which relates output to all the conventional input simultaneously. The concept of total factor productivity defined as the ratio between real output and real factor input while he tried to have an international comparison of productivity growth.

Stigler (1947) developed the concept independently and suggested that a measure of real total factor input could be obtained by weighting inputs by their marginal products.

Griliches (1960) and Dension (1962) extended the principle of weighting inputs by their marginal products to components of labour input. This system of weighting is now common practice in productivity studies. It is implied by the necessary conditions for producer equilibrium in competitive factor market.

Balkrishnan (1958) analyzed labour productivity movements in twelve industries through CMI data incorporating twelve industries. This study has made the regional comparison which is

taken in terms of spatial significance in production. The states of West Bengal and Maharashtra were taken together as one region and the rest of India as the other, on the ground that the former was far more industrialized in relative to the later.

Krishna (1987) has reviewed the trends in industrial production and productivity since 1950. It is mentioned that productivity growth are a major contributing factor in the economic growth of many industrialized countries. In recent three decades, various studies have focused on source of productivity growth, yet there has not been a consensus selecting the attention of the root of productivity. Some of the researchers are focused to find out the impact of trade policies on the growth of total factor productivity.

Mukherjee (1975) conducted a comparative study of the productivity trends in the large scale manufacturing sector of Bihar relative to the productivity trends at the all India level but could find no systematic trend at the state level. There is a declining trend in factor productivity both at the state and all India level. State level represents high level of marginal decline.

Radhakrishnan (1990) in his analysis of partial productivity growth identifies that there was a general rising trend in labour productivity and a falling trend in capital productivity over the entire period of analysis of the whole manufacturing sector. The pre and post 1970 inter temporal comparison showed significant deceleration in the growth rates of both labour and capital productivity during the second period basically.

Unel (2003) investigates the productivity trends in Indian registered manufacturing sector during the period 1980s and 1990s. His study found that labour and total factor productivity growth in total manufacturing and many of the component sectors since 1980 were markedly higher than that in preceding two decades. The estimation shows that Total Factor Productivity Growth (TFPG) ranges between 0.9 and 3.1 percent. The comparison in productivity suggests that labour and factor productivity trends in most of the sectors are significantly higher after 1991 reforms. Justifying the argument, the estimation showed that average annual growth rate of TFPG in aggregate manufacturing is 1.8 percent per annum for the period of 1979-80 to 1990-91 and 2.5 percent per annum for the period 1991-92 to 1997-98. The study has also presented the elasticity of output with respect to labour to be 0.6 percent rather than taking elasticity to be equal to the income share of labour. The average annual growth rate was 3.2 percent during 1979-80 to 1990-91 and 4.7 percent during 1991-92 to 1997-98.

Goldar (2004) estimated TFPG citing the studies of Unel (2003) on productivity trends in

Indian manufacturing. The contradicted Unel's findings and criticized his methodological inadequacies in input measurement. This study showed the indication of slowdown in TFPG in Indian manufacturing of the post reform period.

The RBI development research group Trivedi *et al.* (2011) found TFPG for the period 1980-81 to 2003-04 of the total organized manufacturing sector as 0.92 percent per annum by growth accounting approach which is almost half of that obtained by the production function approach, i.e. 1.81 percent per annum (pcpa). The contribution of the TFPG by these two approaches to the growth of output lies between 13 to 25 percent. The interstate performance of TFPG of organized sector across the states by growth accounting approach indicates that Bihar, Rajasthan, and AP turn out to be best performers while the worst performers are Tamil Nadu, Gujarat and Punjab. Bihar exhibits the highest TFPG of 1.55 pcpa and Tamil Nadu shows 0.65 pcpa. It is because there was a negative growth rate (-1.81) of employment of Bihar during that period while Tamil Nadu witnessed the growth rate of employment of 2.5 pcpa.

Dash *et al.* (2010) estimated the TFPG of manufacturing to know the structure and growth of registered manufacturing sector. The study attempted to examine the extent of employment contribution in Odisha's manufacturing industries to all India to explore the sources of output growth in manufacturing industries. Selecting ten states in India, this study has noticed wide differences in figures for both pre and post reform periods. The findings observed that three states namely Karnatak, U.P., M.P., have increased during 1990s for both the two measures of output, the study used.

1.4 Literature related to Spatial Spread

Seth and Gulati (1974) find the Grossack's index is one of the best and suitable methods to measure industrial concentration which does not only provide the magnitude of dispersal and concentration but also supply information regarding the process of their emergence. This study has first tried to estimate the average capital and labour employed per factory of their selective spatial units.

The average share so obtained by the factory in the pooled spatial units was then multiplied by the number of factories in the individual spatial units. To equate the number of locations of the base year with the terminal year, this study has assumed relative share equals to zero, for those spatial units which had positive share at terminal year but at the base year the industry concerned had not even a single point in that spatial units. Applying the data in the

framework of the Grossack's Index, they have found that the industries differ so far as the magnitude of the dispersion and the process of its emergence are concerned. The study concluded that the industries concerned are not sticking to their original locations. Industries are adapting themselves according to market as well as labour supply. This study has shown that the difference in the magnitude and the process of dispersal and concentration in terms of capital and labour reflected the changes in production technique have a vital role.

Ghosh (1975) found interesting to look at the association between economic growth and industrial concentration. Considering the firms as the ratio that measures the extent to which a small number of firms account for a small, medium, or large proportion of industries total assets, the level of concentration are persistently high over the periods in most of the industries, is one of the important findings by him. There are three economic causes of change in concentration, viz., fast growth in the number of firms, high initial level of concentration and first growth of industry. It is expected that with the growth of industries and the increase in the number of firms under different managements would decline in the two decades in India. Major findings of the study stated that the majority of Indian industries were highly concentrated during 1948-68 and in most of these industries, the degree of concentration declined during that period also. The concentration at the top had decreased significantly in most industries along with relative concentration when fewness of firm was considered.

Papola *et al.* (1979) and Papola (1980) studied the spatial diversification of industries in Uttar Pradesh. The study observed that the industrial concentration remained unchanged during the period under study. They examined the hypothesis of spatial distribution of industrial activity would be determined by the availability of basic raw materials and availability of the market This study found, the infrastructure and agglomeration emerged as the measure determinants of location overshadowing the importance of location of raw materials and markets. The argument was that the fiscal and financial incentives played only a marginal role in the diversification of industries mutually supporting each other and using providing certain facilities for the promotion of skills, entrepreneurial training and marketing for effective industrial development in backward areas. Kaur (1983) examined the spatial distribution of industries in Haryana during the period between 1966 and 1978 and concluded that regional disparities in industrial development widened in that state. Singh (1987) found the regional disparity in the industrial growth of Rajasthan. His study examined the disparity in industrial development at three levels, viz.,

infrastructure level, manufacturing level and demographic level pattern. The study observed that the disparities are highest at manufacturing level followed by infrastructure and demographic level. But all the three levels have shown a declining pattern of disparity. It is concluded that the regional disparity in industrial development increased over the years.

Seth (1987) focused on spatial pattern of industrial concentration in India. Taking some inductive approaches like Hoover's indicator, Zelinsky- Fuch measures for measuring relative gains and losses of the regions, regions relative significance as a measure of concentration and Grossack' Index, the study has shown the scenario of the spatial concentration of manufacturing sector of India. The result by the relative significance of regions suggests that there are marked shifts in the distribution of employment during the period 1965-70 and 1975-80. Overall, the fact suggests that over the period significant regions have lost their share to insignificant regions. Last but not least, the result for Grossack's Index has made the story more revealing where the significant regions have not lost their shares to each other. These facts substantiate that in India the process of concentration are accompanied by the state convergence. In his study, the interstate convergence in the process of industrialization suggests that all the states in India are able to internalize in their respective geographic regions, but it is not a necessary condition to say, there exists less spatial inequality in India.

Mukhopadhayay (1989) studied the district wise variation in employment in the industrial sector in West Bengal. By using coefficient of variation, he found that the degree of variability in employment among the districts had been decreasing over the period of time. To look into the spatial cluster of industries, the study has calculated location quotient. From the analysis the study concluded that the variability is caused by two sets of factors i.e. economic and non-economic.

Dholakia (1989) made two observations, at first the extent of inequality is considerably lower for the traditionally broad definition of industrialization and the second, the observation from the study states that the average dispersion or the extent of inequality in the levels of industrialization among states. The result for regional spread of industries was likely to prove the growth promoting rather than the growth hindering.

The empirical evidence seemed to support the hypothesis of complementarities between the objectives of high growth and reduction of regional disparity. The regional spread of industries appeared to be neutral with respect to technology. The study concluded that the nature

of industrialization in terms of capital per worker, and capital productivity sharply divided the national economy into the north and the south. This study clearly suggested greater regional spread of individual industries, diversification of 'industrial base' for northern states and greater specialisation of industrialization structure for the southern states. The observation stated that reduction in regional disparity in industrialization without sacrificing growth is an important aim of national policy.

1.5 Studies for Countries Other than India

Ebenstine *et al.* (2011) has added some new insight to the existing literature of the spatial analysis. They demanded that there paper extended the spatial analysis of the Chinese economy in two ways at first by analysing sectoral employment at the country scale across the country and second the addition of services in the analysis of spatial pattern of industries. Several studies according to them in Chinese economy have placed the coastal concentration in the context of industrial agglomeration theory. This theory suggested that production efficiencies occurred to producers with geographical concentrations due to decrease in transport cost between suppliers and purchasers, labour market pooling, infrastructural specialisation and intellectual spill-overs. Using index of diversity and coefficient of variation, their result indicated increasing geographical concentration and localisation as well as the continuation of spatial concentration as a result of agglomeration efficiencies which is vital component of aggregate growth of Chinese economy.

Tiwari *et al.* (2003) have tried to estimate disparity in employment generation and equity investment. This study has contributed the debate on concentration of economic activities that was due to globalization with empirical analysis of spatial patterns of employment generation and equity investment in the manufacturing industries. The study has also cited that the convergence effects of concentration are so strong that geography can potentially sidelined in the process of global change. Their result placed the argument that with trade liberalization, urban concentration and industrial concentration are likely to decrease with the argument when firms produce for domestic consumers, they will minimize transport cost by locating closer to main markets. The result of their study indicated that Philippines and Thailand employment and equity investment are highly spatially concentrated in comparison to Malaysia and Indonesia. The disparities in employment generated tended to disperse as the economy grows. Finally, their

result indicates that employment in manufacturing industries with Japanese equity has tended to be concentrate in the lower income countries while it had been tended to disperse in higher income countries.

1.6 Literature related to Capital-Labour substitution in manufacturing sector

The aim of the industrial sector should focus to absorb a sufficient quantity of disguised unemployed labour force of the agricultural sector. Despite the rapid growth of output in the manufacturing sector, employment in this sector appears to have grown rather slowly. So the objectives of high growth rate of output and employment addressing the development policy are in conflict. Two production functions, Leontief and Cobb-Douglas are based on the assumption of zero elasticity of substitution and unity elasticity of substitution respectively. The first one expressed the changes in the ratio of unit labour cost to capital rental (w/r) will leave the capital-labour ratio (K/L) unchanged. If the elasticity of substitution is unity, a given percentage change in w/r will result in equal percentage change in K/L. SMAC (Arrow *et al*., 1961) production function in which elasticity of substitution is assumed to be invariant to changes in the capital labour ratio but free to take any positive value between zero and infinity (Williams, 1974).

Clague (1969) observed there is a limited scope of substitution between labour and capital of the modern manufacturing techniques consequently the ability of the manufacturing sector to absorb labour is quite limited. To reverse the process, production structure should be flexible enough so that it is easy to substitute labour for capital. The technological change should be in a direction so that it encourages labour-intensive rather than capital-intensive techniques.

In this context, the structural magnitude of elasticity of substitution becomes much more relevant and can shed light not only on these issues but also on the pattern of resource use in any productive system. Different schools of thought, in growth literature, have developed production functions based on varied types of restrictive assumptions (Singh *et al.*, 1985). These studies which are attempting estimation the all India level for manufacturing industries have found that the elasticity of substitution does not show any significant difference from unity. However, contrary to these results, Dhesi and Ghuman (1983) found that in the manufacturing sector of Punjab the elasticity of substitution is significantly different from unity.

Arrow *et al.* (1961) viewed a developed version of production function with constant elasticity of substitution not necessarily unity. It is mentioned that the extent to which capital and

labour are substitutable requires necessary assumptions. The important assumptions are used in recent time periods are based on Leontief and Cobb-Douglas kind of production function. The first one assumes constant input coefficients while second one focuses on unitary elasticity of substitution. The study found varying degrees of substitutability in different types of production. Because of numerous technological alternatives available in different sectors, the argument was that the uniform substitutability is most unlikely. The regression analysis showed a highly significant correlation of the labour productivity on the wage rate.

Upender (1996) estimated the elasticity of labour productivity to find out the substitution possibilities of labour for capital in Indian manufacturing sector since 1973-74 to 1989-90. Citing the facts that the manufacturing sector are playing a vital role in the process of Industrial development in India and the growth of Indian manufacturing sector depends largely on factor productivity and substitution possibilities between labour and capital. There is an attempt to study the possibilities of substitution in between capital and labour. Generating empirical information for policy makers, this study tries to estimate the magnitude of return to scale and elasticity of labour productivity as that can assess the substitution possibilities of labour for capital for the Indian manufacturing with the help of time series data by ordinary least square method.

The study found that elasticity of output with respect to capital is significant while the elasticity of output with respect to labour is insignificant even at 10 percent level. Adding to the result, the study observed that negative sign of the elasticity of output with respect to labour is meaningless and not conceivable as well as elasticity of output (gross-value added) with respect to capital-labour ratio is not only positive but also significant at 1 percent level corroborating the fact that Indian manufacturing sector is capital intensive. It is concluded that the elasticity of labour productivity with respect to wage rate in Indian manufacturing sector is more than unity convincing that the appropriate form of the function for his exercise is the Constant Elasticity Substitution production function.

Roskmap (1977) attempted to fill up the gap of information on the elasticity of substitution between labour and capital in West German Industries during 1950-60. Estimating variable elasticity of substitution and Bruno function which are based on stochastic equation and explains labour productivity as a function of real wages and capital labour ratio, the issues of elasticities of substitution solved for 35 industries, and it is found 23 had positive values, ranging

from near 0-2.82. For 16 of these 23 industries the elasticity of substitution was less than unity, for 7 it was above. In 3 industries the VES was 0, disregarding more than two digits. Finally, for 9 industries the VES turned out to be negative, something which was difficult to explain, he mentioned. The study obtained negative elasticities of substitution in other time series estimates. In the constant elasticities of substitution (CES) case no negative values were found. The positive values range from 0.29 to 2.47. For 31 industries the CES values are below unity and for 7 above. He also printed CES values ranged from 0.29 to 1.28 for 35 West German industries.

Dadi (1970) studied the elasticity of substitution for the year 1962 of 17, 2-digit manufacturing industries in India through the cross section data incorporating the well known constant elasticity of substitution production function developed by Arrow *et al.* (1961) that says about a constant elasticity of substitution not necessarily unity. By fitting the logarithmic relation, the elasticities of substitution and other parameters are estimated by him and the hypothesis that value added and wages per worker are uncorrelated are tested. The relative share of the labour in relation to whether the industry is elastic or in-elastic the distributive aspect of the SMAC production function has also been examined by him. The study concluded that thirteen industries confirm the good fit relative wage share and wage rate moving in the opposite direction in those industries where elasticity of substitution is greater than one and in the same direction where it is less than one. Integrating a regression of labour productivity on wage rate, it showed a highly significant correlation in manufacturing industries while the regression co-efficient, the elasticity of substitution, varied from industry to industry in different states in India.

Fitchett (1976) estimated the sectoral elasticity of factor substitution to alternative levels of sectoral capital formation and wage rate movements in order to examine the impact on factor employment and factor earnings and establish the trade-off which exists between higher wages and more employment in the manufacturing sector of Panama. Inciting the facts such as the gross domestic product of Panama grew at a compound rate of 7.6 percent, while overall employment expanded at an annual rate of 3.7 percent from 1960 to 1970, unemployment rate in the Panama City and Colon area fell from 14.4 percent in 1960 to 9.8 percent in 1970, 36 percent of the sector's value added was in food and beverage activities, the study found that the result for using the cross section data for 1970 the elasticity estimate is very close to the time series estimate for the entire sector. It is suggested that in an economy such as, Panama's, where there is rapid expansion of population with appreciable level of unemployment and underemployment.

There is a need to address the policy questions relating to relative factor prices with greater emphasis.

Lianos (1975) published a paper estimating the elasticity of capital labour substitution and the rate of technical change in the manufacturing sector for the period 1958-1969 of Greece. Discussing the facts, the annual growth rate of 6.4 for the period 1955-1970, unemployment 5.8 percent of the labour force in 1961 and 1.8 in 1971, this study tries to describe the major changes in the labour market and build up the concern regarding the ability of Greek economy to continue to grow in the absence of abundant labour. This study tried to find out alternatives either a higher growth rate of labour supply or a change in the average propensity to save or finally a change in incremental capital-output ratio open to the economy for continuing growth. The study suggested better use of labour input including occupational and regional mobility is more desirable factor than importation of foreign workers which is only the last resort. It is suggested that an increase in capital-output ratio that involves substitution of capital for labour to produce same level of output, i.e. more capital intensive techniques are also one of the solutions.

Since most capital goods and nearly all manufacturing equipments are imported from technologically advanced countries, capital-labour substitution implies the production process is fitted with technological progress. The estimation of σ differs substantially from 2.89 to 0.543, but due to high standard errors neither is reliable. Estimating the considerable ease in increasing the capital intensity of production, the capital labour substitution is not instantaneous but it requires time, length, the gestation of capital goods, it is concluded that the cross section estimates of σ are biased towards unity and the time series estimates are towards zero.

Clague (1969) estimated elasticity of substitution between capital and labour for eleven manufacturing sector for U.S.A and Peru. It is found that the modern manufacturing sectors are incapable of absorbing the concealed labour form the traditional sector despite the rapid growth of output, employment in the manufacturing sector seems to have grown rather slowly, in many cases at a slower rate than population, he focused to correct the imperfections of market first. Then his concern was to examine the degree of substitutability between labour and capital among underdeveloped countries. He tried to shed light on the problem by using capital-labour ratios and factor prices in Peru and U.S.A calculating the elasticity of substitution between labour and capital. He observed that modern manufacturing techniques do not permit enough substitution

between labour and capital and consequently the ability of the manufacturing sector to absorb labour is quite limited.

Weiss (1997) focused towards a complete analysis of capital skill complementarities hypothesis by producing cross section estimates for twelve manufacturing industries in 1960. After testing and rejecting the hypothesis that labour can be aggregated into two categories, a little evidence is found that the skilled labour categories are generally less substitutable with capital than are the unskilled categories. It is pointed out that in U.S. manufacturing; capital-labour substitution is not an important part of explanation of recent movements in the wages and quantities of the various categories of labour. The estimation had the advantage of a high degree of disaggregation of industries and labour types. The functional form is relatively restrictive. Using a non linear iterative Zellner procedure, which produces full information maximum likelihood estimates, it is obtained that the aggregation of labour into one or two categories is inconsistent with the data and found capital labour substitution is not universal in U.S. manufacturing. The magnitude estimated is no doubt warrant to further research.

Sankar (1970) has taken 15 major industries whose contribution is more than 95 percent of total value added in manufacturing. Using C.E.S production function, he estimated the parameters through maximum likelihood and Bayesian techniques and considered regional differences in production conditions that come from composition of capital and labour inputs, utilization, social overhead capital. Fixed factor proportions hypothesis is rejected for 11 of 15 industries.

In 10 out of 15 industries the estimates were significantly above the constant return to scale value of unity. In two industries (cement and glass and glassware), the point estimates were significantly below unity indicating decreasing return to scale.

As per the Cobb-Douglas case of unitary value, he could reject it for only one industry. One major conclusion he emerged from his study is that the parameters λ and σ were not determined very precisely. He found increasing return to scale in a number of industries. He also observed that in many industries small firms were insufficient in the sense that they yield low return. He mentioned heavy industries have long gestation periods and in many instances investment take place for the purpose of building ahead of demand. As a result there is a need for more information on the lag structure and capacity utilization for reasonable results as increased output is spread over a number of years. Both functions used by him present good fits to the

observations, the logarithmic form being somewhat better and also fitted by Solow to the manufacturing industries of United States of America.

Seth (2012) has expressed that the companies prefer to employ more capital instead of labour while producing goods, lending credence to the belief that India's growth in the post liberalization era has failed to create more jobs. The country's worker to fixed capital ratio in the registered manufacturing sector has declined from 10.9 in 1990-91 to 3.2 in 2009-10. Growth in employment has also slowed from 2.61 percent in 1993-94 to 1.02 percent in 2009-10 according to five yearly NSSO survey (National Sample Survey Organization) (Seth, 2012).

Sen **(**2012) found that slowing employment is certainly a problem and the main reason for that the labour intensive industries are not growing fast enough, the reason for which traditional labour intensive industries also prefer capital. It should be understood by initiating more researches. India's export baskets are skewed with an increasing bias towards capital intensive production, or a higher degree of mechanization. The matter of concern is the worker-to-fixed-capital that biased towards capital reflecting a greater preference for capital goods in the production process. It is because; this labour intensive manufacturing sector that holds the potential to absorb the large pools of surplus labour from Indian agriculture is in danger.

A fall in labour intensity in manufacturing- the extent of labour inputs used in per unit of output produced- also raises concerns about India's ability to absorb its rapidly expanding work force and reap the benefits of favourable demography. The worker-to-real GDP ratio in the registered manufacturing sector has also declined from 52.2 in 1990-91 to 17.4 in 2009-10, implying that fewer workers are used to produce one unit of product. Simultaneously there is an increase in fixed capital stock- real GDP ratio from 4.9 to 5.5 during the same period. Although some of this fall can be explained by rise in labour productivity, corresponding evidence from slowing employment and rising usage of fixed capital suggest that lower performance of workers vis-à-vis capital (Seth, 2012).

All those above literature imply that studies relating to production function in its various forms are undertaken both for developed and underdeveloped countries are many. Studies pertaining to lower income countries were primarily directed to towards finding the degree of substitution between labour and capital. These efforts are capable to address the higher unemployment problem. The good number of studies have brought the idea the near zero elasticity of substitution between labour and capital are responsible for the existence of the high

rate of unemployment. The higher values of the elasticity of substitution could lead to the substitution of faster growing labour factor to the slow growing capital factor. So, it is argued that the knowledge of the value of elasticity of substitution between labour and capital in the manufacturing sector is essential for understanding the unemployment problem in India as well and its individual states.

1.7 The Rationale of the Study

From the preceding review of literature it is evident that studies on industrialization on manufacturing growth pattern, spread and capital labour substitution in Odisha and its neighbouring states is limited. Some aspects which need an examination are the growth performance of Odisha with its neighbouring states with a clear comparison vis-à-vis spread of manufacturing industries and the possibility of labour to substitute capital. These will be helpful to know the industrial scenario and its drawbacks. In doing so, the analytical frame should be one which will deal the overall performance of some of these indicators of industrialization. Thus, this study is designed to cover in its scope in the following aspects.

1. First, there is an attempt to look at the growth of income, net value added, employment and capital of Odisha vis-à-vis its neighbouring states especially in the secondary sector. This will help us to know the dominant manufacturing groups in Odisha and how their patterns have taken place from its neighbouring states.
2. Next, the spatial pattern of manufacturing industries can been followed through various measures considering regional inequality in terms of employment, net value added and fixed capital and number of factories. Overall literature states that there is a structural change in the process of industrial development over time and the industrial growth pattern varies across states and industries. From the studies on regional disparities, it is observed that the industrial disparity is significant not only across states in India but also districts within each state. Moreover, when the regional disparity is found to be decreasing in India, one can observe that the regional level studies are necessary to understand the growth pattern and to examine the regional disparity in Industrial growth.
3. There are no studies found which address the problem of unemployment examining the capital-labour substitution of manufacturing sector in Odisha although there are few studies for its neighbouring states. It is observed that despite the rapid growth of output in

the manufacturing sector, employment in this sector appears to have grown slowly. So, the objectives of high growth rate of output and employment of the development policy are in conflict. In this context the structural magnitude of elasticity of substitution is much more relevant and can shed light on the issues of unemployment in Odisha making a fare comparison with its neighbouring states. Keeping all this literature in mind, this study is intended to work out for the following three objectives presented in a nut shell as following.

1.8 Objectives

i. To examine the growth of income and growth rate of groups of manufacturing industries in Odisha and to compare its performance with its neighbouring states.
ii. To estimate the rate of extent of the spread of manufacturing that occurred in Odisha and its neighbouring states.
iii. To estimate the degree of substitutability between labour and capital in the manufacturing groups in Odisha.

1.9 Hypotheses

i. Manufacturing sector in Odisha is not robust in terms of growth over a specified time period 1980-2008.
ii. Inequalities have declined in manufacturing spread among Odisha and its neighbouring states over the period of time.
iii. The elasticity of substitution in the manufacturing sector as a whole is equal to unity in case of Odisha.

As soon as the problems are identified in the first chapter, the second chapter has looked into the data sources and methodology. These data and methodologies are used in this ongoing study to reach at the specific objectives is very vital. With a lucid explanation of the overall motivation behind this research in the first chapter, it quite relevant to know the plans and methodology by which the analysis can direct towards the specific goals of this study.

* * *

Chapter- 2

Data Sources and Methodology

2.1 Data Source

Vast sources of information about the manufacturing industries are found in Annual Survey of Industries in India (ASI). It is also the most comprehensive information set up in the organized manufacturing sector in state level. ASI is conducted every year, but the results are available at a time lag of 2 to 3 years. A structured and detailed schedule is used to collect the data filled in by the persons of the Field Operation Division (FOD) of National Sample Survey Organization (NSSO) and is based on the statement of the unit (Singh, 2012). The Industrial statistics was formed in 1945 to administer the industrial statistics act (1942). The Census of Manufacturing Industries (CMI) during 1946 and Sample survey of Manufacturing Industries was formed little later. But the ASI replaced both these because they were discontinued in 1959. The survey under ASI is conducted annually under the statutory provisions of the Collection of Statistics Act 1953 and the rules framed there under in 1959 except in the State of Jammu and Kashmir where it is conducted under the State Collection of Statistics Act 1961 and rules framed there under in 1964. The ASI extends to the entire country except the States of Arunachal Pradesh, Mizoram and Sikkim and Union territory of Lakshadweep. It covers all factories registered under the section 2(m)(i) and 2(m)(ii) of the Factories Act, 1948 i.e. those factories employing 10 or more workers using power ; and those employing 20 or more workers without using power (Nath, 2005).

The entire industrial activities are divided into two sectors such as “factory sector” and “non-factory sector” for collecting data on manufacturing industries. The factory sector covers all manufacturing, processing and repair and maintenance services units irrespective of their employment size, investment and location. This sector is broadly divided into organized or registered and unorganized or unregistered manufacturing industries. The data on organized manufacturing is collected through ASI, annually. The data on unorganized sector comes through National Sample Survey Organisation (Trivedi, *et al.*, 2011). The output series from ASI is at current price. Appropriate price indices are used for deflation purpose from the official series- Index number of wholesale prices in India in this study. Here the official series- Index numbers of wholesale prices are picked from Office of the Economic adviser of India for deflation.

In this study, thirteen manufacturing industries are considered. These are food and food products (20_21), beverages, tobbacco and tobbacco products (22), textiles (23_24_25), textile products (26), wood and wood products (27), paper and paper products (28), leather and leather products (29), chemical and chemical products (30), rubber and plastic products (31), nonmetallic, mineral products (32), basic metal and alloy (33), metal products, nonelec. Machinery (34_35_36), and transport equipment (37). These thirteen manufacturing industries are responsible for more than 95 percent of value added in total manufacturing production India. Some Codes at the state level are clubbed and presented due to the unavailability of data. Concordances of Industries are taken through 1998 industrial classification. The time period are taken from 1980/81- 07/08 for all groups of manufacturing industries for all the studied states. This study has incorporated 5 states. These are: Andhra Pradesh, Bihar*, Madhya Pradesh*, Odisha and West Bengal. The two states suffixed with '*' indicate that these were bifurcated in the year 2000. In this study, Bihar* includes Bihar and Jharkhand; Madhya Pradesh* includes Madhya Pradesh and Chhattisgarh. The variables to be used in this study have some technicalities which need to be explained very clearly to place the accurate result for our objectives.

2.2 Measuring Variables

2.2.1 Capital Construction (K)

There is no unique method to measure real capital, but it is necessary to find out a way to measure real capital and that are focused by various scholars. These scholars have found both theoretical and empirical problems in measuring capital stock.

Goldar (1986) looked at the conceptual problems of estimation and reviewed the short comings of estimations of capital stock for Indian manufacturing sector. He found there is always a dilemma in selecting either gross fixed capital formation or net fixed capital formation as the measure of capital input. Ideally for purposes of economic analysis, it is desirable to use the estimate of net capital stock provided a reasonable measure of true economic depreciation can be found out. But existing estimation of depreciation are either tax based accounting concepts or based on certain rules of thumb. So this dilemma is there.

The next problem relates to the measurement of a time series data of real capital. Perpetual inventory method is usually used to measure capital. In a step by step process time

series of stock of capital is measured from investment and price of capital goods. Careful attention is paid to obtaining the base year capital stock, obtaining an appropriate deflator and making allowances for discarding assets (Goldar, 2004).

The measure of capital stock includes land and excludes working capital. Working capital is excluded in many earlier studies including Goldars. The estimates of capital stock are also gross of depreciation. The perpetual inventory method is used to obtain the time series on capital stock.

Let K_0 denotes the base year capital stock, I_t the gross investment at base year prices in fixed assets in year t. Then fixed capital stock in year T denoted by K_T is given as follows:

$$K_T = K_0 + \sum_{t=0}^{T} I_t$$

The gross investment $I_t = [B_t - B_{t-1} + D_t]/P_t$ where B_t stands for the book value of fixed assets at the end of year t. D_t is the amount of depreciation allowances made during year t is taken at 10 percent (Trivedi, *et al.*, 2011). P_t is the capital goods price deflator. But the deflated figures of capital with its book value are used here (Trivedi, *et al.*, 2011).

2.2.2 Labour Input (L)

In the case of labour, the stock available to the industry is the number of persons employed by it during a year. The ASI publishes annual data on workers as well as employees and either of them can be used as a measure of labour input. Total employees as a measure of labour inputs include both workers as well as persons other than the workers. Persons other than workers consist of Supervisor, technicians, managers, clerks and other similar types of employees. They are important for getting the work done as the workers who operate the machines and therefore their services should be taken into the measurement of labour input. Here Total persons engaged (Total Employees) are taken as a measure of labour input. Using total employees as a measure of labour input thus involves the assumption that workers and persons other than workers are perfectly substitutable: This is clearly an assumption which is not realistic and is thus a delimitation of this measure of labour input (Trivedi, *et al.*, 2011).

2.2.3 Value Added (V)

To convert nominal value added to real value added, WPI series for each sector can be used. There are different series of WPI, the method of splicing can be used for these series to

find out overall WPI series at a given base year price. The detailed categories for which the wholesale price data are available do not match exactly with the two digit classification of the ASI. A close and detailed scrutiny of the available data is required before selecting the suitable price deflators. Hence output can be measured in terms of both value added or gross output. In this present study net value added are used as more relevant measure than that of gross value added and gross output keeping the previous research suggestions and its clarifications in mind (Dholakia, 1989). But researchers like Dash *et al.* (2010) in an IGIDR paper have argued in favour of gross value added as a good measure of output, he argued depreciation figures are not reliable as the entrepreneurs often provide data with inflated figures to avoid tax-laws.

2.2.4 Wage (W)

Wage includes all payments made in each as compensation for work done during the year; it is paid to workers, salaries paid to non-workers, and money value of benefits paid to the workers and non-workers. Here wage rate (w) is taken as (W/L). V/L is labour productivity, K/L is capital intensity, V/K is capital productivity, and 'r' is rate of return on capital (V-W/K). This figure is deflated by consumer price index of industrial workers available on labourbureau.nic.in. This consumer price for industrial workers is converted into a single base year and then it is deflated by the wages (Singh and Singhal, 1985).

2.3 Methodology

2.3.1 Growth Rate

This analysis is being started to meet the first objective by examining the annual growth rates for the entire period under consideration as well as different segments are made. The growth rate will help us to analyze the trends in the variables over time. The methodology of Semi logarithmic function to find out the growth rates is used. The growth rates are functions of either time or dependent variable or both which changes with time. Thus for those curves where the growth rate is a variable growth rate, growth rates are computed by the simple average over period of time. All wholesale price index of manufacturing commodities is used to deflate the figures.

The Semi logarithmic function is used to compare the trend rate of growth of employment and output for Odisha and its neighbouring states.

The exponential growth of 13 major industries calculated using the following model.

$$LnY = a + bt + u_t$$

Here, Y indicates different shares of manufacturing groups. The regression coefficient "b" yielded an estimate of Compound Annual Growth Rates when it is estimated finding the exponential of "b" deducting 1 and multiplying 100. It is as follows

$$= (Exp\ (b)-1)* 100$$

This is the Compound Annual Growth Rate for dependent variables. Here the aim is to find out the growth rates of Output (net value added), employment, capital, and number of factories for Odisha and its neighbouring states regressing with respective time periods (Gujurati and Sangeeta, 2007).

2.3.2 Coefficient of Variation

Coefficient of variation is a relative measure of dispersion, this is used in such problems where there is a need to compare the variability of two or more than two series. The group or series for which the coefficient of variation is greater is said to be more variable or conversely less consistent, less uniform, less stable or less homogenous. Coefficient of variation is denoted by C.V. and is obtained as follows:

$$\text{Coefficient of Variation or C.V.} = \frac{\sigma}{\overline{X}} \times 100 \text{ or } \frac{S.D}{Mean} \times 100$$

This measure is used throughout the study where there is a requirement to show the variation among the series. In studying the problem of inter state variations, the coefficient of variation is used. It is a relative measure of dispersions among states. When two time points are considered in a comparison of the magnitudes of coefficient of variation, it would indicate the change and direction of relative dispersion.

Measures of Spatial Spread

2.3.3 Location Quotient (LQ)

Location quotient is a commonly used index of analyzing industrial arrangement and industrial superiority in industrial economics, regional economics. In regional economics, Location quotient to judge that whether this industry can form regional specialization, called compared superiority coefficient, is used. It can be calculated by sales incomes, the number of enterprises and the number of employees (Xiao and Young Heng, 2008).

Location quotients are calculated for all manufacturing industries to determine whether or not the local economy has a greater share of each industry than expected when in comparison to reference economy. This approach estimates the basic employment in each industry by relating an industry's local employment share to its national employment share. It is the most commonly used technique to compare the local economy to a reference economy in the process of attempting to identify the specialization in the local economy. This technique is based upon a calculated ratio between the local economy and the economy of some reference unit. It does not assume that all employment in each industry is basic or non-basic. If an industry has a greater share of each industry than expected of a given industry, then that extra industry employment is assumed to be basic because these jobs are above what a local economy should have to serve local needs (Xiao and Young Heng, 2008).

Calculation of Location Quotient

$$LQ = \frac{\textbf{\textit{Regional Employment in Industry I in year T}}}{\textbf{\textit{Total Regional employment in year T}}} \div \frac{\textbf{\textit{National Employment in Industry I in year T}}}{\textbf{\textit{Total National Employment in year T}}}$$

LQ provides evidence for the existence of basic employment in a given industry. Here region implies the respective states and national implies addition of all the states.

Interpretation of the Results of LQ

When calculating location quotients, only three general outcomes are possible.

a. **LQ > 1**, it shows the local employment is greater than expected and it is therefore assumed that there extra employment is basic in nature.
b. **LQ < 1**, it implies that industry is not meeting local demand for a given goods or services, therefore, all of his employment is considered as non-basic by definition.
c. **LQ = 1**, all of his employment is considered as non-basic because none of these goods or services is exported to non-local areas.

To determine the number of basic jobs when LQ > 1. This formula will be as follows:

$$\text{Basic Sector Employment} = \left(\frac{\text{Regional Employment in Industry I}}{\text{National Employment in Industry I}} - \frac{\text{Total Regional Employment}}{\text{Total National Employment}}\right) \times \text{National Employment in Industry I}$$

2.3.4 Hoover's Measure of Spatial Concentration

The problem of spatial distribution of industries was first used by Hoover in an inductive way. He found the solution to understand as to which industries influenced the population standards more effectively and which were passive ones adjusting themselves to the population (Seth and Gulati, 1974). He defines concentration as a degree of dissimilarities between spatial organizations of industries and that of population. He used localization curve for measuring concentration. This curve gives geometrical representation of dissimilarity between the spatial distribution of population and industrial workforce (Seth, 1987).

He incorporated two measures as following:

a. If L_i is the share of the ith region in terms of labour employment and $\sum_{i=1}^{n} L_i$ is the total employment in all the regions, then the relative share of ith region can be written as

$$\mathbf{L_i} / \sum_{i=1}^{n} L_i$$

But this measure is silent about the concentration with respect to size of the region.

b. The second index is the index of industrialization which specifically takes into account regions share of the employment in comparison to its share of population.

$$I = \frac{L_i}{\sum_{i=1}^{n} L_i} - \frac{P_i}{\sum_{i=1}^{n} P_i}$$

Where, P_i and the summation P_i are the population of the region and population of the country respectively.

2.3.5 Regions relative significance as a measure of concentration

The term concentration here implies that the region enjoying relatively significant position at the base year gains proportionally or more than proportional increase from the expansion of the national economy. The term relatively significant means that the share of particular regions is equal to or greater than the average of national share. Similarly proportion means the regions gain from the growth manufacturing over time, a share which is at least equal to its relative share in the base year (Seth, 1987).

$$M.C = \frac{L_{i0}}{\sum_{i=1}^{n} L_{i0}} \leq \frac{\Delta L_{it}}{\sum_{i=1}^{n} \Delta L_{it}}$$

Where M.C implies measures of concentration and $L_{i0,}$ L_{it} implies the labour employed in base and terminal year respectively while Δ shows the change in the labour employment in the economy as a whole between the base and terminal year.

a. The region is said to be significant if the $L_{i0} < \frac{\sum_{i=1}^{n} L_{i0}}{n}$

b. The insignificant regions can become significant if

$$L_{i0} + \Delta L_{it} > \frac{\sum_{i=1}^{n} L_{i0}}{n} + \frac{\sum_{i=1}^{n} L_{it}}{n} \quad or \quad \frac{\Delta L_{it}}{\sum_{i=1}^{n} \Delta L_{it}} > \frac{1}{n}$$

2.3.6 Zelinsky- Fuch's measuring for relative gains and losses of the regions

In this measure hypothetical figures are drawn for the terminal year from the data of the base year assuming that the rate of growth of each spatial unit is equal to the overall rate of each spatial unit is equal to the overall rate of growth of the economy. If a region has grown faster than the national growth rate, then the region is said to have gained and as region did not go rapidly, the region has lost is meant. The gains and losses are computed as the differences between the actual shares of industrial employment of the specific specified region in the terminal year and the respective hypothetical share (Seth, 1987).

Let $L_{i0,}$ $L_{It\ is}$ labour employed in the ith region in the base and terminal year respectively. The summation of the labour employed in base and terminal year is taken as $\sum_{i=1}^{n} L_{i0}$ & $\sum_{i=1}^{n} L_{it}$, then the rate of growth of the economy can be calculated as follows:

$$\alpha = \frac{\sum_{i=1}^{n} L_{it} - \sum_{i=1}^{n} L_{i0}}{\sum_{i=1}^{n} L_{i0}}$$

The hypothetical distribution of the terminal year can be derived through the given value of α.

$$\overset{\Lambda}{L}_{it} = \alpha L_{i0} + L_{i0} \Rightarrow \overset{\Lambda}{L}_{it} = L_{i0}(1+\alpha)$$

Then, gain and losses will be computed as the differences between the labour employed in the terminal year and its hypothetical share. Three implications can be drawn from this measure, these are as follows:

a. If $L_{it} > \overset{\Lambda}{L}_{it}$, it means the ith region has grown faster than the national growth rate which implies that the region has gained from the overall expansion of employment.

b. If $L_{it} = \overset{\Lambda}{L}_{it}$, the region has grown at the same rate, therefore it has just maintained the status quo.

c. If $L_{it} < \overset{\Lambda}{L}_{it}$, it implies the region's growth is less than the national growth rate, therefore the regions have suffered losses.

Though we have explained the above three very important measures to show spatial spread, the following measure has found to be very suitable to measure the spatial spread. So, the results of the above three measures have not been placed here either to show the spatial spread or to make a comparison with the following index. This can be taken care in further research and extended work.

2.3.7 Grossack's Index

Grossack (1965 and 1972) developed a dynamic measure which is known as Grossack's index to know the monopoly power of industries. In this study both static and dynamic measure is used to find out the industrial concentration. This study has used Grossack's methodology with a vital importance. With the help of Herfindahl Index which is a static measure (Michelini and Pickford, 1985), he integrated the regression technique to analyze the concentration of economic power. This is the soul methodology that the present study incorporates with the help of employment, fixed capital and output.

2.3.7.1 Static Measure: ***Herfindahl Index as a Static measure of Industrial Concentration***

It is an excellent measure of the static size structure for two basic reasons, because it is sensitive and takes into account the complete size distribution of the firms and secondly it incorporates both of the two static size structural features that are probably most relevant to the ability of the larger firms to enhance the price with a minimum of the market loss, namely the smallness of the number of firms and the variation among the size of the firms (Grossack, 1965).

$$\text{The index is defined as HI} = \sum_{i=1}^{N} (s_i)^2 + 1/n$$

As it is mentioned, total numbers of employees, fixed capital and output are taken as the relative share of these factors to the manufacturing industries as S_i, then the deviations from the mean is taken as s_i where N refers to number of locations.

So the "b" can be written as following

$$b = \frac{\sum_{i=1}^{n} (s_{it})^2 . s_{i0}}{\sum_{i=1}^{n} S_{i0}^2}$$

If b = 0.80, then the significant locations of the base year lost about 20 percent share on their average. To know more information whether the losses incurred by significant locations are shared by other insignificant locations or not. That result can be extracted from the product moment form of regression coefficient (Seth and Gulati, 1974).

2.3.7.2 Dynamic Measure

The dynamic measure indicates whether or not the large industries of some initial year are able to maintain their share up to some terminal year or not. In addition it would be more desirable if such a measure could throw some light on whether some losses of shares by the large industries are to other large 33ndustries or to small industries or to new entrants.

A measure of structural change that comes closer to meet these requirements is the regression coefficient obtained by a linear regression of the terminal year employment share upon their shares on the initial year of all industries. Basic information of this measure together, each industry must be identified from both years together with its share in each year.

If S_{i0} and $S_{It\ is}$ the employment share of the i^{th} industry and s_{io} and $s_{It\ is}$ their deviations from the respective mean, then the regression coefficient 'b' can be written as follows:

$$b = \frac{\sum_{i=1}^{n} S_{it} \cdot S_{i0}}{\sum_{i=1}^{n} S_{i0}^{2}}$$

Where 'n' is the number of regions and it is same in numbers in our study. If the numbers of regions are substantially large, the interpretation can be made directly with the help of 'b' coefficients.

Here, more information can be reaped even to explain whether the losses in incurred by all significant regions are shared by other significant regions. For this product moment of regression analysis is an essential element (Grossack, 1965).

2.3.7.2.1 Product Moment of Regression Coefficient

$$b = r * (\sigma^{t} / \sigma^{0})$$

Where σ^{t}, σ^{0} the standard deviation of the subscript years and "r" are is the correlation coefficient among the relative share of the base year "0" and terminal year "t". Writing the standard deviation formulae for any share of manufacturing of base year and terminal year, the above equation can be written as follows:

$$\Rightarrow \sigma^{t} / \sigma^{0} = \sqrt{\sum_{i=1}^{n} s_{it}^{2}} \Big/ \sqrt{\sum_{i=1}^{n} (s_{i0})^{2}}$$

Now, if C (HI) = H_{it} /H_{i0}, as It is explained that $H_{it\ and}$ H_{i0} are representing Herfindahl index in terminal year and base year respectively. So that can be written as following formula:

$$\text{Then } C(HI) = \frac{\sum_{i=1}^{n} s_{it}^{2} + 1/n_{t}}{\sum_{i=1}^{n} s_{i0}^{2} + 1/n_{0}}$$

Where, n_t= number of locations in terminal year and n_0 is number of locations in base year. It is generally assumed $n_t = n_0 = n$.

Then C (HI) can be written as follows:

$$\Rightarrow C(HI) = \frac{\sum_{i=1}^{n} S_{it}^2}{\sum_{i=1}^{n} S_{i0}^2} \qquad \Rightarrow \sqrt{C(HI)} = \sqrt{\frac{\sum_{i=1}^{n} S_{it}^2}{\sum_{i=1}^{n} S_{i0}^2}} \qquad \Rightarrow \sqrt{C(HI)} = \sqrt{\frac{\sigma_t}{\sigma_0}}$$

And now regression coefficient 'b' can be written as

$$b = r.\sqrt{C(HI)} \Rightarrow \sqrt{C(HI)} = \frac{b}{r} \Rightarrow C(HI) = \left(b / r\right)^2$$

Here 'b' is the function of degree of correlation ratio and the ratio of Herfindahl index between the terminal year and base year (Seth and Gulati, 1974). Then the value of 'b' depends upon the degree of correlation of the employment share between terminal and base year; and the square root of the ratio of the respective years (Grossack, 1965).

Here, the findings can be concluded on the basis of the value of 'b', 'r' and $(b/r)^2$, these analysis are as follows:

a. If the value of b < 1, it means that larger locations of the base year have lost their share on the average. It implies that the overall tendency of the manufacturing is towards dispersal. To analyse how the expansion of manufacturing of terms of different shares that are shared, it needs a look towards the value of 'r' and $(b/r)^2$ the manufacturing industries can be divided into following three categories:
   i. A high value of 'r' and lower value of $(b/r)^2$ mean that the industry is being shared by the larger locations only. Dispersion has emerged because of changes in the relative share of above average regions.
   ii. A lower value of 'r', but higher value of $(b/r)^2$ implies the dispersion has emerged because of the larger locations having lost their share to each other.
   iii. Both lower value of 'r' as well as lower value of $(b/r)^2$ implies dispersion has emerged because significant of the base year have lost their share to other significant locations as well as to the insignificant locations.
b. If b > 1, and $(b/r)^2$ > r, these conditions implies that the significant locations of the base year have maintained their share and expansion of the industry are shared by them only.

The analysis implies that 'b' coefficient will give us the magnitude of dispersal or concentration depending upon the estimated 'b' is less than unity or greater than unity. Similarly 'r' and $(b/r)^2$ say about the process of sharing the gains or losses from the expansion of industrial employment (Seth, 1987).

This study has followed this methodology and has explained the results accordingly. The tools and techniques have not been changed. The slight difference, taking the logarithm of both the terminal share and base year share, is made and then only correlation and regression value are calculated. It is seen that the deflated share without taking the log values of the factors give slight different result in this study. It is because taking the log values of the deflated shares has presented a reliable picture. The deflated figures are taken only for fixed capital and output and as common sense says total numbers of employees do not need deflation. While log values of all variable are considered. The above methodology leads to the chapter – 4 in this study.

2.3.8 Constant Elasticity Substitution Production Function

The direct estimation of the production function has an advantage in that it is not necessary to assume competitive equilibrium in order to derive an estimate of productivity growth. The efficiency parameter, the scale parameter and the extent of substitutability between factors can be obtained by directly estimating the parameters of a suitable specified production function through regression analysis (Ahluwalia, 1991). The elasticity of substitution measures the substitution between two factors which can be possibly substituted for one another. Here, let's take two factors of production capital (K) and labour (L). The ratio of the inputs (L/K) varies with the ratio of the marginal productivities of the inputs.

$$L/K = g\ (M_s) \ldots\ldots\ldots (1)$$

Here M_s for rate of technical substitution. Taking the derivatives and computing corresponding elasticity in the above equation, the elasitcity of substitution can be obtained as follows:

$$\sigma = \frac{\partial (L/K)}{\partial\ M_s} \cdot \frac{M_s}{L/K} \ldots\ldots\ldots (2)$$

In the above equation "σ" measures the proportionate changes in factor ratios for proportionate changes in the rate of technical substitution.

If the assumptions, factors are paid by the values of their marginal productivity, are incorporated, the σ can be reformulated as follows:

$$\sigma = \frac{\partial(L/K)}{\partial(\frac{r}{W})} \cdot \frac{r/W}{L/K} \quad \ldots\ldots\ldots (3)$$

Here, W is the wage rate and r is the unit price of capital. This equation is significant in that σ now measures the substitution between the factor inputs that obtains in response to changes in relative factor prices (Mulat, 1980).

Assuming profit maximizing behaviour of firms in competitive product and factor markets the coefficient 'σ' of log W as shown by Arrow *et al.* to be the elasticity of substitution of a linear homogenous C.E.S. production function as follows:

$$Y = \theta[\gamma K^{-\beta} + (1-\gamma)L^{-\beta}]^{-\frac{1}{\beta}} \quad \ldots\ldots\ldots\ldots (4)$$

Here, Y refers to output[1], θ, γ, β are efficiency, distributive and substitution parameters. Here constant return to scale is assumed. The marginal productivities of labour and capital can be obtained as follows from the constant elasticity substitution production function.

K, L stands for the capital and labour input respectively, γ shows Hicks-neutral efficiency parameter, δ is the distribution parameter, ρ = (1- σ)/ σ is the substitution parameter. Assuming constant return to scale the application of the definition (2) to the function (4) yields

$$\sigma = \frac{1}{1+\rho} \quad \ldots\ldots\ldots\ldots \quad \ldots\ldots\ldots (5)$$

The marginal productivities of labour and capital can be derived from the CES function.

$$\Rightarrow \frac{\partial Y}{\partial L} = \frac{1-\gamma}{\theta^{\beta}} \left(\frac{Y}{L}\right)^{1+\beta}$$

$$\Rightarrow \frac{\partial Y}{\partial K} = \frac{\gamma}{\theta^{\beta}} \left(\frac{Y}{K}\right)^{1+\beta} \quad \ldots\ldots\ldots\ldots (6)$$

The value of factor productivity equals factor price, the equations are as follows:

$$\Rightarrow P\left(\frac{\partial Y}{\partial L}\right) = \frac{1+\gamma}{\theta^{\beta}} \left(\frac{Y}{L}\right)^{1+\beta} = w \quad \ldots\ldots\ldots (7)$$

$$\Rightarrow P\left(\frac{\partial Y}{\partial K}\right) = \frac{\gamma}{\theta^{\beta}} \left(\frac{Y}{L}\right)^{1+\beta} = r \quad \ldots\ldots\ldots (8)$$

Here, "P" stands for the price of the commodity price, taking logarithms for both the above equations.

[1] This study has used net value added as the measure of output, though there is a doubt on the reliability of depreciation figures from gross value added.

The following equations can be obtained:

$$\Rightarrow log\left(\frac{Y}{L}\right) = \frac{1}{1+\beta}\ log\frac{\theta^{\beta}}{1-\gamma} + \frac{1}{1+\beta}\log w$$

$$\Rightarrow log\left(\frac{Y}{K}\right) = \frac{1}{1+\beta}\ log\frac{\gamma}{\theta^{\beta}} + \frac{1}{1+\beta} log\, r$$

Take $\frac{1}{1+\beta}\ log\frac{\theta^{\beta}}{1-\gamma}\ as\ a_0\ and\ \frac{1}{1+\beta}\ as\ a_1$ then Take $\frac{1}{1+\beta}\ log\frac{\gamma}{\theta^{\beta}}\ as\ b_0\ and\ \frac{1}{1+\beta}\ as\ b_1$, also add the time as a variable here, then the above equations can be written as follows:

$$\Rightarrow log\left(\frac{Y}{L}\right) = a_0 + a_1\, log\, w + a_2\, t \quad \ldots\ldots\ldots\ldots (9)$$

$$\Rightarrow log\left(\frac{Y}{K}\right) = b_0 + b_1\, log\, r + b_2 t \quad \ldots\ldots\ldots\ldots (10)$$

Both the above equations can be estimated by least squares and require data on output, labour input, wage rate, capital and capital pricing. In the above equation time is added as a variable which can give us very important information of calculation of capital labour substitution. In estimation part the calculation are taken both taking and without the time variable[2]. Consider, instead the marginal rate of substitution between labour and capital in equation (4), the following equation will be obtained:

$$M_s = \frac{\partial Y/\partial L}{\partial Y/\partial K} = \frac{1-\gamma}{\gamma}(K/L)^{1+\beta} = \frac{w}{r} \ldots\ldots\ldots\ldots\ldots (11)$$

Taking the logs and it can be written again as following:

$$\Rightarrow log\left(\frac{K}{L}\right) = \frac{1}{1+\beta}\ log\frac{1-\gamma}{\gamma} + \frac{1}{1+\beta}\log\ (w/r)$$

The above equation can be written as follows:

$$\Rightarrow log\left(\frac{K}{L}\right) = C_0 + C_1 \log\ (w/r) \ldots\ldots\ldots\ldots\ldots (12)$$

If equation (4) is differentiated with respect to L, and equate with marginal products and apply logarithms there is an equation as follows:

$$\text{Log } (Y/L) = \beta_0 + \beta_1 \log w + \beta_2 \log L + U \ldots\ldots\ldots\ldots (13)$$

[2] The whole methodology in this part is found relevant in a paper by Mulat (1980) and it is borrowed where he has explained very comprehensively the estimation of capital labour substitution. In estimating the substitution Singh and Singhal (1985) are also followed, basically to run the regression for equation (13). The original article on the estimation of capital labour substitution Arrow *et al.* (1961) are completely cared. Dhrymes are made very excellent observation by putting his remarks that finding level of significance is difficult in a ratio, so equation (14) are estimated following him.

Where, $\beta_0 = (\theta / \theta + \beta) \log (\gamma\theta)$, $\beta_1 = (\theta / \theta + \beta)$, $\beta_2 = = \beta (\theta\text{-}1) / (\theta + \beta)$

Here β_0, β_1, and β_2 are constants; the capital labour substitution is given by β_1 / β_2 and where the degree of homogeneity is given by $(\beta_2 - \beta_1) / (1 - \beta_1)$.

The CES function of ACMS then becomes a special case where $\beta_2 = 1$ and h = 1 as well as capital labour substitution is β_1. A major problem with estimation of the above equation is that it would be difficult to find out the significance of capital labour substitution since it is derived as a ratio of two coefficients.

So the proper estimation is possible by the following model:

$$\log L = P_0 + P_1 \log w + P_2 \log (Y/L) + U \ldots\ldots\ldots (14)$$

Where E_0, E_1 and E_2 are constants and where E_1 is capital labour substitution (Dhrymes, 1965). Theoretically, the elasticity of substitution will always be positive ranging from zero to infinity. It is well known that the criteria can be derived from economic theory and also from statistical decision making rules. The sign of the coefficient of elasticity of substitution and time must be consistent. Statistical decision-making criteria such as significance of acceptance of an estimated coefficient and goodness of fIt are also used (Arrow, *et al.,* 1961). This estimation is attempted in chapter 5 of this study.

Each of these aspects that are discussed above as objectives and methodology are analyzed and used; the results are presented in successive chapters 3, 4 and 5. Finally the chapter 6 sums up the major findings and underline their significance as critical elements in any meaningful policy frame work for accelerating the growth of the Industrial sector in Odisha.

* * *

Chapter- 3

Industrial Growth: An Analysis of Odisha and Its Neighbouring states

3.1 Introduction

Vital examinations on industrial growth performances are given after increasing availability of regional data. And the development of the theory of economic growth has together led to a strong revival of interest in regional growth disparities. There is always a debate underlying the causes of economic growth. Some researchers argue in the favour of the role of factor supplies in economic growth following neo classical growth model. Others emphasize the role of demand factors following Keynes. But perhaps the most interesting development in regional growth theory is the attempt to incorporate the principle of cumulative causation into demand based explanations of regional growth disparities. According to this approach disparity in growth is cumulative once it occurs. One should be very careful discussing regional growth disparities. Growth can be defined in different ways. The most commonly used measures of growth are (i) growth of output (ii) growth of output per worker and growth of output per capita (Armstrong and Taylor, 2000).

In order to examine the phenomenon of reducing regional disparity, the level and the growth of per capita net value added in the industrial sector over the period can be compared. Various measures may give different readings of a region's growth performance. But the question is which measure to use as appropriate? This depends on the purpose for which the measure is to be used. Output growth is used as an indicator of the growth of productive capacity which depends on part of the extent to which regions are attracting capital and labour from other regions. The growth of output per worker is often used as an indicator of changes in region competitiveness. The growth of output per capita is used as an indicator of changes in economic welfare. All they are useful in their own capability to show the regional competitiveness (Dholakia, 1989).

This chapter aims to evaluate the performance of manufacturing industries in Odisha vis-à-vis its neighbouring states viz. Bihar, West Bengal, Andhra Pradesh and Madhya Pradesh.

It is thought to use the appropriate indicators that can focus the goals and objectives of this study. Here, the aim is confined to show the industrial growth in general and manufacturing growth in particular. So, it is thought to use some very appropriate indicators of manufacturing

like net value added, number of factories, fixed capital, wage and employment to register the facts and figures for manufacturing growth. The indicators like real state domestic product and per capita state domestic products has also been incorporated to find out the overall growth performances of Odisha and its neghbouring states. All the objectives are thought to be captured through the comprehensive data source of industries which is none other than the Annual Survey of Industries as explained in the previous chapter. So, it is found relevant to use the ASI data to examine the growth of manufacturing sector. The primary concern goes to calculate the manufacturing growth structures in general and growth rate of net value added, wage, and number of factories, fixed capital as well as employment in particular. It is because these estimations can draw an overall idea regarding the performances of industries and that of manufacturing sector in Odisha with a fare comparison with its neighbouring states. All these estimations can be used to treatment the existing problem of industrial sector and that to organized manufacturing sector of Odisha and its neighbours. Due to the lack of consistent time series data for some groups at the state level, some industries are clubbed and presented. The data since 1980/81- 07/08 are incorporated and 13 manufacturing industries out of total manufacturing sector are considered. It is because these 13 manufacturing industries are found to be responsible for more than 95 percent of value added in manufacturing production.

The analysis is started with an issue and background of growth performances in chapter-1 back to its broad objectives. The methodologies are installed in chapter- 2. In this chapter- 3, introduction of growth theory and the broad objectives are addressed and furcated into relevant various single objectives in mind to reach at the specified goals. Then estimations are analysed and concluded. All the relevant tables and figures are given at the end of this chapter.

It is aimed to compare the growth performances and variation in terms of real GSDP, Per Capita GSDP, and to examine the sectoral composition of growth in Odisha and its neighbouring states. Also, there is an attempt to identify the individual group of manufacturing industries that accounted for the growth performances of the respective states in terms of net value added, fixed capital and employment in Odisha with its neighbouring states during over the period of time. At the end, this chapter shows the variability among Odisha and its neighbouring states whether it shows the same pattern like this state or not, using the above indicators of manufacturing.

Here, keeping focus on the overall growth structures, the first part has explained its necessity with the clear objectives. And then there is a move towards respective findings and analysis of

the objectives. Again these observations are concluded providing a background and impetus to move into spatial spread analysis in the second chapter. All the tables and figures are given in appendix of every chapter.

3.2 Analysis of findings

3.2.1 Interstate Variation in Growth: An Overview of Odisha and Its neighbouring States

In this part, explanations to find out the answers for the observed trend in the interstate variation are taken with the help of rate of growth of real gross state domestic product and per capita gross state domestic product. It is important to know whether or not the observed trend in the variability among the neighbouring states of Odisha show the same growth pattern with it or it is different. Hence, this analysis is based on the variability in Gross State Domestic Product and Per Capita Net State Domestic Product of states during the studied period. The variability is seen in terms of estimated coefficients of variation. The whole time period is divided into six parts. The comparative average growth rates of state domestic product for five states and all-India at 1999-00 prices for the six time phase taken in this study are given in Table 3.1.

These six time phases are 1980/81- 85/86, 1985-86/ 90-91, 1990/91- 95/96, 1995/96-00/01, 2001/02- 05/06 and 2004/05- 06/07. In this Table, the phenomenal growth are recorded after 2004-05, and the most of the states taken in this study has witnessed higher growth than all-India. Table 3.1 shows that Odisha has not stayed behind its neighbours at any time phases rather than 1985/86- 90/91 and 1995/96- 00/01 where this state has shown only 1.6 and 3 percent growth in terms of growth rate of real state domestic product respectively. In these phases, the growth rate of Odisha lagged behind all of its neighbouring states Andhra Pradesh, Bihar, West Bengal and Madhya Pradesh and that to all-India also. All the states here taken in this study including Odisha and all-India have managed to push up their growth rates into such a considerable digit during the period after 2004-05. This is shown in graph 3.1. Odisha has grown much slower in 1985-86 to 1990-91 in terms of real state domestic product in comparison to all its neighbouring states. The robust growth rate in state domestic product of this state has come only after 2004-05 as similar to all other states and that to all-India. But, it is interesting to note that Odisha has grown faster than all-India and Madhya Pradesh in this phase. The regional disparity among Odisha and all its neighbouring states have increased since first time phase to third time phase and then they have recorded a falling trend.

A better analysis of regional disparities can be analysed by the per capital state domestic product. So, the growth rate of per capita state domestic product for Odisha and its neighbouring states with all-India average are presented in Table 3.2. The main aim is to show the regional disparities of standard of living among Odisha and its neighbouring states may be achieved through per capita state domestic product at constant prices. It is clear form this table that Odisha is the poorest performer in the second time phase, i.e. 1985/86- 90/91 which is negative witnessing -0.20 percent growth, lower than Andhra Pradesh, Bihar, West Bengal, Madhya Pradesh and all-India. This state has also bagged lowest growth rate than all other states instead Madhya Pradesh during the fourth time phase. It is stood at just 1.6 percent above the 1.4 percent of Madhya Pradesh, but far behind from all other states and all-India level. The last time phase i.e. 2004/05- 06/07 are noticed as the rapid growth phase for Odisha and all its neighbour states in terms of real per capital state domestic product. Intrestingly, Odisha's growth rate 8.1 percent has stood at higher than 7.36 percent of West Bengal, 6.5 percent of Madhya Pradesh and 6.7 percent of all-India average. It is very clear form the table that the standard of living in Odisha is better after 2000 to 2008. The growth rate has jumped from 2.55 percent in fourth time phase to 9.3 percent in fifth time phase in an average.

Table 3.1 indicates that the regional disparities has widened during first phase to third phase. The coefficient of variation of real state domestic product has jumped form 0.42 of the first phase to 0.65 in the third phase. But, after the third phase, it has declined up to the sixth phase. It is 0.65 in the third phase, 0.55 in the fourth phase, 0.50 in the fifth phase and 0.09 during the sixth phase. In terms of growth rates of real per capita state domestic product, the coefficient of variation has become even worse during all time phases in comparison to variation in real state domestic product. The variation in real per capita state domestic product for all the states are stood at 0.48, 0.70, 1.28, 0.63, 0.74 and 0.18 during first, second, thrird, fourth, fifth and sixth time phase respectively. Though the variation in real per capita state domestic product are higher than variation in real state domestic product, the change in variation of both these measures have shown almost same trend. It means an increase in regional disparity from first to third phase and a decrease from thrid to sixth phase has taken place in both the measures. But the slight difference is, the variation are registered quite low during the fifth phase in real per capita state domestic product. And it is noted that variation in standard of living is wider than that of gross income among the states over the period of time.

The rise and fall in coefficient of variation does not necessarily imply lack of convergence or lack of divergence. But, an inference can be drawn from the coefficient of correlation between average real growth rates of state domestic product during the time period of first phase and the last phase. The estimated coefficient of correlation is 0.58 which is positive and statistically significant at 10 percent level. This implies that Odisha and its neighbouring states have continued to grow faster over the period of time from 1980 to 2008 without the evidence of convergence.

3.2.2 Sectoral Shares and Growth rates in Odisha and its neighbouring states

Sectoral composition and state domestic product are given in figure 3.2 to figure 3.9. From figure 3.2 to figure 3.4, It is recorded a tremendous growth rate in industrial share for Odisha in comparison to its neighbouring states and that of all-India average.

In the figure 3.3, the growth of industrial contribution to the state domestic product (SDP) in Odisha since 1980-90 has shown a robust figure of 7.44 percent higher than all its neighbouring states and all-India average. But in the figure 3.4, though the industrial growth rate has declined in comparison to the previous decade, the drastic reduction in contribution of agricultural sector are partly responsible for sustained growth in this sector. Andhra Pradesh , Bihar, Wesh Bengal and Madhy Pradesh have performed very well in industrial growth rate during this time period in comparison to Odisha. But the performance of Odisha in industrial growth has become resilient during 1980-2000 and recorded a robust industrial growth rate even higher than some of its neighbouring states and close to that of all-India average. It is intersting to note that during 2000-2008 the share of industrial growth of Odisha has recorded a higher digit growth rate than that of all-India average. But service sector are found as the engine of growth over the period of time. But, It is experienced that sustained growth is not possible without a healthy and growing manufacturing sector. An overdependence on service sector and the neglect of its manufacturing sector is partly responsible for the slower growth for the economy. Results from most research studies show that for India, service can not be an engine for a sustained growth in income and employment. In the long run the growth of the service sector would also depend on the manufacturing base (Siddharthan, 2012).

In the second part of the presentation, it is assumed sectoral shares of all-India as the representation of average shares of Odisha's all neighbouring states. It is because of the difficulty in presenting all states shares in pie chart individually in comparison to Odisha, yet the

shares of its neighbouring states are averaged and in comparison to all-India and It is found very negligible differences. So, all-India, all the neighbourings states of Odisha are thought relevant to present. The share of agriculture has fallen from 33.03 percent in 1980-81 to 18.4 percent in 2007-08 for Odisha while the all-India share in agriculture has fallen from 35.99 percent to 14.6 percent during that same period. The industrial contribution are recorded higher than all-India during 1999-00 to 2008. The share of the industry over the period of time form 1980/81- 07/08 are kept same pace as it is 23.68 percent for all-India and 22.75 for Odisha. So, it is clearly visible form the figures that Odisha has maintained the same pace in industrial sector growth and share with all its neighbouring states and all-India.

However, the growth rate of Odisha has recorded higher industrial growth rate than all-India average. In both the aggregate level and individual state level the growth of secondary sector has contributed immensly to the overall growth of Gross Domestic Product and State Domestic Product. Sevice sector are higher than agriculture and industry after 1999-00. The contribution of the services remains as engine of growth for Odisha and its neighbouring states. All these above discussions can be extended and examined through the performances of various indicators of manufacturing sector in Odisha and all its neighbouring states.

3.2.3 Growth of Manufacturing Sector using Some indicators of it

The performances of the available indicators are taken care in this part to know the manufacturing growth. These indicators are number of employees, net value added, fixed capital and number of factories. As It is noted net valued added are thought as the proper measure of output and used citing the previous research. There is no such debatable issues found for all other indicators. So, here is an attempt to find out the compound annual growth rate of all the above indicators for thirteen manufacturing groups in Odisha and its neighbouring states over the period of time 1980/81- 07/08. These industries are food and food products (20_21), beverages, tobbacco and tobbacco products (22), textiles (23_24_25), textile products (26), wood and wood products (27), paper and paper products (28), leather and leather products (29), chemical and chemical products (30), rubber and plastic products (31), nonmetallic, mineral products (32), basic metal and alloy (33), metal products, nonelec. Machinery (34_35_36), and transport equipment (37). All those above manufacturing groups are considered in this study and a proper examination of their performances are thought to find out through the indicators. The compound

annual growth rate (CAGR) are estimated over the period of time since 1980 to 2008 for all the manufacturing groups. Regional disparities in these individual industries in Odisha and all its neighbouring states are examined. To fulfill the objective of disparity, coefficient of variation are calculated for all individual industries as well as for the whole manufacturing group.

In this part, only the indicator employment are estimated before and after 1990 aiming the post reform period, though there is no aim and lucid objective to analyse the differences in pre and post reform period. So it is thought not to find out the same for all other indicators used in this study. The calculation of overall growth and their variation in the tables are nothing but the simple average of all thirteen manufacturing groups.

At the outset, the performances of the available indicators for Odisha and its neighbouring states are given in Table 3.3, 3.4, 3.5, 3.6 and 3.7. Table 3.3 and 3.4 represent the growth performances of employment before and after a period of 1990. Before the period 1990, the CAGR of number of employees for Odisha and its neighbouring states have shown a negative growth rate. In these period the performances in terms of growth of number of employees are only better of than West Bengal while other neighbouring states have shown a robust rate of growth. But, the situation are changed in terms of growth of number of employees for Odisha after 1990 where this state has recorded a quick recovery in growth of number of employees in comparison to all its neighbouring states. The manufacturing group in Odisha which has performed quite well in terms of growth of number of employees after 1990 is basic metal and alloy (33). It is interesting to note that the variation in employment growth among Odisha and all its neighbouring states haveb been widened.

Using the indicator of net value added, It is found that the CAGR of rubber and plastic products (31), basic metal and alloy (33), textile products (26), beverage tobbacco and tobbacco products (22), have shown roboust figures in comparison to other manufacturing groups in Odisha. The same also exists for all manufacturing groups of all its neighbouring states. But, Madhya Pradesh has recorded higher CAGR in rubber and plastic products (31), basic metal and alloy (33) in comparison to Odisha over this same period of time 1980/81- 07/08. During the time period 1980 to 2008 Odisha has recorded robust compound growth rate in net value added in basic metal and alloy (33) with 10.57 percent, non metallic mineral products (32) with 5.46 percent, rubber and plastic products (31) with 21.88 percent, textile products with 9.67 percent

and beverage, tobbacco and tobbacco products (22) with 12.63 percent. The performances of these industires in Odisha are higher than the same industries of its neighbouring states.

The main disparities among Odisha and its all neighbouring states in terms of varitation in net value added are found for textiles (23_24_25), wood and wood products (27), leather and leather products (29), chemical and chemical products (30). But the overall disparities in CAGR are found less varied in all manufacturing of Odisha and its neighbouring states. But in the industries like food and food products (20_21), textile products (26), paper and paper products (28), non metallic, mineral products (31) and surprisingly basic metal and alloys (33) have recorded less disparities in terms of CAGR of net value added among Odisha and all its neighbouring states over the period of time. All these are presented in Table 3.5.

The compound growth rate of overall manufacturing of terms of fixed capital are recorded at 9.22 percent over the period of time for Odisha. This state has shown a fare competition with all its neighbouring states in this indicator. The manufacturing groups like food and food products (20_21), beverages, tobbacco and tobbacco products (22), textile products (26), wood and wood products (27), chemical and chemical products (30), non metal and mineral products (32) and basic metal and alloys (33) have evidence of robust growth rate. All these above industries in Odisha have not lagged behind in comparison to its neighbouring states. Table 3.6 is given in terms of fixed capital for the industries like chemical and chemical products (30), leather and leather products (29), rubber and rubber products (31) have registered 10.79, 7.74, and 10.66 percent respectively for Odisha which are higher than the same industries of its neighbouring states.

In Table 3.7, the CAGR of number of factories showed a positive growth rate in food and food products (20_21), textile products (26), leather and leather products (29), chemical and chemical products (30), rubber and plastic products (31), non metallic mineral products (32), basic metal and alloys (33) over the period 1980/81- 07/08. The industries like textile products (26), leather and leather products (29), rubber and plastic products (31), non metallic mineral products (32), basic metal and alloys (33) have stood at the growth rate of 3.24, 6.90, 10.89, 2.40 and 3.43 percent which are higher than the growth of all other manucfacturing groups in Odisha and from that of same industries in West Bengal and Bihar.

From the above facts and figures, it is clear that regional disparities are widened in post reform period in terms of the indicator of number of employes. The coefficient of variation are

found at 1.80 for pre reform decade while it is 4.80 for the post reform period for this indicator. It is interesting to note that the regional disparities in terms of number of employes are widened after the reform period, but these disparities are reduced after 2000. It is same for all the indicators. But, it is found that regional disparities in net value added are less in Odisha and its neighbouring states in comparison to other indicators used in this study over the period of time. Andhra Pradesh, Bihar, West Bengal and Madhya Pradesh in Codes like food and food products (20_21), paper and paper products (28), non metallic mineral products (32), basic metal and alloys (33) are observed as less variation industries for Odisha and its neighbouring states. It implies that the growth of the above said industires have showed equal rate of growth for all the states through all the indicators used over the period of time. In overall manufacturing, the indicator in the rate of growth in terms of fixed capital has recorded a lower digit in comparison to net value added. With the same indicator the regional disparities are widened for Codes like textiles (23_24_25) and leather and leather products (29).

There is also an attempt in this study to show a complete scenario of regional disparities of all manufacturing sector in Odisha and all its neihgbouring states. It is presented in figure 3.10 where both net value added and gross output varitaion are shown. Variation in net state domestic product has also been considered in this figure for a fare comparison. Wage are included with number of factories in this study. It is relevant to note that these all manufacturing variation are not the variation of simple average growth rate of the thirteen manufacturing, but it has added all the respective manufacturing shares to find out overall manufacturing variation. So this overall variation reveals its own importance to indicate the regional disparities among Odisha and its neighbouring states over the period of time. Variation among number of factories and wage have recorded higher digit for Odisha in comparison to all its neighbouring states, but disparities among other indicators like net value added, gross output, net state domestic product and fixed capital are varied among the states. It means the growth of output has kept its pace among all states over the specified period of time. The overall disparities among all manufacturing of terms of all the indicators have become narrowed in Odisha and its neighboruring states over the period 1980 to 2008. So it is assumed that it may be the higher growth rate after 2003/04 which has narrowed the regional varitaion among Odisha and all its neighbouring states over that specified period of time.

3.3 Summary

The above analysis of the growth performances in terms of real state domestic product and real per capita domestic product in Odisha and all its neighbouring states in 1980/81- 07/08 reveals that development process are uneven during the six time phase of the studied time period. The regional disparities in the growth rates of real per capita state domestic product becomes sharper in comparison to real state domestic product for Odisha and all its neighbouring states. Different population growth in different states may be the reason for it although these states have performed well in real per capita SDP in comparison to each other. There is an evidence that the tertiary sector is the engine of growth, but the performances of secondary sector is also commendable and need a proper investigation as it has a capability to absorb labour form primary sector. The problem of unemployment may be addressed through this sector. So the ladders of a development process go through this sector and appeal to address this. And this issue are addressed in this chapter through measurement of growth. It is found that there is a sharp increase in regional disparities after 1990 in terms of employment which is a cause of concern. But it is also found that regional disparities among Odisha and all its neighbouring states have decreased after 2000-01 in terms of real state domestic product and real per capita state domestic product, and it is interesting to note that the wider disparities have observed in per capita state domestic product. It may be due to the population growth. So, efforts should be made to restrain population growth. There may be a role of good governance should be addressed in these states to narrow the gap of disparities among these states.

This study has estimated coefficient of variation for 1980 and 2008 for net value added, fixed capital, number of factories and employment. It is seen that variation in wage and number of factories very high in Odisha in comparison to all its neighbouring states. It may be because of a wider wage variation among the manufacturing groups in Odisha. There is not an evidence of considerable difference in variation in terms of net value added, fixed capital and gross output. Yet, the variations among Odisha and its neighbouring states have the evidence of significant difference in rate of growth of individual manufacturing groups. All the analysis of the various indicators has implied that growth of output has kept its pace over the studied period of time of Odisha in comparison to its neighbouring states, though there is an evidence of higher regional disparities among the states.

Table 3.1: GSDP growth rates (percent) at constant prices (1999-00).

States→ / Year↓	Andhra Pradesh	Bihar	Odisha	West Bengal	Madhya Pradesh	All-India – GDP	C.V.*
1980/81- 85/86	5.10	5.21	4.00	4.00	3.63	4.61	0.42
1985/86- 90/91	7.51	4.40	1.60	4.70	6.61	6.12	0.54
1990/91- 95/96	5.32	-0.51	5.40	6.60	4.25	5.20	0.65
1995/96- 00/01	6.00	9.63	3.00	7.00	3.53	5.41	0.55
2001/02- 05/06	6.50	2.53	7.81	6.3	4.43	7.08	0.50
2004/05- 06/07	10.07	11.06	9.8	10.5	8.31	8.90	0.09

Source: EPW Research Foundation Data and RBI, *C.V. is for Coefficient of Variation

Table 3.2: Per Capita GSDP growth rates at constant prices (1999-00)

States→ / Year↓	Andhra Pradesh	Bihar	Odisha	West Bengal	Madhya Pradesh	All-India – GDP	C.V.*
1980/81- 85/86	2.81	2.93	2.21	1.81	1.20	2.32	0.48
1985/86- 90/91	5.20	2.31	-0.20	2.32	4.01	4.00	0.70
1990/91- 95/96	3.40	-2.60	3.51	4.81	2.12	1.71	1.28
1995/96- 00/01	4.91	6.80	1.63	5.45	1.43	4.42	0.63
2001/02- 05/06	5.00	0.60	10.50	5.00	2.80	5.20	0.74
2004/05- 06/07	10.65	9.59	8.10	7.36	6.50	6.70	0.18

Source: EPW Research Foundation Data and RBI, *C.V. is for Coefficient of Variation

Figure 3.1: Growth rate of year on year Per Capita State Domestic Product (1990-00 prices)

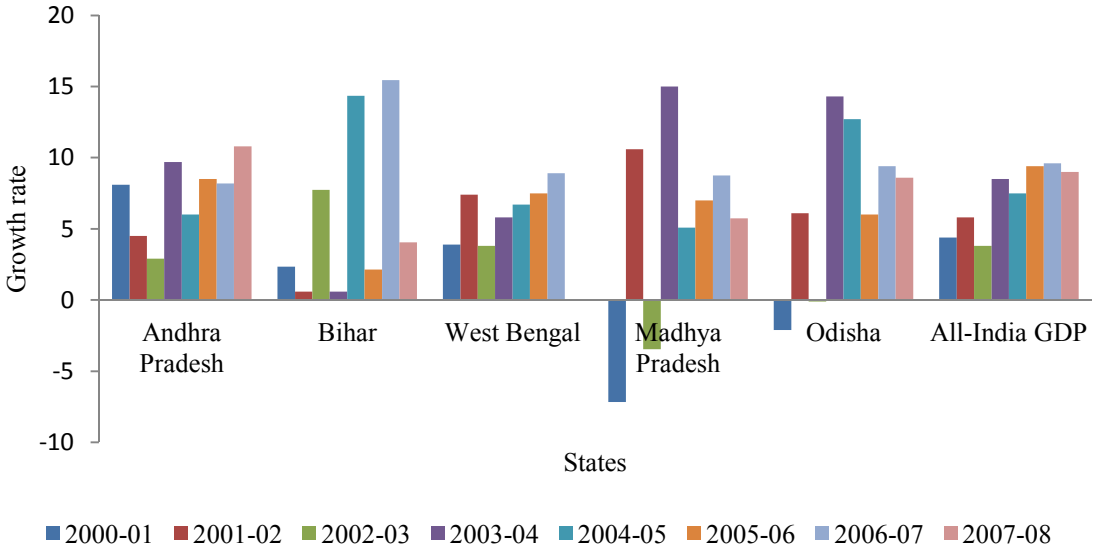


Table 3.3: State wise trend growth rate (percent) of employment in the two digit registered manufacturing sector during pre- reform period, i.e. 1980-90

Code → States↓	**20_21**	**22**	**23_24_25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34_35_36**	**37**	**Over all**
Andhra Pradesh	-1.60	1.89	0.15	10.89	-1.80	1.61	14.35	-0.89	13.90	6.28	7.54	3.07	-2.38	4.08
Bihar	-10.06	8.43	-1.62	-0.76	6.30	-10.9	-0.30	-1.70	0.09	0.23	2.44	1.02	1.15	-0.44
Madhya Pradesh	-1.20	4.32	-2.01	-5.79	-1.07	0.20	7.79	2.30	20.10	5.60	3.70	3.20	3.60	3.13
Odisha	-2.30	-0.41	6.13	23.20	-2.13	-2.73	5.35	7.27	12.2	0.05	0.26	8.04	7.59	4.81
West Bengal	-3.20	-2.16	-3.88	-3.79	-1.29	-6.03	-3.40	-2.21	0.01	-3.45	-2.2	-3.15	-6.00	-3.13
C.V.	-0.85	0.84	-1.10	0.94	-1.18	-0.86	0.81	-16.71	0.79	1.12	0.81	0.83	-4.84	1.78

Source: Authos's Calculation, EPW Research Foundation Data and ASI Summary Results, c.v. implies coefficient of variation. Overall calculation are done taking the simple average of all 13 manufacturing compound growth rate.

Table 3.4: State wise trend growth rate (percent) of employment in the two digit registered manufacturing sector during post- reform period, i.e. after 1990.

Code → States↓	**20_21**	**22**	**23_24_25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34_35_36**	**37**	**Over all**
Andhra Pradesh	2.36	1.58	-9.32	27.98	7.00	-1.30	-7.30	7.02	7.15	2.76	-2.30	-0.71	5.65	3.12
Bihar	-5.30	-3.40	-1.80	NA	-2.95	-8.6	-0.75	-4.50	-2.00	-1.70	-1.30	-5.70	-8.40	-3.57
Madhya Pradesh	-1.40	-3.10	0.80	21.00	-4.10	-4.00	-1.70	1.40	5.00	-2.50	1.50	-1.40	2.50	1.08
Odisha	5.40	17.20	-8.10	0.86	-0.23	-4.50	NA	-1.60	8.60	-4.20	1.96	-3.40	5.40	1.34
West Bengal	1.10	9.29	0.20	-4.58	0.04	-3.70	7.10	-1.30	-4.04	-3.00	-2.50	-2.89	9.15	0.37
C.V.	8.34	1.83	-17.00	1.35	-80.44	-0.53	-8.97	30.12	1.71	-1.38	-3.58	-3.29	2.10	4.80

Source: Authos's Calculation, EPW Research Foundation Data and ASI Summary Results, c.v. implies coefficient of variation and NA implies Not Available. Overall calculation are done taking the simple average of all 13 manufacturing compound growth rate.

Table 3.5: State wise Compound Annual Growth Rate of Net Value Added in the two digit registered manufacturing sector from 1980/81- 07/08.

Code → States↓	**20_21**	**22**	**23_24_25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34_35_36**	**37**	**Over all**
Andhra Pradesh	7.95	3.42	3.23	1.83	2.49	3.03	2.9	11.94	14.42	9.53	13.79	5.59	5.57	6.59
Bihar	2.35	2.67	-2.93	2.36	0.83	-0.72	-8.07	35.52	2.59	2.4	6.88	1.02	-0.39	3.42
Madhya Pradesh	10.76	1.39	6.02	7.99	-1.58	-1.33	10.78	11.62	23.13	8.09	7.75	5.52	10.27	7.72
Odisha	5.09	8.29	-5.54	9.67	3.39	-1.16	-1.43	-9.61	21.88	5.46	10.57	3.63	-18.68	2.42
West Bengal	4.17	12.63	10.71	6.56	4.68	1.94	4.47	8.25	1.75	6.16	2.88	2.14	-2.21	4.93
C.V.	0.48	0.73	2.56	0.54	1.96	0.35	3.62	1.24	0.71	0.38	0.43	0.5	-9.04	0.38

Source: Authos's Calculation**,** EPW Research Foundation Data and ASI Summary Results, c.v. implies coefficient of variation.
Overall calculation are done taking the simple average of all 13 manufacturing compound growth rate.

Table 3.6: State wise Compound Annual Growth Rate of Fixed Capital in the two digit registered manufacturing sector from 1980/81-07/08.

Code → States↓	**20_21**	**22**	**23_24_25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34_35_36**	**37**	**Over all**
Andhra Pradesh	8.99	8.44	11.24	19.55	16.94	2.31	4.10	8.18	10.15	13.46	10.46	13.44	5.72	10.23
Bihar	5.36	7.49	-2.17	9.12	6.9	2.85	-1.91	-1.89	-0.53	8.98	6.53	2.88	2.78	3.57
Madhya Pradesh	13.49	13.52	11.41	16.53	13.99	0.78	-0.59	6.05	8.87	23.54	7.82	4.17	7.34	9.76
Odisha	11.92	10.65	-3.71	15.41	12.9	1.95	7.74	10.79	10.66	21.29	7.12	10.08	3.09	9.22
West Bengal	9.58	9.26	5.79	13.56	11.09	9.31	5.85	13.19	8.69	9.73	9.82	5.43	5.07	1.99
C.V.	0.28	0.21	1.42	0.23	0.26	0.87	1.22	0.71	0.54	0.38	0.43	0.54	0.35	0.29

Source: Authos's Calculation**,** EPW Research Foundation Data and ASI Summary Results, c.v. implies coefficient of variation.
Overall calculation are done as the simple average of all 13 manufacturing compound growth rate.

Table 3.7: State wise Compound Annual Growth Rate of Number of Factories in the two digit registered manufacturing sector from 1980/81- 07/08.

Code → States↓	**20_21**	**22**	**23_24_25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34_35_36**	**37**	**Over all**
Andhra Pradesh	2.88	-9.90	-3.66	5.31	3.03	3.48	7.09	3.01	8.61	6.06	2.67	2.39	2.87	2.60
Bihar	-4.18	-3.31	-7.44	-3.08	0.03	-4.08	-5.45	-2.19	1.68	0.13	-0.99	-3.45	1.05	-2.41
Madhya Pradesh	1.62	-2.46	-4.96	1.41	-1.55	2.45	9.10	2.75	6.71	0.66	3.49	3.34	3.85	2.03
Odisha	1.95	0.74	-3.37	3.24	-4.34	-1.06	6.90	0.88	10.89	2.40	3.43	-10.02	-7.88	0.29
West Bengal	0.81	14.2	-2.45	0.14	-1.00	-0.89	3.22	0.31	0.56	0.15	-1.43	-0.93	-1.99	0.82
C.V.	4.04	-54.55	-1.47	2.02	-3.12	-135.41	1.24	1.98	0.70	1.20	1.52	-2.77	-10.06	6.59

Source: Authos's Calculation, EPW Research Foundation Data and ASI Summary Results, c.v. implies coefficient of variation.Overall calculation are done as the simple average of all 13 manufacturing compound growth rate.

Figure 3.2: Sectoral growth of State Domestic Product (SDP) since 1980- 90

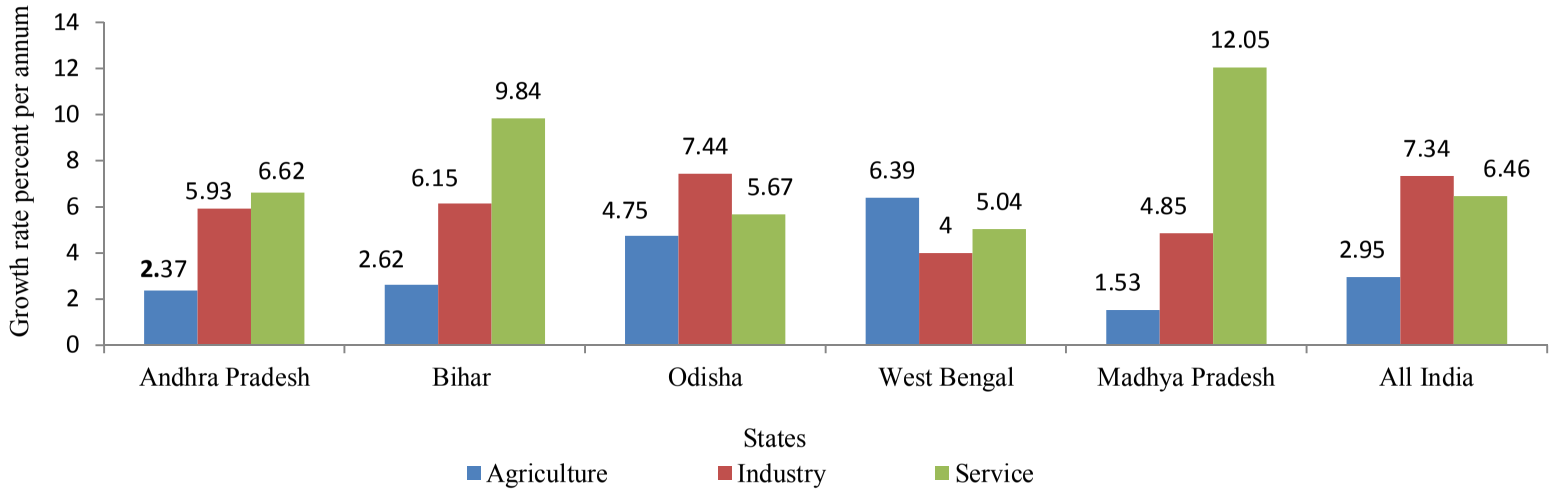


Figure 3.3: Sectoral growth of State Domestic Product (SDP) since 1990- 00

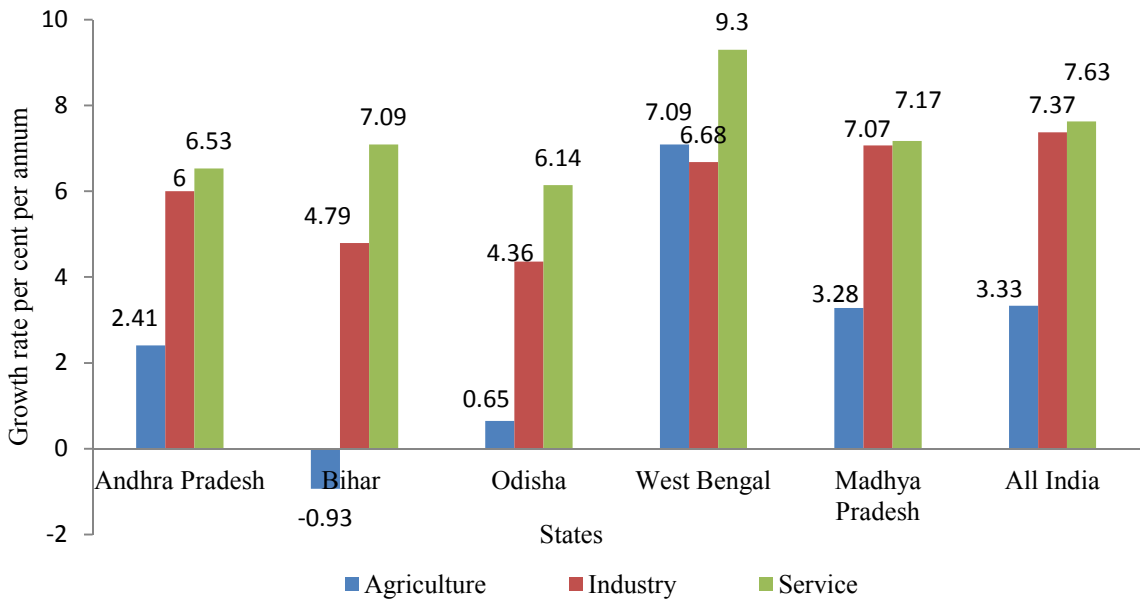


Figure 3.4: Sectoral growth of State Domestic Product since 1980- 00

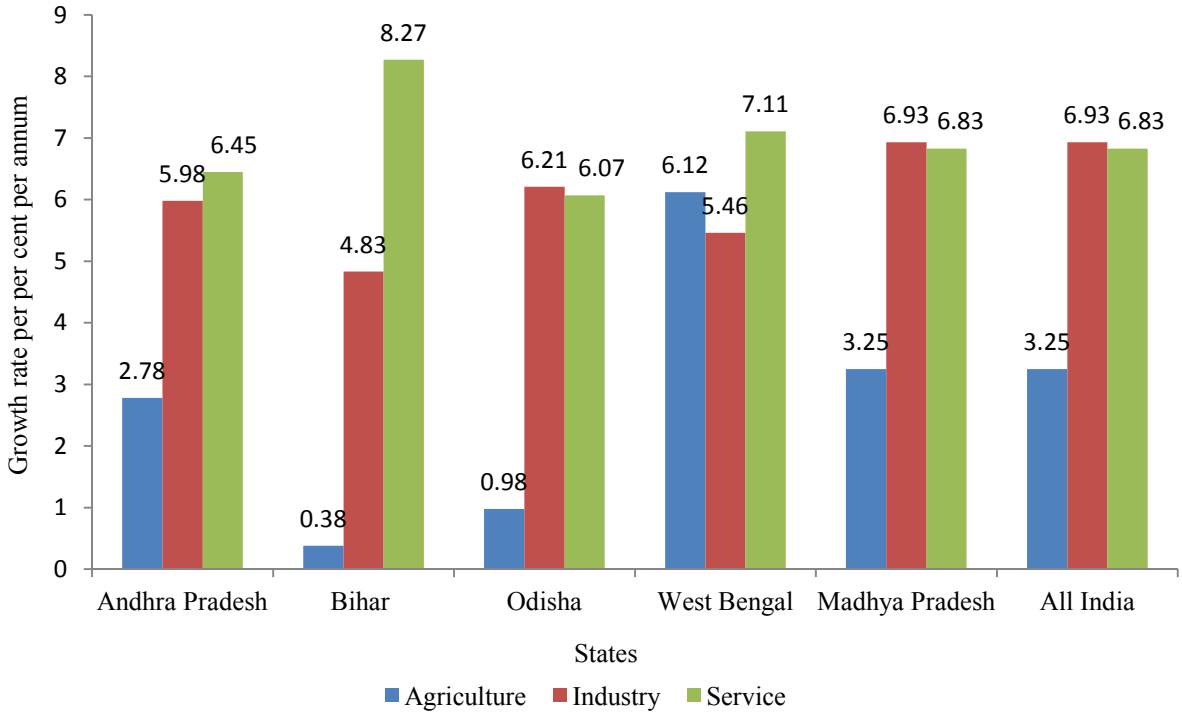


Figure 3.5: Sectoral Composition of State Domestic Product of Odisha's Economy vis-à-vis to Indian Economy (1980-81) in (%)

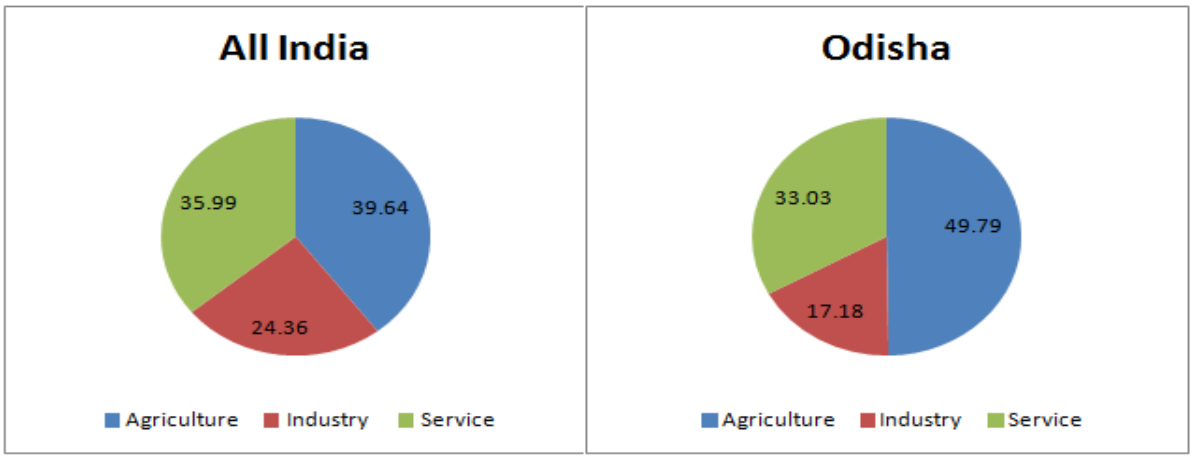


Figure 3.6: Sectoral Composition of State Domestic Product Odisha's Economy vis-à-vis to Indian Economy (1990-91) in (%)

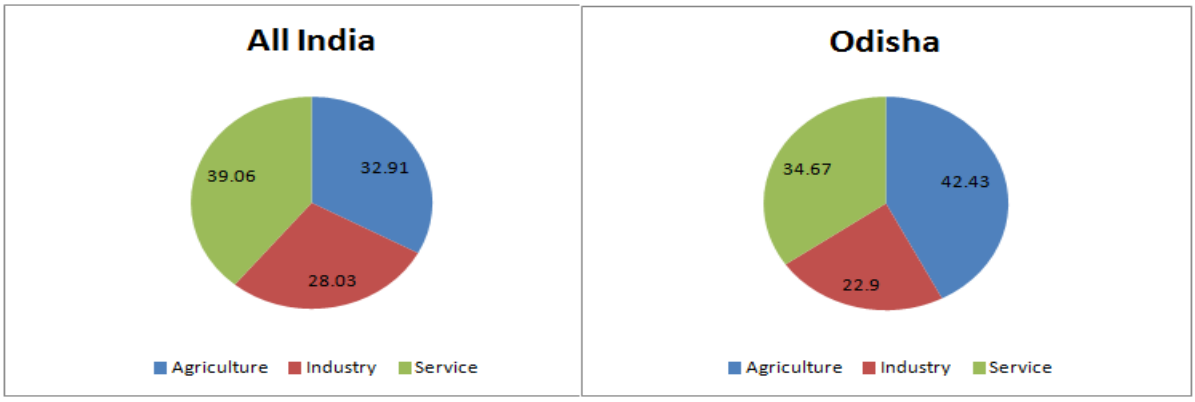


Figure 3.7: Sectoral Composition of State Domestic Product of Odisha's Economy vis-à-vis to Indian Economy (1999-00) in (%)

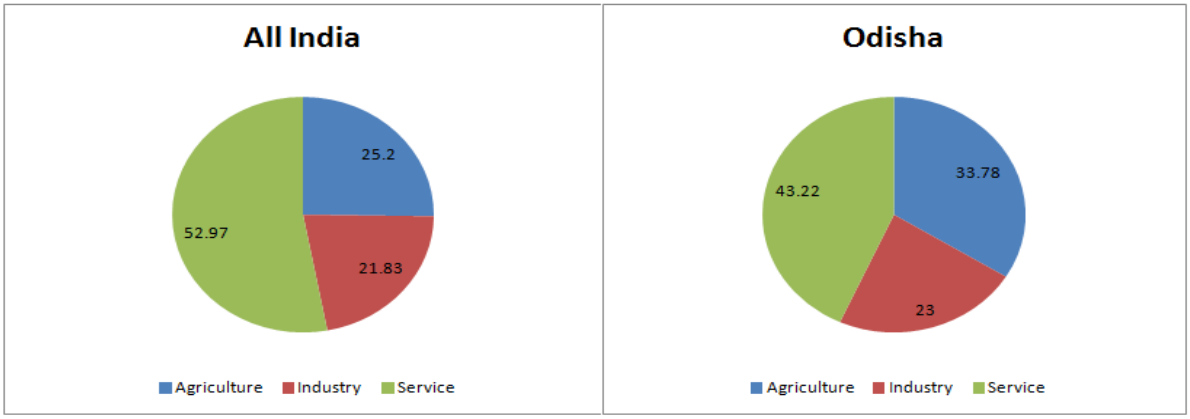


Figure 3.8: Sectoral Composition of Stated Domestic Product of Odisha's Economy vis-à-vis to Indian Economy (2007-08) in (%)

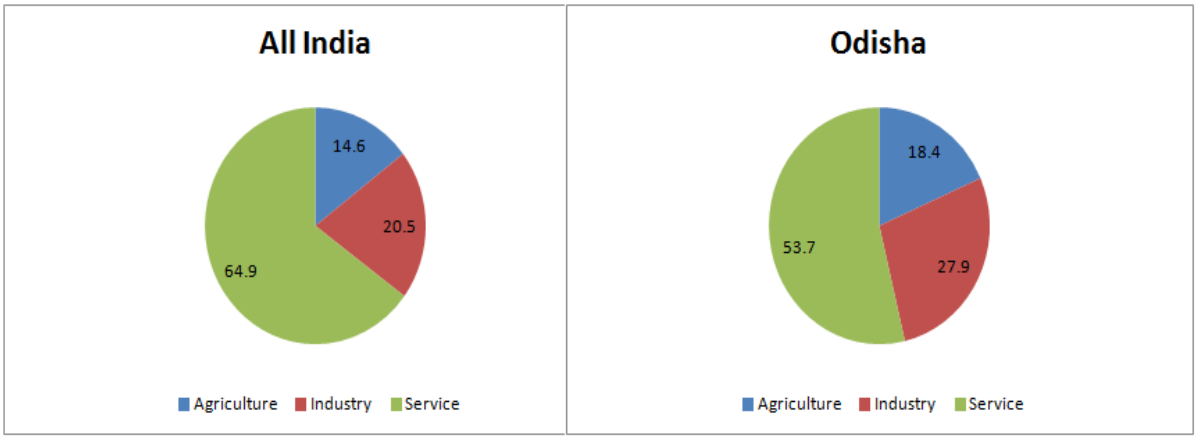


Figure 3.9: Average of Sectoral Composition of State Domestic Product of Odisha's Economy vis-à-vis to Indian Economy (1980/81- 07/08) in (%)

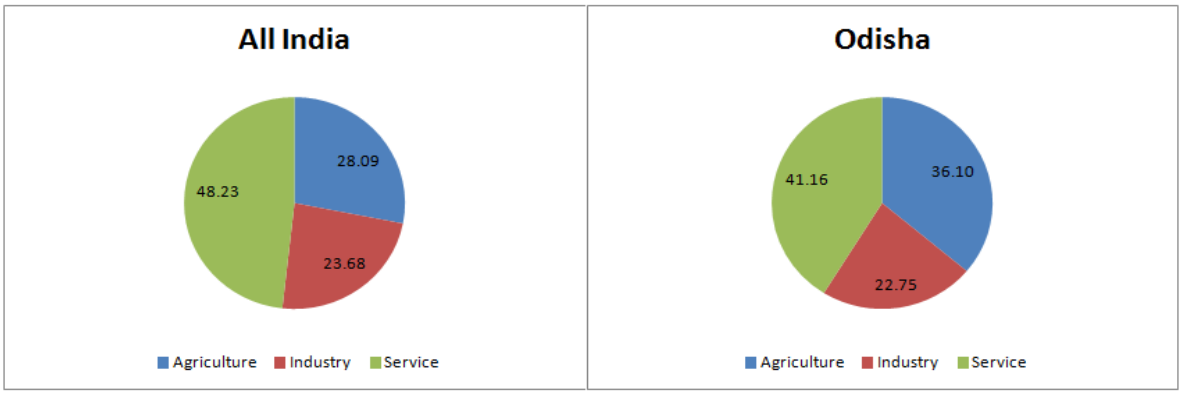
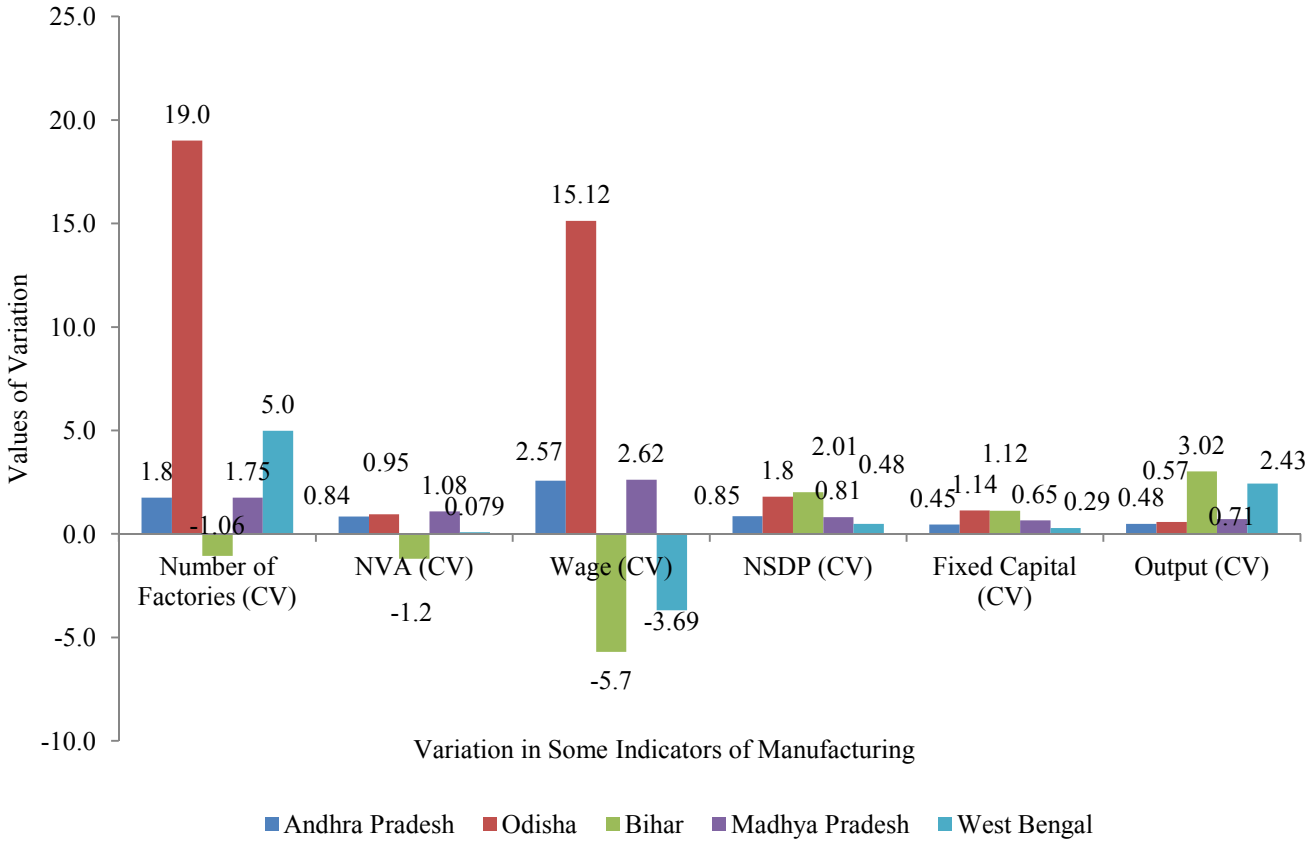


Figure 3.10: Variation in manufacturing growth of Odisha and its neighbouring States (1980-2008)



* * *

Chapter- 4

Patterns of Spatial Concentration of Manufacturing Sector: An Analysis of Odisha and Its Neighbouring states

4.1 Introduction

Valuable attempts are made to realize the historical process which led to the beginning of the modern industry in India. The impact of Colonial rules has also been examined on the structure, composition and location of industries in India. As the cotton textile mills were localized in the Bombay region, the jute textile mills were concentrated in Bengal. Over the period, industrial structure has undergone structural transformation in its spatial distribution. During the course of development, a wide dispersal of industrialization could take place which are described as a convergence hypothesis. The non-dispersal or divergence can be put as the null hypothesis (Seth, 1987). This hypothesis has brought an interest to be tested among researchers in recent decades.

As a reaction to the colonial past, India's development strategy focused on self reliance. In pursuit of the same it placed a heavy emphasis on the creation of a well diversified industrial base to realize the dream of industry led development (Trivedi, *et al.*, 2011). But the question is at what extent it is achieved. Previous studies have tested this hypothesis and thrown some light on spread of industries to discover the relative importance of various locations in the case of each industry, but that tends to be descriptive in nature (Seth, 1987). Some studies have used three different surrogates such as electricity consumed, value added generated and employment in the industry in each spatial unit as the measure and the extent of the industrialization (Dholakia, 1979 and Dhar and Sastry, 1969).

The policy issues are asked whether equity reduces regional disparities in industrialization or not as well as regarding the geographical contribution to the industries in few regions or about their high degree of specialization in a few industrial groups (Dholakia, 1989). The analysis of industrial location is traced by various researchers. During the time of Losch, the work in this field was concerned with partial analysis and did not take into account the interdependency of the problems of location of different industries. After economists like Weber, Ohlin, Losch and Isard, there found an availability of plethora or literature which had concentrated mainly the optimality of resources in the context of spatial allocation and

efficiency of location pattern with some objectives. But, in developing economy, optimality is considered the secondary approach and primary concern goes to understand the location of different industries, the tendency towards dispersal or concentration over the time (Seth and Gulati, 1974). It will be quite relevant if this study will include an economic base analysis method among regions of Odisha and its neighbouring states before going to estimate the dispersal or concentration over time. So, Location quotient are thought as suitable one and taken to compare Odisha with its neighbouring states to identify this states' specialization. This method is thought to determine whether Odisha has a greater share of each manufacturing group than expected when in comparison to all its neighbouring states. If a manufacturing group has a greater share than expected in a given manufacturing group then the extra industry share is assumed to be basic because the above shares are found redundant after serving the requirement of an economy. All these theoretical discussion and interpretation of location quotient are comprehensively given in chapter 2.

There exists also a political debate and public commotion for a topic like economic concentration in India in recent decades. By all available accounts in previous studies have found that most of the Indian industries are identified by a high degree of economic concentration (Ghose, 1975). There is very little study at the manufacturing level to examine the manufacturing concentration meaningfully. It is also disappointing to know that the studies regarding manufacturing concentration on regional level are negligible.

So, the objective of this chapter is to determine whether the concentration in thirteen manufacturing sector had increased for Odisha and its neighbouring states over a period of time1980/81- 07/08. The concern is also to find out the extent to which manufacturing concentration of regional gain and loss of shares. This problem is thought to be addressed through such a dynamic measure like Grossack's index.

This inductive measure, which is used to capture monopoly power[3] in terms of shares of manufacturing industries, is completely explained under chapter 2. This measure is estimated in this study in terms of industrial shares like number of factories; number of employees, net value added and fixed capital to show monopoly power of industries from various directions. The

[3] Monopoly power as explained by Grossack (1965) indicates the extent to which a manufacturing group lose its customer because of its price enhancement or the other firms are willing and able to supply customer of that firm, in effects define that firm's monopoly power.

whole time period are furcated into five semi decades from 1980/81- 07/08. This estimation has found suitable to state whether the manufacturing groups for Odisha and its neighbouring states have accounted for small, medium or large shares or not.

Keeping all these views in mind, it is noticed that there are very few studies articulating on this problem and locating the solution for policy purposes and further research. The issues of spatial concentration of industries are major concerns among the academics and regional policy makers as it is noted previously. It is also found that industrialization occurred differently in different regions, so the uneven process of concentration are made responsible the regions into developed and underdeveloped. There was also a discussion earlier for the spread of manufacturing that shows a collection of a few isolated geographic centers of manufacturing in respect of evolution, structure, labour organization, technology use, and pattern of resources. During the course of development of industrialization a wide dispersal could take place which are described as a convergence hypothesis. The non-dispersal and divergence can be put as the null hypothesis. This chapter may help to develop the ideas for reducing regional inequality and to the research literature on spatial concentration of manufacturing industries in regional level. So this study are taken into five parts incorporating the total number of employees, fixed capital, net value added and number of factories of manufacturing industries as the surrogate of the measure of extent of industrialization with five time periods such as 1980-81 /85-86, 1986/87-91/92, 1992/93- 97/98, 1998/99- 03/04, 2002/03- 07/08. Overall, there is an attempt to study the spatial concentration since 1980 to 2008 and an attempt of quantitative testing of convergence hypothesis.

To address all these issues, it is quite relevant to analyse the spatial spread of industries in a lucid manner. It is well known that the choice of spatial units to analyse the spatial spread of industries is quite crucial because changes in the referred spatial units may alter the results into a significant level. Here the states are taken as the relevant spatial units. This chapter tries to find out the solution of the above question for Odisha and its neighbouring states using various measures of spatial spread. Chapter 1 in this study has focused on previous literature while chapter 2 has come with detailed description regarding the methodology used to estimate the relevant facts and figures. This chapter is intended to the analysis of findings with a brief introductory discussion. At the end the summary is given for this chapter and the complete tables and graphs for this study are attached.

4.2 Analysis of findings

4.2.1 Results for Location Quotient

Location quotient using number of employees for Odisha is given in Table 4.1. It is seen that the variation in location quotient over period of time have declined over period of time in terms of number of employees. It seems to be good for Odisha's manufacturing; it is because there is an evidence of manufacturing groups to be located as basic industries over the time 1980/81- 07/08. Out of the thirteen manufacturing groups, the basic manufacturing groups are found as wood and wood products (27), rubber and plastic products (31), non metallic mineral products (32), basic metal and alloys (33) and transport equipment (37). And the best basic industries are found as non metallic mineral products (32) and basic metal and alloys (33) with location quotient 2.14 and 2.44 respectively. It is also interesting to note that these two industries have performed well in every time phase in comparison to all other manufacturing groups in Odisha. It can be noted that more industries are observed as basic using number of employees in comparison to net value added.

Location quotient with net value added is presented in Table 4.2. It gives a similar picture like location quotient using number of employees. In this table, it is found basic metal and alloys (33) as the best basic industries over the period of time.

The variation over period of time has fallen and this table has shown relatively better picture than location quotient table with number of employees witnessing less variation. Wood and wood products (27) and basic metal and alloys (33) are found to be basic industries in output (net value added) with 1.98 and 2.14 respectively. All other industries are found as non basic in terms of output produced. Table 4.3 represents location quotient with the help of number of factories. In this measure, more industries have included themselves as basic in comparison to the number of employees and net value added measure. Wood and wood products (27) with a location quotient 2.72, leather and leather products (29) with 2.41, rubber and plastic products (31) with 2.35, non metallic mineral products (32) with 2.10 and basic metal and alloys (33) with 1.48 are found basic during the last time phase while the similar trend exists for these manufacturing groups over the period of time. Using fixed capital for location quotient, it is found in Table 4.4, the variation trend over the period of time has a similar pattern with all other three measures taken in the previous tables. But in the measure fixed capital, it is found metal, non elec. Machinery (33_34_35) and leather and leather products

(29) as basic with the location quotient 1.90 and 1.38. In this measure non metallic mineral products (32) is close to unity in the last time phase and it has performed as basic in all previous time phases.

The consistent basic industries in Odisha are wood and wood products (27), non metallic mineral products (32), and basic metal and alloys (33) with the help of all indicators of manufacturing. It is interesting to note that the important industries in Odisha like food and food products (20_21), beverages, tobacco and tobacco products (22), textiles (23), textile products (26), paper and paper products (28), chemical and chemical products (30) are found to be non basic during all time phases and over the period of time. But, it is also interesting to mention that using the average of all indicators of all manufacturing to find out location quotient. This result shows dominant and basic industries in Odisha are as wood and wood products (27) with location quotient 2.57, paper and paper products with 1.83, non metallic mineral products (32) with 1.31 and basic metal and alloys (33) with 1.56, all these results are given in Table 4.5.

Using the figure 4.9, it is attempted to identify how the location quotient in all manufacturing is catching up gradually in decreasing its variation among overall manufacturing over time period. This graph is clearly indicating the performances of all manufacturing variation to be located in Odisha in comparison to all its neighbouring states.

4.2.2 Results for Grossack's Measure

Grossack's measure using fixed capital is given in Table 4.6. There are some interesting explanations over the total time period and time phases as divided in this table. As it is known that the value of 'b', 'r' and $(b/r)^2$ are estimated in terms of fixed capital, output (net value added) and number of employees. In this table, only the results in terms of fixed capital are given. The grossack's measure in terms of other two indicators are given and compared with each other to show dispersal of Odisha's manufacturing sector. When there is a value of "b" less than 1, it means that larger locations of the base year have lost their share in average. In this table, four time phases have the value of 'b' which is less than 1. The least 'b' value is 0.66 for the time phase 2002/03- 07/08 which shows the maximum dispersal of 34 per cent. The least dispersal is only 3 percent in case of first time phase, i.e. 1980/81- 85/86. To analyse the complete process as to how the expansion of manufacturing in terms of capital is being shared by different locations, the value of 'r' and $(b/r)^2$ can be considered. As it is discussed in chapter 2, the time phases which has a high value of 'r' and a lower value of $(b/r)^2$ show manufacturing

groups expansion of manufacturing is being shared by the larger locations only. Dispersion has emerged because of changes in the relative share of above average regions. And if there is a lower value of 'r', but a higher value of $(b/r)^2$, it shows manufacturing dispersal has emerged because of the larger locations having lost their share to each other. Hence, if a lower value of r as well as lower value of $(b/r)^2$ is found, then it shows the manufacturing dispersion has emerged because significant locations of the base year have lost their share to other significant locations as well as to the insignificant locations. So, in Table 4.8, four time phases 1980/81- 85/86, 1986/87- 91/92, 1992-93-97-98 and 2002/03- 07/08 have shown a less than 1 of 'b' value.

But, the high value of 'r' and lower value of $(b/r)^2$ are there present in first, second and third time phase which simply implies that the manufacturing sector in these phases are being shared in larger locations only. In these phases, dispersion has emerged because of changes in the relative share of the above average regions. The time phase 2002/03- 07/08 implies a lower value of 'r' and a higher value of $(b/r)^2$ which shows the dispersion has emerged in this time phase because of the larger locations have lost their share to each other. The time phase 1998/99- 03/04 where the value of $b > 1$ and $(b/r)^2 > r$ is showing the significant manufacturing locations of the base year have maintained their share and the expansion of manufacturing group are shared by themselves only. The overall time period shows above similar trend for all manufacturing of Odisha where $b = 0.88$, $r = 0.80$ and $(b/r)^2 = 1.21$ as the time phases.

With the help of output (net value added), the Grossack's measure for manufacturing of Odisha. All the neighbouring states share are taken as the national share and the Grossack's index is calculated and presented in Table 4.7. First, second, fourth, fifth and the overall time phase have a value 'b' less than l. It shows the overall tendency of manufacturing of Odisha have a tendency towards dispersal. The further explanations of all the above time periods with overall manufacturing are worthy to note. The time phases 1980/81- 85/86, 1986/87- 91/92 have a high value of 'r' and lower value of (b/r)2 which shows that the manufacturing group is being shared by the larger locations only in these time phases. The time phase 1992/93- 97/98 shows a value of 'b' and (b/r)2 is greater than 1, so in these phases the significant locations of the base year have maintained their share and expansion of manufacturing group are shared by them only in Odisha. The last two phases show the dispersion has emerged because of the larger locations having lost their share to each other. But the overall time phase of manufacturing of Odisha

shows that the dispersion has taking place may be because of the larger locations having lost their share to each other as same as the last two time phases with the help of fixed capital.

Grossack's measure is given in Table 4.8 with the help of number of employees. In this table; first, second and fifth time phases have a tendency towards dispersal. The third and fourth time phases explain that the base year significant manufacturing locations have able to maintain their share. The expansions in manufacturing are shared by them only.

The overall time taken in this table shows dispersion has emerged because of the changes in relative shares of above average regions. All the indicators of manufacturing for Grossack's measure give different pictures over the time. As it is more or less same for both net value added and fixed capital, a different picture are found form number of employees in Odisha. But with the help of three indicators, the manufacturing of Odisha has shown a tendency towards dispersion. The maximum dispersal is in respect of the the indicator net value added which shows the magnitude of dispersion 18 percent. These magnitudes of dispersions are 12 percent in terms of fixed capital and 5 percent in terms of number of employees for the manufacturing of Odisha over the period of time. It is interesting to note that the manufacturing expansion of the manufacturing groups is being shared by the larger locations in Odisha in terms of output (net value added).

4.3 Summary

This chapter attempted to examine the manufacturing sector and find out the important, dominant and basic manufacturing industries in Odisha. It is also focused to find out the changes in the patterns of manufacturing concentration in Odisha and its neighbouring states over a period 1980-2008. Location quotient found for Indian manufacturing shows that wood and wood products (27) with location quotient 2.57, paper and paper products (28) with 1.83, non metallic mineral products (32) with 1.31 and basic metal and alloys (33) with 1.56 are dominant and basic industries over this time period. All the facts and figures has suggested that Odisha's manufacturing has the capability to produce and meet demands of its local economy as well as it can serve the reference economies. The variation among manufacturing are found declining over the period which suggests a resilient manufacturing sector in Odisha. From the analysis of the Grossack's measure, it is found that the manufacturing sector in Odisha is towards dispersal. But it is also found that the process of its emergence and its magnitude of dispersion have differed over the period of time.

This is suggesting that manufacturing sector in Odisha is not sticking to its original locations rather it is dispersing towards its neighbouring locations. The facts also substantiate that in Odisha the manufacturing are accompanied by a convergence with its neighbouring states. The inter convergence process in Odisha and its neighbouring states's manufacturing suggest that these states are able to internalize manufacturing sector in their respective geographical areas.

The differences in the magnitude and process of dispersal and concentration in terms of output, labour and capital suggests that changes in the techniques in production process are playing an important role in the manufacturing sector of Odisha and its neighbours.

Table 4.1: Location Quotient of Odisha considering its neighbouring states with the help of number of employees

Code → Year↓	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	C.V.
1980/81- 85/86	0.73	5.84	0.47	0.41	4.38	3.07	0.23	1.00	0.17	2.40	2.33	0.54	0.04	1.05
1986/87- 91/92	0.65	1.00	0.65	0.94	3.38	2.81	0.21	1.31	0.32	1.81	1.92	0.76	0.07	0.76
1992/93- 97/98	0.76	0.06	0.74	0.76	2.71	2.49	0.16	1.37	0.75	1.88	1.80	0.95	0.06	0.75
1998/99- 03/04	1.13	0.20	0.39	0.33	3.01	1.73	0.16	1.26	1.09	1.35	2.39	0.55	0.03	0.87
2002/03- 07/08	0.47	0.24	0.17	NA	1.38	0.46	0.77	0.49	2.04	2.14	2.44	0.62	1.91	0.69

Source: Author's Calculation, EPW Research Foundation Data and ASI Summary Results, NA- not available

Table 4.2: Location Quotient of Odisha considering its neighbouring states with the help of Net Value Added

Code → Year↓	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	C.V.
1980/81- 85/86	0.78	0.24	0.48	0.23	3.40	3.18	0.05	0.68	0.09	2.36	1.55	0.36	0.68	1.03
1986/87- 91/92	0.30	0.12	0.36	0.37	2.36	1.75	0.06	0.75	0.28	1.33	2.18	0.33	0.03	0.80
1992/93- 97/98	0.80	0.07	0.26	0.58	3.18	2.2	0.01	0.38	1.07	1.65	1.72	0.41	0.05	0.80
1998/99- 03/04	0.37	0.27	0.03	0.12	2.42	1.06	NA	0.40	0.85	0.43	3.22	0.24	0.05	0.95
2002/03- 07/08	0.26	0.27	0.04	0.11	1.98	0.29	NA	0.33	0.53	0.78	2.14	0.19	0.01	0.34

Source: Author's Calculation, EPW Research Foundation Data and ASI Summary Results, NA- not available

Table 4.3: Location Quotient of Odisha considering its neighbouring states with the help of Number of Factories

Code → Year↓	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	C.V.
1980/81- 85/86	1.05	0.27	0.55	0.70	5.95	0.97	0.59	0.98	0.57	1.05	0.89	0.94	0.41	1.22
1986/87- 91/92	0.93	0.16	0.67	1.39	6.19	1.06	0.71	1.32	0.77	1.31	0.61	1.07	0.38	1.14
1992/93- 97/98	0.87	0.14	0.54	1.75	5.40	0.98	0.54	1.27	0.98	1.26	1.23	1.57	0.46	0.96
1998/99- 03/04	0.84	0.85	0.75	1.12	3.03	0.60	1.96	1.01	1.21	1.09	1.39	0.71	0.14	1.87
2002/03- 07/08	0.94	0.92	0.54	0.76	2.72	0.65	2.41	0.77	2.35	2.10	1.48	0.16	NA	0.60

Source: Author's Calculation, EPW Research Foundation Data and ASI Summary Results, NA- not available

Table 4.4: Location Quotient of Odisha considering its neighbouring states with the help of Number of Factories

Code → Year↓	**20_21**	**22**	**23_24_25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34_35_36**	**37**	**C.V.**
1980/81- 85/86	0.45	0.56	0.69	0.66	0.73	3.27	1.25	0.21	0.61	0.06	1.02	1.19	0.51	0.92
1986/87- 91/92	0.25	0.12	0.35	0.3	0.29	3.15	1.12	0.12	1.62	0.73	0.41	1.19	0.42	1.09
1992/93- 97/98	0.45	0.16	0.21	0.69	0.7	2.59	1.84	0.13	1.02	0.45	0.78	1.23	0.45	0.70
1998/99- 03/04	0.43	0.03	0.03	0.22	0.21	4.16	1.68	NA	0.87	0.26	0.39	1.68	0.26	1.32
2002/03- 07/08	0.4	0.48	0.03	0.15	0.14	0.52	1.9	NA	0.95	0.19	0.44	1.38	0.16	0.93

Source: Author's Calculation, EPW Research Foundation Data and ASI Summary Results, NA- not available

Table 4.5: Average Location Quotient (LQ) of Odisha considering its neighbouring states since 1980/81- 07/08.

Industry Groups	**LQP**	**LQF**	**LQNVA**	**LQFXC**	**ALL**
Food Products (20_21)	0.75	0.93	0.35	0.40	0.59
Beverages, Tobacco and Tobacco Products (22)	1.47	0.47	0.19	0.27	0.54
Cotton and Jute Textile (23_24_25)	0.48	0.61	0.23	0.26	0.37
Textile Products (26)	0.49	1.14	0.28	0.40	0.52
Wood and Wood Products (27)	2.97	4.66	2.67	0.41	2.57
Paper and Paper Products (28)	2.11	0.85	1.70	2.74	1.83
Leather and Leather Products (29)	0.31	1.24	0.02	1.56	0.63
Chemical and Chemical Products (30)	1.09	1.07	0.51	0.09	0.76
Rubber and Plastic Products (31)	0.87	1.18	0.56	1.01	0.83
Non-Metallic Mineral Products (32)	1.92	1.36	1.31	0.34	1.31
Basic Metal and alloy (33)	2.18	1.12	2.16	0.61	1.56
Metal Products, Non-Elec. Machinery(34_35_36)	0.68	0.89	0.31	1.33	0.73
Transport Equipment (37)	0.42	0.28	0.15	0.36	0.26

Source:Author's Calculation, EPW Research Foundation data and ASI Summary Result LQP- Location Quotient of Total employment, LQF- Location Quotient Number of Factories, LQNVA- Location Quotient Net Value Added, LQFXC- Location Quotien Fixed Capital, LQTO- Location Quotient Total Output

Table 4.6: Values of the parameters of the Grossack's Measure for Odisha using fixed capital of total 13 manufacturing groups of all five states

Year	b	r	$(b/r)^2$
1980/81- 85/86	0.97	0.99	0.95
1986/87- 91/92	0.96	0.99	0.94
1992/93- 97/98	0.72	0.91	0.62
1998/99- 03/04	1.11	0.58	1.91
2002/03- 07/08	0.66	0.54	1.48
1980/81- 07/08	0.88	0.80	1.21

Source: Author's Calculation, Annual Survey of Industries

Table 4.7: Values of the parameters of the Grossack's Measure for Odisha using net value added total 13 manufacturing groups of all five states.

Year	b	r	$(b/r)^2$
1980/81- 85/86	0.83	0.98	0.71
1986/87- 91/92	0.82	0.98	0.70
1992/93- 97/98	1.35	0.99	1.86
1998/99- 03/04	0.17	0.12	2.00
2002/03- 07/08	0.95	0.92	1.06
1980/81- 07/08	0.82	0.79	1.06

Source: Author's Calculation, Annual Survey of Industries

Table 4.8: Values of the parameters of the Grossack's Measure for Odisha using total number of employees for total 13 manufacturing groups of all five states Output

Year	b	r	$(b/r)^2$
1980/81- 85/86	0.87	0.99	0.77
1986/87- 91/92	0.95	0.99	0.92
1992/93- 97/98	1.04	0.98	1.10
1998/99- 03/04	1.02	0.99	1.06
2002/03- 07/08	0.91	0.98	0.86
1980/81- 07/08	0.95	0.98	0.93

Source: Author's Calculation, Annual Survey of Industries

Figure 4.1: Location Quotient of manufacturing groups in Odisha (1980-2008)

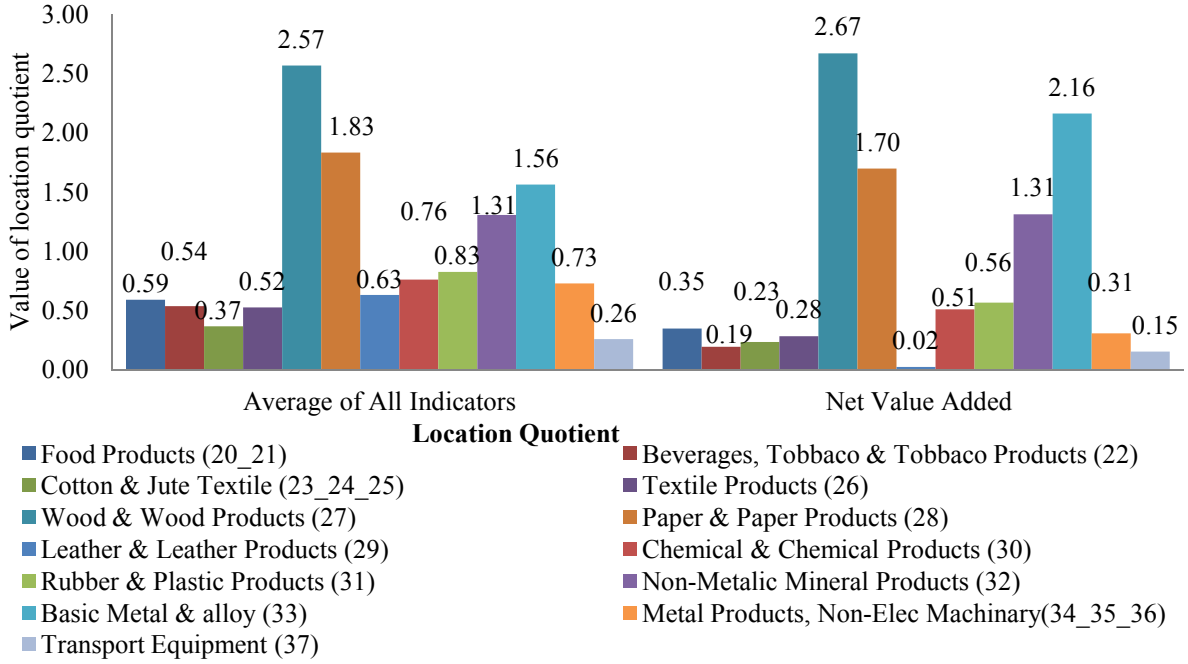
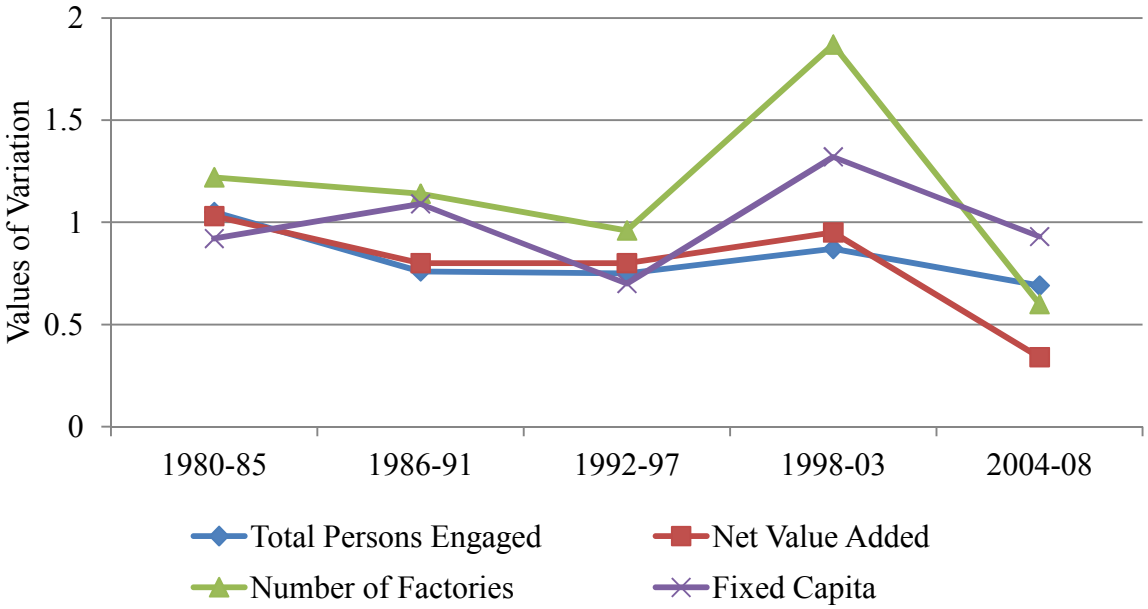


Figure 4.2: Trends in Coefficient of Variation in Location Quotient of all manufacturing groups of Odisha since 1980/81- 07/08.



***

Chapter- 5

Capital- Labour Substitution in the Organized Manufacturing Sector: An Analysis of Odisha and Its Neighbouring states

5.1 Introduction

Vast studies are also found absent in the possibility of substitution of labour for capital in regional level in India. So, there is a need to have a look at the complete scenario of capital labour substitution to address the unemployment problem in manufacturing sector. This estimation of substitution can say which manufacturing group has the capability to absorbing labour more. Capital-labour substitution estimation is necessary for many economic decisions both for public and private decision makers and to enhance growth. Rapid growth in manufacturing could be an answer for unemployment problem if it is able to provide jobs and ease the pressure on land. But, if manufacturing fails to grow and provide jobs, the existing imbalance between sectoral share in GDP and the percentage of population dependent on it will not only continue but also worsen with serious economic, social and political consequences (Bhusnurmath, M., 2012). These possibilities of substitution of labour to capital in manufacturing depend on the flexible production process which will allow absorbing more labour from the overburden land. In this estimation process, variations in the ratio of unit labour cost to capital rental will result in greater than, less than, or equally proportionate change in capital per unit of labour employed according to the elasticity of substitution is greater than, less than or equal to unity (Arrow *et al.*, 1961). And these estimation and analysis may be helpful in decision making process.

Two production functions, Leontief and Cobb-Douglas are based on the assumption of zero elasticity of substitution and unity elasticity of substitution respectively. The first one expressed the changes in the ratio of unit labour cost to capital rental (w/r) will leave the capital-labour ratio (K/L) unchanged. If the elasticity of substitution is unity, a given percentage change in w/r will result in equal percentage change in K/L. SMAC (Arrow *et al*., 1961) production function in which elasticity of substitution is assumed to be invariant to changes in the capital labour ratio but free to take any positive value between zero and infinity (Williams, 1974).

Measurement of technical substitutability between capital and labour, have placed its relevance in both theoretical and empirical problems. These relevancies can be pointed towards

employment, income distribution and foreign trade. Relative changes in the quantity demanded of labour in response to changes in real wage rate, is a focal point in employment theory. In the theory of distribution, the functional shares of capital and labour, depends upon the substitution coefficient (Dhananjayan and Muthulakshmi, 1989).

There are plethora of studies estimating the possibilities of capital-labour substitution in both developed and developing countries. In India, It is found that Indian manufacturing sector is capital intensive and operating under decreasing returns to scale (Upender, 1996). The elasticity of labour productivity is more than unity implying that substitution possibilities in favour of labour are quite high. But it is a difficult task to switch from capital intensive techniques to more relatively labour intensive techniques of production in manufacturing sector. Hence the production structure should be flexible enough where easier substitution of labour for capital is possible. It is because this possibility will encourage bridging the gap between rate of growth of output and employment in manufacturing sector.

So, labour intensive techniques should be encouraged rather than capital intensive by which the problem of the failure of modern sector absorbing disguised labour from the traditional sector can be wiped out. If there is an attempt to look at the unemployment scenario of Odisha it is clearly visible that the unemployment rate are declined from the 61st round (July, 2004 to June, 2005) to the 62nd round (July, 2005 to June 2006) (Odisha Economic Survey, 2009-10). But the state's unemployment rate is higher than the national rate of unemployment. In the category of organised sector the share of employment of the public continues to be much higher than that of private sector. Keeping these views in mind, the structural magnitude of elasticity of substitution constitutes much more relevance in its estimation which can address the issue of unemployment.

So, there is an attempt to look into the possibility of employment of labour force instead of capital. It is also because, if in a given system measured substitution possibilities exist and there is a considerable scope for it, then the policy parameters should be blamed for the slow growth rates in employment. If the possibilities are shown to be null, then the empirical bases for policy recommendation which include removal of capital subsidy, a raise in capital interest, maintenance of low and rigid wage policies and other approaches aimed at distortions of factor prices to stimulate employment growth would be shown to be rather shaky. So there is an urgent need to estimate the elasticities of substitution of labour for capital in industry (Mulat, 1980).

There are few studies of this estimation for individual states in India, but such calculation have not been noticed to this researcher for Odisha.

In this chapter, the attempt is made to look into the possibilities of substitution of labour for capital in Odisha manufacturing groups as well as its neighbouring states. As It is already mentioned previously, 13 manufacturing groups are considered for the estimation in each state. All these estimations are made with the hypothesis that the possibility of capital labour substitution is unity. In the first chapter the back ground of the studies are given with a comprehensive review with its rationale. In the second chapter the methodology for capital labour substitution is given with various equations. In this chapter, with a simple introduction, the findings are analyzed and concluded.

5.2 Analysis of findings

5.2.1 Results for Capital Labour Substitution

The estimates of elasticity of substitution based on (equation 9) logarithmic regression of net value added per unit of labour on wage rate and time trend is presented in Table 5.1. This estimation is given for all individual manufacturing groups in Odisha during 1980-2008.

This estimation is also given for all individual manufacturing groups in Odisha. The sign of coefficient of time is not consistent with the sign of elasticity of substitution in respect of food and food products (20_21), beverages tobacco and tobacco products (22), textile products (26), wood and wood products (27), basic metal and alloys (33) and metal products non elec. Machinery (34_35_36).

The sign of coefficient of time is negative in respect of three manufacturing groups in Odisha, these three manufacturing groups are food and food products (20_21), textiles (23_24_25) and leather and leather products (29). Two manufacturing groups, textiles (23_24_25) and leather and leather products (29) are consistent with the sign of elasticity of substitution. The coefficient of time is positive in case of other nine manufacturing groups and out of these five manufacturing groups have significant positive coefficient of time. The positive and significant time coefficient shows the importance of neutral technological progress in the production process. These manufacturing groups with neutral technological progress are wood and wood products (27), paper and paper products (28), non metallic mineral products (32), basic metal and alloys (33) and metal products non elec. machinery (34_35_36). But the manufacturing groups where the coefficient of time is either negative or insignificant, these

groups show neutral technological progress has not an important role in their production process. These groups are food and food products (20_21), beverages tobacco and tobacco products (22), textiles (23_24_25), textile products (26), chemical and chemical products (30) and rubber and plastic products (31).

In Table 5.2, there was an attempt to estimate a regression analysis by dropping the time variable. In this table, it is found that the coefficient of wage rate is significantly different from zero in respect of paper and paper products (28), rubber and plastic products (31) and transport equipment (37). The coefficient of wage rate found significantly different from unity in respect of non metallic mineral products (32) and basic metal and alloys (33). The coefficient of determination is found quite low for this regression analysis which shows a worse fit. The estimates of the values of elasticity of substitution based on logarithmic regression of net value added per unit of capital on the rate of return on capital and time using equation 10 are given in Table 5.3.

The same equation of elasticity of substitution without time variable is given in Table 5.4. In the first regression presented in Table 5.3 shows that the sign of coefficient of time is negative in respect of most of the manufacturing groups in Odisha and inconsistent with the sign of elasticity of substitution. This implies that the capital output ratio is unaltered at a given rate of profit does not seem to play a role in the most of the manufacturing groups in Odisha. The next table shows without the time trend, the coefficient of rate of return on capital (capital labour substitution) is significantly different from zero in respect of all the manufacturing groups instead textile products (26). In this regression, the goodness of fit is quite well and the values of elasticity of substitution are found highly significant. It may be because competitive market is more realistic in regard to capital.

The elasticity of substitution based on logarithmic regression of capital labour ratio on wage rental ratio is given in Table 5.5 for manufacturing group in Odisha over the time period 1980-2008. The coefficient of wage rental ratio for the manufacturing group food and food products (20_21), beverages tobacco and tobacco products (22), textiles (23_24_25), chemical and chemical products (30), rubber and plastic products (31), and basic metal and alloys (33) is significantly different from unity. The goodness of fit is quite well and fit into the regression model. In the case of three industries textile products (26), paper and paper products (28) and transport equipment (37), the coefficient of wage rental ratio does not significantly different from

zero. For the overall manufacturing, the elasticity of substitution is quite high and significantly different from zero.

The estimates of elasticity of substitution using constant elasticity substitution production function with changing return to scale for Odisha, Andhra Pradesh, Bihar, West Bengal and Madhya Pradesh are given in Table 5.6, 5.8, 5.10, 5.12 and 5.14 respectively. All these tables have used equation 13 to find out values for possibility of substitution of labour for capital for all manufacturing groups in Odisha. In Odisha, It is observed that the capital labour substitution is significantly different from zero for all manufacturing given in Table 5.6. But Capital labour substitution for which manufacturing groups are significantly different from unity are paper and paper products (28), rubber and plastic products (31), non metallic mineral products (32). But in Table 5.8, the value of capital labour substitution is significantly different from zero in the manufacturing of Andhra Pradesh in respect of food and food products (20_21), beverages tobacco and tobacco products (22), non metallic mineral products (32), basic metal and alloys (33), metal products non elec. machinery (34_35_36) and transport equipment (37). The value of substitution for overall manufacturing of Andhra Pradesh has also similar characteristic. But the substitution values which are significantly different from unity are in respect of textile products (26) and rubber and plastic products (31).

The same characteristics in the values of capital labour substitution exist only in respect of rubber and plastic products (31) for Odisha and Andhra Pradesh. The substitution values for overall manufacturing of Odisha and Andhra Pradesh have the same characteristics as it is 0.26 for Odihsa and 0.66 for Andhra Pradesh, and these are significantly different from zero. In Table 5.10, the same calculations are taken for Bihar. The overall manufacturing does not show a significant capital labour substitution value for this state. The substitution value is significantly different from zero only in respect of basic metal and alloys (33). While, beverages tobacco and tobacco products (22), the value of substitution is significantly different from unity. The goodness of fit is quite low and shows a worse fit in all these three states manufacturing groups' viz. Andhra Pradesh, Odisha and Bihar. In the Table 5.12, the capital labour substitution values for the manufacturing groups of Madhya Pradesh are given. Most of the manufacturing groups in this state show a significant capital labour substitution value different from unity. The substitution values are insignificant in respect of textile products (26), paper and paper products (28) and basic metal and alloys (33). No manufacturing group in Madhya Pradesh found a capital

labour substitution value significantly different from zero. At the same time most of the manufacturing groups found insignificant capital labour substitution values in respect of West Bengal given in Table 5.14. Two manufacturing groups such as food and food products (20_21) and non metallic mineral products (32) have significant capital labour substitution values different from unity. In respect of Odisha and all neighbouring states using equation 13, the R^2 values are quite high for Madhya Pradesh and for all other states manufacturing groups, these values are quite low.

Equation 14 are calculated for manufacturing groups in Odisha and its neighbouring states to find a superior picture of capital labour substitution values during 1980-2008. All these findings are given in Table 5.7, 5.9, 5.11, 5.13 and 5.15 respectively. This equation is thought superior because it is difficult to find out the significance of capital labour substitution since it is derived as a ratio of two coefficients in equation 13. So, equation 14 may help to find out a comparison with equation 13 for all manufacturing of Odisha and its neighbouring states.

Using equation 14 the value of capital labour substitution is calculated and given in Table 5.7 for manufacturing groups in Odisha. The overall manufacturing in Odisha have a significant value of capital labour substitution different from unity. The manufacturing groups like textile products (26), wood and wood products (27), leather and leather products (29) have a capital labour substitution value significantly different from unity. But one clear difference in equation 14 is that the R^2 value in this equation has a very good fit in comparison to equation 13. In Andhra Pradesh the value of capital labour substitution found negative but significantly different from unity in respect of six manufacturing groups while another six manufacturing groups have an insignificant capital labour substitution value. For Bihar, textile products (26) have a capital labour substitution value that is significantly different from unity. The value of capital labour substitution was found statistically significant and negative in respect of eight manufacturing groups in Bihar. For Madhya Pradesh most of the manufacturing groups have a negative significant value over the period of time. Only two manufacturing groups in Madhya Pradesh such as textile products (26) and basic metal and alloys (33) have insignificant values of capital labour substitution. The value of substitution is significant and negative for overall manufacturing of Madhya Pradesh. Most of the manufacturing groups in West Bengal have negative values. But significant and negative capital labour substitution values are found for five manufacturing groups in Odisha. But, positive insignificant values are found for beverage

tobacco and tobacco products (22) in West Bengal. But one common thing among Odisha and its neighbouring states is a higher value of R^2 which is a witness of a good fit. This characteristic in equation 14 is superior to equation 13 in respect of all manufacturing groups in Odisha and its neighbouring states. One another interesting difference found that the values of capital labour substitution is significantly different from unity in respect of Odisha, Andhra Pradesh and West Bengal while capital labour substitution value is significantly different from zero in equation 13. But in case of Bihar and Madhya Pradesh the value of capital labour substitution is insignificant.

5.3 Summary

The purpose of this chapter is to estimate values of possibility of substitution of labour for capital for the manufacturing groups in Odisha and its neighbouring states. Various possibilities of substitution of labour for capital are calculated using number of equations. But there was a comparison among Odisha and its neighbouring states in respect of equation 13 and 14. Two important equations such as Capital labour substitution production function (equation 13 in this study) and some of its developments (equation 14) used to find out the values of capital labour substitution. A major problem with estimation of the equation 13 is that it would be difficult to find out the significance of capital labour substitution since it is derived as a ratio of two coefficients. Equation 14 was taken to find out a superior picture of capital labour substitution in respect of all manufacturing groups in Odisha and its neighbouring states. This equation provides a better picture in terms of good fit in comparison to equation 13. Using equation 13, value of capital labour substitution for Odisha, West Bengal and Andhra Pradesh is found significantly different from zero for overall manufacturing.

At the same time, equation 14 provided a significant capital labour substitution value which is different from unity. In both the cases the hypothesis of unitary elasticity of substitution is rejected. But, other two states showed an insignificant capital labour substitution value. In equation 13, a slow absorption of surplus input in response to change of factor prices are found, consequently a slow growth of employment inference can be drawn. But equation 14 shows a completely different picture for these three states. It is clear from the capital labour substitution estimation that the growth of employment is possible in the manufacturing groups in Odisha. A similar inference is true for its neighbouring states also. The growth of employment can be higher in Odisha in respect of textile products (26) and basic metal and alloys (33) in Odisha in terms of equation 14, the similar characteristic of manufacturing groups like paper and paper

products (28), rubber and plastic products (31) and basic metal and alloys (33) found using equation 13. The slow absorption of surplus input in response to change in factor price and the slow growth of employment found in respect of all manufacturing groups using equation 13 and 14 instead of the above manufacturing groups.

Table 5.1: Estimates of the elasticity of substitution based on (equation no. 9) logarithmic regression of net value added per unit of labour on wage rate and time for Odisha, 1980-2008. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
a_1 (t)	-0.01 (-1.63)	0.004 (1.16)	-0.002 (-1.53)	0.001 (0.17)	0.009* (6.43)	0.003* (3.72)	-0.01* (-2.83)	0.002 (0.69)	0.001 (0.34)	0.004* (4.82)	0.008* (6.50)	0.004* (7.00)	-	-0.01 (0.73)
a_2 (σ_1)	2.22 (1.90)	-0.19 (-0.59)	-0.19 (-0.99)	-0.87* (-4.47)	-0.28 (-1.38)	0.60* (6.25)	-0.48* (-3.23)	0.41 (0.52)	0.42** (2.05)	0.29 (0.72)	-0.43 (-1.26)	-0.29 (-1.40)	0.28 (1.94)	0.32 (1.54)
R^2	0.31	0.06	0.08	0.45	0.65	0.64	0.77	0.11	0.65	0.65	0.74	0.66	0.18	0.09
F-Value	2.03	0.88	1.17	10.39*	23.64*	22.67*	43.37*	1.63	23.85*	23.40*	35.64*	24.56*	2.86	1.29

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.2: Estimates of the elasticity of substitution based on (equation no. 9) logarithmic regression of net value added per unit of labour on wage rate for Odisha, 1980-2008. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
a_1	0.79* (15.51)	0.83* (41.15)	0.82* (29.54)	0.37* (4.50)	0.88* (37.91)	0.84* (32.41)	0.05 (1.18)	0.73* (6.54)	0.95* (62.38)	0.61* (6.03)	0.58* (4.17)	0.96* (16.17)	0.91* (15.42)	10.96* (99.41)
a_2 (σ_2)	0.39 (1.14)	0.11 (0.63)	-	-0.87* (-4.64)	-0.47 (-1.51)	0.52* (4.59)	-0.82* (-7.87)	0.84 (1.68)	0.48* (7.01)	1.55* (3.55)	1.23* (3.33)	-0.04 (-0.13)	0.28** (2.44)	0.22 (1.44)
R^2	0.04	0.01	-	0.45	0.08	0.44	0.70	0.09	0.65	0.32	0.30	-	0.18	0.07
F-Value	1.30	0.40	-	21.56*	2.28	21.07*	61.99*	2.85	49.24*	12.65	11.15*	-	5.96**	2.08

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 1 and 27 respectively.

Table 5.3: Estimates of the elasticity of substitution based on (equation no. 10) logarithmic regression of net value added per unit of capital on rate of return on capital (r) and time for Odisha, 1980-2008. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
b_1 (t)	-0.004* (-9.53)	-0.01* (-5.80)	-0.002 (-1.53)	-0.027 (-1.82)	0.005 (1.54)	-0.002** (-2.41)	-0.01* (-9.80)	0.002 (0.73)	-0.009* (-3.26)	-0.03** (-2.12)	-0.005* (-3.94)	–	–	-0.04 (-1.90)
b_2 (σ_1)	0.05* (28.87)	0.10* (7.94)	-0.19 (-0.99)	0.10 (1.75)	0.03 (1.71)	0.06* (9.74)	0.14* (19.71)	0.002 (0.72)	0.08* (8.18)	0.06* (5.87)	0.07* (9.01)	0.03* (2.94)	0.05* (3.92)	0.02** (2.44)
R^2	0.97	0.73	0.08	0.12	0.66	0.81	0.98	0.12	0.89	0.85	0.93	0.72	0.42	0.19
F-Value	423.61*	34.01*	1.17	1.77	25.02*	53.32*	632.3*	1.77	101.97*	71.35*	179.87*	33.74*	9.08*	3.09

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.4: Estimates of the elasticity of substitution based on (equation no. 10) logarithmic regression of net value added per unit of capital on rate of return on capital (r) for Odisha, 1980-2008. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
b_1	0.46* (15.07)	0.59* (9.26)	0.45* (4.76)	0.58* (3.27)	0.49* (7.89)	0.49* (9.81)	0.03 (1.43)	0.92* (43.74)	0.53* (14.57)	0.54* (14.07)	0.55* (16.43)	0.55* (11.15)	0.59* (10.99)	10.27* (20.48)
b_2 (σ_4)	0.04* (13.02)	0.037* (3.90)	0.05* (3.88)	0.01 (0.19)	0.06* (6.72)	0.05* (9.21)	0.19* (15.91)	0.004 (1.74)	0.05* (11.87)	0.04* (11.03)	0.04* (14.85)	0.04* (8.26)	0.05* (4.31)	0.009 (1.52)
R^2	0.86	0.36	0.36	0.007	0.63	0.76	0.90	0.10	0.84	0.82	0.89	0.72	0.41	0.08
F-Value	169.59*	15.21*	15.06*	0.19	45.20*	84.95*	253.40*	3.06	141.08*	121.70*	220.73*	68.38*	18.59*	2.33

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 1 and 27 respectively.

Table 5.5: Estimates of the elasticity of substitution based on (equation no. 12) logarithmic regression of capital labour ratio on wage rental ratio for Odisha, 1980-2008 (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
c_1	-1.06* (-2.91)	-0.52 (-1.01)	1.54 (1.40)	1.37* (3.13)	-3.97* (-3.63)	5.34* (2.69)	6.33* (24.11)	-7.88* (-7.00)	3.98* (12.18)	-13.19* (-6.21)	0.08 (0.12)	0.69 (0.90)	4.01* (11.39)	-27.06* (5.31)
c_2 (σ_5)	0.79* (15.33)	0.59* (6.27)	0.32** (2.12)	0.04 (0.32)	1.01* (4.98)	-0.29 (-1.14)	-0.65* (-4.95)	0.94* (6.43)	0.38* (7.05)	2.18* (8.11)	0.56* (7.57)	1.05* (9.82)	0.18 (1.84)	0.99* (14.62)
R^2	0.90	0.60	0.14	0.004	0.48	0.04	0.48	0.61	0.65	0.71	0.68	0.78	0.11	0.89
F-Value	235.00*	39.40*	4.49**	0.10	24.84*	1.13	24.11	41.43*	49.74*	65.86*	57.40*	96.56	3.88	213.85*

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.6: Estimates of the elasticity of substitution based on (equation no. 13) logarithmic regression of net value added per unit of labour on wage rate and labour for Odisha,1980-2008. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
β_0	2.82 (4.11)	1.58* (2.60)	0.70 (0.95)	-0.03 (0.04)	2.75* (10.15)	1.65* (5.49)	0.007 (0.15)	0.60 (0.44)	2.48* (3.49)	1.65** (3.10)	-0.60 (1.14)	2.86* (5.36)	0.39 (0.28)	5.13 (2.96)
$\beta_1(\sigma)$	1.78 (3.89)	0.81 (1.36)	-0.12 (-0.15)	-0.68* (-5.34)	1.00* (3.48)	1.27* (4.29)	-0.48* (-3.19)	0.75 (0.67)	1.36* (3.31)	1.65** (3.10)	0.46 (0.98)	2.24 (3.18)	0.08 (0.15)	0.26** (2.08)
β_2	-0.23 (-2.96)	-0.09 (-1.22)	0.01 (0.15)	0.09* (5.91)	-0.23 (-6.89)	-0.10* (-2.68)	0.05* (2.82)	0.01 (0.09)	-0.19** (-2.14)	-0.12** (-1.98)	0.13** (2.31)	-0.25* (-3.57)	0.07 (0.37)	0.05** (3.37)
R^2	0.29	0.07	0.001	0.77	0.68	0.57	0.77	0.09	0.70	0.41	0.42	0.33	0.19	0.36
F-Value	5.23*	0.95	0.01	42.35*	26.94*	16.67*	43.32*	1.37	30.36*	9.01*	9.18*	6.39*	2.95	7.16*

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 1 and 27 respectively.

Table 5.7: Estimates of the elasticity of substitution based on (equation no. 14) logarithmic regression of labour on wage rate and net value added per unit of labour for Odisha, 1980/81- 07/08. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
P_0	9.56 (30.34)	8.76* (20.20)	7.78* (21.88)	1.76* (2.76)	10.60* (28.80)	9.43 (13.94)	0.73 (1.66)	7.75* (36.72)	8.60* (24.05)	9.29* (20.47)	7.87* (15.50)	8.75* (23.28)	6.66* (35.8)	42.65** (2.65)
P_1	6.39 (9.43)	7.81* (15.91)	8.11* (24.39)	3.51** (2.49)	5.08* (7.25)	8.18* (13.17)	-2.74 (-1.66)	5.61* (9.24)	4.85* (21.62)	6.41* (4.16)	3.97* (3.19)	8.95* (13.37)	2.55* (20.0)	-2.07 (-1.59)
P_2 (σ)	-1.11* (-2.96)	-0.62 (-1.22)	0.06 (0.15)	6.43* (5.91)	-2.83* (-6.89)	-2.11* (-2.68)	4.74* (2.82)	0.02 (0.09)	-0.79** (-2.15)	-1.12** (-1.98)	1.28** (2.31)	-1.32* (-3.57)	0.07 (0.37)	5.58* (3.37)
R^2	0.78	0.91	0.95	0.6	0.84	0.9	0.71	0.79	0.97	0.41	0.57	0.88	0.95	0.32
F-Value	44.92*	126.88*	297.57*	19.50*	69.95*	120.85*	31.57*	47.75*	574.52*	8.77*	16.88*	97.28*	250*	5.94*

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.8: Estimates of the elasticity of substitution based on (equation no. 13) logarithmic regression of net value added per unit of labour on wage rate and labour for Andhra Pradesh,1980- 2008. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
β_0	0.18 (0.30)	1.54* (7.79)	0.97** (2.00)	1.21* (7.91)	-0.54 (-0.55)	1.88* (2.79)	0.85 (1.56)	0.73 (1.13)	1.33* (4.70)	1.14* (2.75)	1.95* (4.28)	1.62* (4.03)	0.91* (3.07)	19.95* (2.58)
β_1(σ)	0.46* (3.36)	0.63* (6.46)	0.26 (1.51)	1.34* (8.40)	0.11 (0.32)	0.17 (0.99)	-0.02 (-0.08)	0.55 (1.92)	1.55* (3.87)	0.40** (1.97)	0.86* (4.31)	0.70* (4.38)	0.70* (6.12)	0.66* (3.46)
β_2	0.02 (0.53)	-0.09* (-6.10)	-0.02 (-0.71)	-0.15* (-5.29)	0.16 (1.29)	-0.14 (-0.54)	-0.001 (-0.01)	-0.01 (-0.25)	-0.16* (-2.79)	-0.04 (-1.08)	-0.16* (-3.21)	-0.10* (-3.03)	-0.06** (-2.17)	-0.11 (-1.63)
R^2	0.51	0.73	0.15	0.77	0.08	0.10	-	0.14	0.44	0.13	0.43	0.50	0.64	0.34
F-Value	13.23*	34.05*	2.30	42.34*	1.11	1.44	-	2.07	10.08*	1.96	9.78*	12.56*	22.54*	6.59*

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.9: Estimates of the elasticity of substitution based on (equation no. 14) logarithmic regression of labour on wage rate and net value added per unit of labour for Andhra Pradesh, 1980/81- 07/08. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
P_0	10.36* (22.70)	14.38* (19.22)	13.29* (13.39)	6.33* (15.88)	7.02* (16.29)	10.50* (16.68)	6.54* (10.05)	9.13* (12.42)	5.29* (11.24)	9.65* (10.43)	9.40* (16.68)	11.75* (15.50)	10.89* (14.52)	117.68* (20.88)
P_1	1.48* (2.92)	4.38* (4.59)	-1.84** (-1.89)	6.70* (12.25)	0.75 (1.39)	0.60 (1.28)	1.62 (2.34)	1.97** (2.38)	7.10* (14.08)	2.48* (2.90)	3.05* (5.02)	2.24 (2.44)	1.53 (1.21)	2.32* (5.18)
P_2 (σ)	0.37 (0.53)	-6.27* (-6.20)	-0.71 (-0.71)	-3.36* (-5.29)	0.37 (1.29)	-0.83 (-1.54)	-0.007 (-0.01)	-0.15 (-0.25)	-1.44* (-2.79)	-0.96 (-1.08)	-1.76* (-3.21)	-2.49* (-3.04)	-2.64** (-2.17)	-0.86 (-1.63)
R^2	0.43	0.6	0.2	0.87	0.14	0.12	0.17	0.19	0.9	0.25	0.51	0.28	0.16	0.53
F-Value	11.24*	19.47*	3.20**	87.81*	2.11	1.72	2.74	3.07	113.66*	4.23**	13.14*	5.02*	2.5	14.28*

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.10: Estimates of the elasticity of substitution based on (equation no. 13) logarithmic regression of net value added per unit of labour on wage rate and labour for Bihar, 1980-2008. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
β_0	1.78* (6.79)	1.54* (3.33)	0.89 (1.86)	0.003 (0.13)	0.79* (31.18)	2.15* (5.71)	-2.51 (-1.54)	2.50* (3.46)	0.40 (0.35)	1.36 (1.59)	3.48* (15.77)	1.82* (5.93)	1.65* (3.37)	11.18* (4.76)
β_1(σ)	0.03 (0.06)	1.19** (2.37)	0.23 (0.26)	-0.30 (-2.41)	0.03 (0.30)	0.60 (0.98)	-2.61 (-1.46)	0.34 (0.37)	0.85 (1.82)	-0.34 (-0.62)	0.58* (3.40)	0.95 (1.45)	0.83 (0.97)	-0.06 (-0.16)
β_2	-0.089* (-4.82)	-0.08 (-1.38)	-0.01 (-0.26)	0.08* (10.92)	0.005 (0.78)	-0.15* (-2.94)	0.46** (2.03)	-0.17 (-1.82)	0.03 (0.28)	-0.03 (-0.48)	-0.23* (-9.21)	-0.11* (-2.99)	-0.091 (-1.82)	0.005 (0.25)
R^2	0.43	0.19	0.01	0.93	0.029	0.34	0.17	0.26	0.11	0.02	0.88	0.26	0.12	0.003
F-Value	14.55*	3	0.25	172.65*	0.38	6.46	2.69	4.44**	1.66	0.26	97.07	4.50**	1.72	0.04

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.11: Estimates of the elasticity of substitution based on (equation no. 14) logarithmic regression of labour on wage rate and net value added per unit of labour for Bihar, 1980/81- 07/08. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
P_0	16.29* (14.51)	8.73* (14.48)	7.67* (9.32)	0.26 (0.88)	8.77* (27.81)	8.84* (14.07)	6.88* (53.78)	8.12* (16.24)	10.16* (26.60)	11.27* (18.07)	13.53* (24.44)	9.55* (8.99)	9.25* (7.44)	103.2* (4.10)
P_1	-6.47 (-1.59)	7.07* (6.06)	-1.20 (-0.82)	0.90 (0.62)	4.51 (12.05)	7.80* (5.75)	7.01* (12.58)	7.56* (7.50)	-0.84 (-0.93)	-1.50 (-1.05)	3.43* (7.14)	9.34* (3.70)	6.47** (2.14)	3.43 (0.92)
P_2 (σ)	-5.41* (-4.82)	-0.88* (-1.38)	1.75 (1.72)	9.54* (10.92)	-0.72** (-1.98)	-1.66* (-2.94)	0.30** (2.03)	-0.66 (-1.88)	0.10 (0.28)	-0.25 (-0.48)	-3.31* (-9.21)	-2.36* (-2.99)	-1.29 (-1.82)	0.52 (0.25)
R^2	0.58	0.59	0.11	0.91	0.87	0.7	0.87	0.77	0.03	0.04	0.94	0.48	0.22	0.03
F-Value	17.29*	18.58*	1.67	139.96	85.20*	29.91*	90.20*	42.28*	0.44	0.63	228.05*	11.78*	3.71**	0.45

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.12: Estimates of the elasticity of substitution based on (equation no. 13) logarithmic regression of net value added per unit of labour on wage rate and labour for Madhya Pradesh, 1980/81- 07/08. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
β_0	1.37* (5.63)	1.74* (19.29)	3.22* (11.34)	0.54** (2.10)	2.43* (16.68)	1.62* (11.64)	2.49* (10.85)	0.77* (5.48)	1.87* (8.31)	1.06* (3.99)	1.16* (3.04)	1.40* (9.88)	1.47* (11.30)	17.44* (8.90)
β_1(σ)	1.57* (6.76)	1.08* (7.78)	-1.40* (-2.92)	0.39 (0.71)	1.61* (3.55)	0.15 (0.49)	1.96* (8.15)	2.47* (9.54)	1.85* (8.04)	1.83* (6.82)	0.63 (1.87)	1.50* (7.98)	1.80* (10.59)	1.84* (9.50)
β_2	-0.07* (3.68)	-0.10* (-12.24)	-0.16* (-11.11)	0.05 (1.43)	-0.19* (-10.46)	-0.07* (-5.46)	-0.20* (-6.29)	-0.04* (-2.96)	-0.12* (-4.49)	-0.05* (-2.56)	-0.03 (-0.95)	-0.08* (-6.98)	-0.09* (-6.08)	-0.07* (-5.39)
R^2	0.78	0.90	0.84	0.08	0.81	0.54	0.80	0.81	0.79	0.72	0.14	0.82	0.82	0.80
F-Value	46.33	116.56*	69.81*	1.17	55.84*	14.91*	50.29*	53.81*	47.01	32.65*	2.15	57.26*	58.21	80.95*

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.13: Estimates of the elasticity of substitution based on (equation no. 14) logarithmic regression of labour on wage rate and net value added per unit of labour for Madhya Pradesh, 1980/81- 07/08. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
P_0	13.76* (18.51)	15.64* (30.21)	19.34* (24.50)	5.42* (5.62)	11.56* (31.54)	15.81* (10.04)	10.36* (23.75)	12.37* (15.79)	11.22* (16.11)	12.69* (14.74)	11.88* (9.45)	14.81* (17.26)	12.86* (16.19)	182.2* (17.25)
P_1	4.43 (1.52)	8.59* (5.80)	-10.27* (-4.37)	-2.30 (-0.81)	8.78* (4.72)	2.28 (0.77)	6.43* (5.25)	13.34* (3.26)	8.38* (11.18)	4.33 (1.24)	1.04 (0.48)	11.77* (4.62)	13.42* (6.80)	11.01* (3.36)
P_2 (σ)	-4.59* (-3.68)	-8.16* (-12.24)	-5.10* (-11.11)	1.41 (1.43)	-4.14* (-10.46)	-7.30* (-5.46)	-3.10* (-6.79)	-5.67* (-4.08)	-3.59* (-4.49)	-3.20* (-2.56)	-1.12 (-0.48)	-7.92* (-6.92)	-6.45* (-6.08)	-6.94* (-5.39)
R^2	0.44	0.85	0.88	0.09	0.85	0.55	0.65	0.4	0.87	0.25	0.03	0.65	0.66	0.57
F-Value	10.22*	75.93*	95.85*	1.25	73.32*	15.29	23.59*	8.48*	87.25*	4.26**	0.47	24.01*	24.27*	16.93*

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.14: Estimates of the elasticity of substitution based on (equation no. 13) logarithmic regression of net value added per unit of labour on wage rate and labour for West Bengal, 1980- 2008. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
β_0	–	0.19 (0.49)	1.51** (2.33)	3.70* (5.77)	1.86 (1.56)	2.00* (3.68)	1.60 (1.64)	5.21* (10.99)	1.83* (3.65)	3.52* (6.11)	1.83** (2.48)	2.51* (9.87)	1.61* (7.40)	49.27* (9.25)
β_1(σ)	3.60* (3.13	-1.51 (-0.96)	0.53 (0.70)	0.60 (0.66)	-0.57 (-0.55)	-0.60 (-0.49)	0.26 (0.39)	0.86 (1.83)	0.55 (0.90)	2.34** (2.44)	1.18 (2.26)	1.43 (1.61)	0.10 (0.12)	-0.32 (-0.33)
β_2	-0.01 (-0.07)	0.11 (1.82)	-0.06** (-2.01)	-0.33* (-3.77)	-0.11 (-0.77)	-0.08 (-1.82)	-0.07 (-0.70)	-0.42* (-8.22)	-0.10 (-0.75)	-0.32* (-4.30)	-0.11* (-2.69)	-0.18* (-3.91)	-0.06 (-1.43)	-0.26* (-4.65)
R^2	0.34	0.13	0.25	0.71	0.12	0.5	0.02	0.76	0.1	0.44	0.34	0.62	0.36	0.72
F-Value	6.54*	1.93	4.26**	30.92*	1.81	12.63	0.25	39.65*	1.54	9.93*	6.54*	20.66*	7.04*	33.08

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Table 5.15: Estimates of the elasticity of substitution based on (equation no. 14) logarithmic regression of labour on wage rate and net value added per unit of labour for West Bengal, 1980/81- 07/08. (Real Values)

Codes→	20_21	22	23_24_25	26	27	28	29	30	31	32	33	34_35_36	37	Overall
P_0	13.88* (11.45)	4.93* (7.12)	9.12* (4.78)	8.69* (12.76)	8.47* (32.13)	6.91* (10.01)	9.07* (21.6)	11.01* (18.57)	9.41* (11.37)	8.86* (18.69)	14.89* (10.34)	8.25* (8.33)	5.89* (4.81)	130.38* (11.68)
P_1	-9.10 (-1.78)	18.98* (6.33)	8.24 (1.78)	6.66* (6.72)	5.16* (5.25)	12.82* (11.04)	2.33** (2.05)	3.57** (2.32)	5.37* (3.02)	8.52* (6.51)	-3.76 (-0.99)	14.00* (9.21)	16.61* (10.74)	6.58* (1.38)
P_2 (σ)	-0.22 (-0.27)	1.04 (1.82)	-0.50 (-0.40)	-1.09* (-3.77)	-0.21 (-0.77)	-0.45 (-1.02)	-0.25 (-0.70)	-1.70* (-8.22)	-1.09 (-1.75)	-1.31* (-4.30)	-1.90* (-2.69)	-2.10* (-3.91)	-1.20 (-1.43)	-1.72* (-4.65)
R^2	0.19	0.65	0.11	0.89	0.57	0.91	0.15	0.79	0.32	0.74	0.32	0.9	0.88	0.8
F-Value	2.93	23.73*	1.62	107.3*	17.25*	133.9*	2.32	48.32*	6.08*	36.38*	6.10*	119.5*	97.25*	11.19*

Source: Author's Calculation, ASI, Parentheses values are the t values. * Statistically significant at 1 percent level. ** Statistically significant at 5 percent level, "σ" implies capital labour substitution. Degrees of freedom of F for the numerator and denominator are 2 and 27 respectively.

Figure 5.1: Possibilities of Capital Labour Substitution in Odisha's Manufacturing Sector

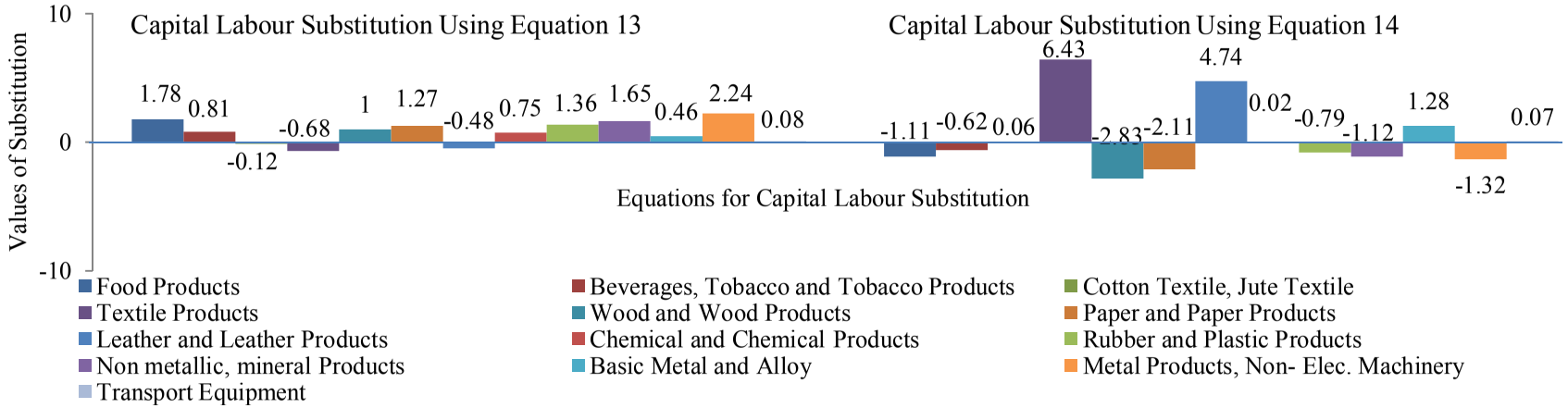
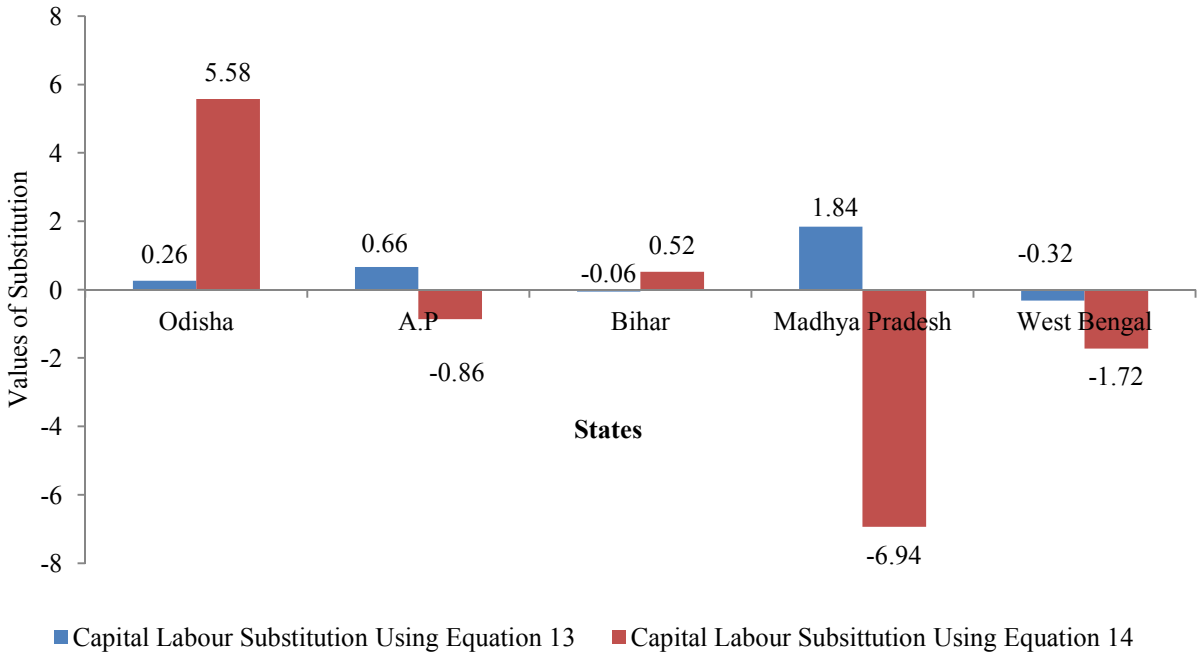


Figure 5.2: Capital Labour Substitution in Manufacturing Sector: A Long Term Perspective for Odisha and its neighbouring States (1980/81- 07/08)



* * *

Chapter- 6
Summary and Conclusions

6.1 Summary and Conclusion

This study examines the disparities of growth in income and manufacturing, its spread in Odisha and its neighbouring states. The most important examinations of this study are growth rates, the spatial spreads of manufacturing and estimation of possibility of capital labour substitution of manufacturing groups for Odisha and its neighbouring states. The analysis of the growth performances in real gross state domestic product and per capital gross state domestic product reveals that the development processes are uneven across Odisha and its neighbouring states. The variation in standard of living in terms of income are found higher, but there is an evidence of less variation in per capita income. It is interesting to note that the variation in terms of total income and per capita income have declined over the studied time period for Odisha and its neighbouring states.

The contributions of tertiary sector are proved as the engine of growth. It has seen that the shares of service sector to the overall growth are very high in comparison to agriculture and industry sector. This is true for Odisha and its neighbouring states and all India over the studied time period. Industry remains as an important sector in growth pie, and the organized manufacturing has given a boost to the industrial sector. It may be because of the share of organized manufacturing to the industry in all India is near about 80 per cent. The examination of manufacturing is always given due importance due to mainly the employment concern. It is because a healthy and growing manufacturing sector can sustain the economic growth as It has been shown from the experiences of many developing countries. Slower growth can be caused partly may be due overdependence on service sector and the negligence of its manufacturing sector. Results from most research studies showed that service can not be an engine for a sustained growth in income and employment in India. In the long run the growth of the service sector would also depend on the manufacturing base (Siddharthan, 2012). The manufacturing groups are with higher growth rate and capable to absorb employment found are given. The manufacturing groups like wood and wood products (27), rubber and plastic products (31), non metallic mineral products (32), basic metal and alloys (33) has given a healthy contribution to the

growth of the economy of Odisha and all its neighbouring states. The growth of all manufacturing is remained satisfactory over period of time.

The growths of all manufacturing groups have shown an increase in its share for the economy of Odisha. The disparities are found higher using number of employees as an indicator, but the same is less using fixed capital for Odisha and its neighbouring states over the studied time period. It is found from the calculation of the compound annual growth rate and its variation among manufacturing groups in terms of number of employees, net value added, fixed capital and number of factories. This study has revealed that the growth of number of employees has varied higher after 1990 in comparison to its previous period. It is also interesting to find a wider variation in employment growth among Odisha and all its neighbouring states. The compound growth rate of overall manufacturing of terms of fixed capital are recorded at 9.22 percent over the time for Odisha. Odisha has shown a healthy growth performance with all its neighbouring states in terms of fixed capital. But the overall disparities with all indicators of manufacturing of CAGR has shown a less variation for all manufacturing of Odisha and its neighbouring states. However, industries like food and food products (20_21), textile products (26), paper and paper products (28), non metallic, mineral products (31) and basic metal and alloys (33) have recorded less disparities in terms of growth of net value added for Odisha and all its neighbouring states over the period of time. The CAGR of number of factories in Odisha for 1980-2008 are witnessed as 1.95 for food and food products, 0.74 for beverages tobacco and tobacco products (22), 3.24 for textile products (26), 6.90 for leather and leather products (29), 0.88 for chemical and chemical products (30), 10.89 for rubber and plastic products (31), 2.40 for non metallic mineral products (32) and 3.43 for basic metal and alloys (33) over the period of time. This implies that most of the manufacturing groups have shown a positive growth in Odisha and its neighbouring states over the time period.

The result indicates that the above manufacturing groups play an important role in Odisha and these industries are found to be dominant groups because of a positive and higher compound growth over three decades. It is also interesting to note that these industry groups have shown positive growth rate using all indicators of manufacturing over the period of time for Odisha. Andhra Pradesh and Odisha has similar kind of growth in manufacturing groups while other three states have shown a different figure in this characterstic.

The second attempt of this study was to calculate the location quotient and to examine the manufacturing spread over time by taking Odisha and all its neighbouring states into consideration. Location quotient are calculated to find out the basic industries which have the capability to produce an extra unit after meeting the needs of the local demand. It is very important to identify which industries are capable to proudce an extra unit after meeting the local demands. These calculations can identify the well performed industries which satisfy the local requirments and have capability to export outside generating higher level of output. Out of the thirteen manufacturing groups, the basic manufacturing groups which are found capable of producing an extra unit is wood and wood products (27), rubber and plastic products (31), non metallic mineral products (32), basic metal and alloys (33) and transport equipment (37). The variation for basic industries over the time period has fallen and net value added has shown a relatively better picture than number of employees. Wood and wood products (27) and basic metal and alloys (33) are found to be basic industries in output (net value added) with 1.98 and 2.14 respectively. Remaining industries rather than Wood and wood products (27) and basic metal and alloys (33) are found as non basic in terms of output produced. Therefore What it can be inferred is that most of the dominant industries in terms of their compound annual growth rate are found basic over the studied time period in Odisha and its neighbouring states. This is an interesting finding of this study.

The Grossack's measure in terms various indicators are calculated and compared with each other to show dispersal of Odisha's manufacturing sector with the help of regression coefficient 'b', correlation coefficient 'r' and a product moment of regression analysis. As the regression analysis and correlation coefficient are used for the share of manufacturing of terminal year over a base year. When there is a value of "b" less than 1, it means that larger locations of the base year have lost their share in average. The complete analysis of Grossack's measure is based on the time phases divided into a semi decades for all manufacturing groups in Odisha and all its neighbouring states. The complete explanation indicates some simple inferences; a high value of 'r' and a lower value of $(b/r)^2$ show manufacturing groups expansion of manufacturing is being shared by the larger locations only. Dispersion has emerged may be because of changes in the relative share of above average regions. If there is a lower value of 'r', but higher value of $(b/r)^2$, it shows manufacturing dispersal has emerged because of the larger locations having lost their share to each other. If a lower value of 'r' as well as lower value of

$(b/r)^2$ is found, then it shows the manufacturing dispersion has emerged because significant locations of the base year have lost their share to other significant locations as well as to the insignificant locations. This study found that the manufacturing groups of Odisha have a tendency towards dispersal. In terms of fixed capital, the dispersion is very high after 1998. This dispersal is high in terms of net value added with 18 percent. The dispersion is found may be because of the larger locations and manufacturing groups have lost their share to each other over the period of time. It is also found that the significant regions have lost their share to each other and to insignificant regions. This is also another interesting finding of this study for Odisha manufacturing over the period of time.

In this study, there was an attempt to calculate values of possibility of labour for capital manufacturing groups of Odisha and its neighbouring states over the period 1980-2008. It is found from the previous studies that the efficiency parameter, the scale parameter and the extent of substitutability between factors can be obtained by directly estimating the parameters of a suitable specified production function through regression analysis. So, various equations were fitted to find out a complete picture of possibility of capital labour substitution in the manufacturing groups. Two important equations such as Capital labour substitution production function (equation 13 in this study) and some of its developments (equation 14) are used to find out the values of capital labour substitution. A major problem with estimation of the equation 13 is that it would be difficult to find out the significance of capital labour substitution since it is derived as a ratio of two coefficients. Equation 14 is found good fit for all manufacturing groups in Odisha and its neighbouring states in comparison to equation 13. Though there are number of equations are used to calculate these possibilities, but equation 14 found best fit for the manufacturing groups in Odisha and its neighbouring states It is very interesting to note that the manufacturing groups which are found important, dominant and basic over the period of time for Odisha and its neighbouring states. Using equation 13, it was found Odisha, West Bengal and Andhra Pradesh has a value of capital labour substitution which is significantly different from zero for overall manufacturing. At the same time equation 14 provided a significant capital labour substitution value which is different from unity. In both the cases the hypothesis of unitary elasticity of substitution is clearly rejected. But other two states show an insignificant capital labour substitution value. In equation 13, a slow absorption of surplus input in response to

change factor prices, consequently a slow growth of employment inference are drawn. But equation 14 shows the completely different picture for these three states.

Though It is seen that there is a decline in unemployment rate from the 61st round (July, 2004 to June, 2005) to the 62nd round (July, 2005 to June 2006) and a higher possibilities of substitution of labour for capital, the problem of unemployment is chronic. So the faulty policies of the government may be responsible for it.

6.2 Delimitations of the Study

Given the short span of time, a complete study is not possible. Hence scope for the further research may be taken through delimitations. These are presented here to motivate further research and to conduct re-examination of manufacturing groups in Odisha and its neighbours. The first delimitation of this study is found in terms of its division of time phases. Rather showing an argument as semi decade phases, there is no such strong reasons behind it. There are six time phases for growth rate while five phases are taken to use Grossack's index, though there is an addition of another complete time phase for Grossack's measure. It is taken only for smooth calculation on growth and Grossack's index respectively. But, it shows a lack of uniqueness in this division of time period. And the another delimitation of this study is found that Grossack's index can be calculated for individual manufacturing groups, which has not been calculated in this study. But, it is also true that calculation of Grossack's index for thirteen individual manufacturing groups and that to six time phases require too much time, space and patience.

The additional work like district level explanations of manufacturing can also be considered further. Second delimitation of this study is to assume all its neighbouring states as national share to calculate both of location quotient and Grossack's measure which may not give an appropriate picture to Odisha. But, it is also true that this study is aiming to compare Odisha with its neighbouring states. However, a more transparent picture can be drawn if the same study could be taken for Odisha and all other states in India. Only fear is the volume of the study would be very large, if Odisha and all states considered. Very important delimitation of this study is to use book value of fixed capital instead of its proper calculation through a suitable method like perpetual inventory method.

* * *

Appendix-1

Table 3.8: State wise Compound Annual Growth Rate of Wage in the two digit registered manufacturing sector of each industry from 1980/81- 07/08. (Real Values)

Code →	**20_21**	**22**	**23_24_25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34_35_36**	**37**	**Over all**
Andhra Pradesh	4.63	0.82	11.60	11.80	2.65	2.64	3.34	4.97	9.31	5.57	9.25	2.39	0.88	2.60
Bihar	-0.05	2.85	-3.7	11.01	-0.79	-4.07	-1.48	-4.8	2.54	-0.88	-0.12	-1.78	-2.21	-2.41
Madhya Pradesh	6.46	0.48	-2.25	3.04	-0.13	-0.44	6.54	3.95	-8.52	3.06	1.34	2.89	5.98	2.03
Odisha	6.99	8.31	-5.65	5.39	-0.51	-2.37	16.25	4.03	20.23	1.51	3.93	0.37	-8.08	0.29
West Bengal	3.54	2.37	-0.47	-3.44	-0.02	-2.93	-1.42	-0.79	-0.02	-1.28	-0.1	-0.26	-5.69	0.82
C.V.	0.58	0.95	-64.56	1.00	5.14	-1.63	1.4	2.53	2.04	1.59	1.23	2.38	-2.71	6.59

Source: Author's Calculation, EPW Research Foundation Data and ASI Summary Results, wage are deflated by suitable consumer price index of industrial workers.

References

Abramovitz, M., 1986, "Catching Up, Forging Ahead, and Falling Behind", *Journal of Economic History,* Vol. 46, No. 2, pp. 385-406.

Ahluwalia, I.J., 1986, "Industrial Growth in India: Performance and Prospects", *Journal of Development Economics*, Vol. 23, No. 1, pp. 1-18.

Ahluwalia, I.J., 1991, *"Productivity and Growth in Indian Manufacturing"*, Oxford University Press, Delhi.

Albin, A., 1988, "Manufacturing Sector in Kerala, A Study of Scale Structure and Growth", *M. Phil dissertation submitted to Jawaharlal Nehru University*, New Delhi.

Algha, Y.K. *et al.*, 1971, "Regional Industrial Diversification in India", *Economic and Political Weekly,* Vol. 6, No. 15, pp. 795-802.

Armstrong, H. and J. Taylor, (ed.), 2000, *"Regional Economics and Policy"*, Black Well Publication, pp. 1-437.

Arrow, K. *et al.*, 1961, "Capital-labour Substitution and Economic Efficiency", *Review of Economics and Statistics*, Vol. 43, No. 3, pp. 225-250.

Arun, T.G., 1992, "Growth and Structural Changes in the Manufacturing Industries in Kerala 1967-87, *M. Phil dissertation submitted to Jawaharlal Nehru University*, New Delhi.

Bhattachary, B.B., and S. Sakthivel, 2004, "Regional Growth and Disparity in India: A Comparison of Pre and Post Reform Periods", *Working Paper No. 244*, Institute of Economic Growth, New Delhi.

Bhusnurmath, M., 2012 (June 4), "The Fault Dear Brutus..." The Economic Times, pp.16

Chenery, H. B. and L. Taylor, 1968, "Development Patterns among Countries and over Time", *Review of Economics and Statistics,* Vol. 50, No. 4, pp. 391-416.

Chenery, H. B., 1960, "Patterns of Industrial Growth", *American Economic Review,* Vol. 50, No. 4, pp. 624-654.

Dadi, M.M., 1970, "Productivity, Wage rate and Relative Share of Workers in Manufacturing Industries", *Economic and Political Weekly*, Vol. 5, No. 17, pp. 711-715.

Dasgupta, D. *et al.*, 2000, "Growth and Interstate Disparities in India", *Economic and Political Weekly*, Vol. 35, No. 27, pp. 2413-2422.

Dash, M.K., Kabra, G., and Ajaya singh, 2010, **"**Productivity Growth of Manufacturing Sector in India an Inter-State Analysis", *European Journal of Scientific Research*, Vol. 44, No. 3, pp. 387-399.

Dhananjayan, R.S., and Muthulakshmi, 1989, "Factor Substitution in Indian Manufacturing Sector: A Disaggregative Analysis of Large Non-Traditional Industries", *Indian Journal of Industrial Relations*, Vol. 24, No. 3, pp. 295-311.

Dhar, P.N. and D.U. Satstry, 1969, "Inter-State Variations in Industry, 1951-61", *Economic and Political Weekly*, Vol. 4, No. 12, pp. 535-538.

Dholakia, R.H., 1979, "An Interstate Analysis of Capital and Output in the Registered Manufacturing Sector", *Indian Journal of Industrial Relations*, Vol. 15, No. 1, pp. 63-76.

Dholakia, R.H., 1989, "Regional Aspects of Industrialization in India", *Economic and Political Weekly*, Vol. 24, No. 46, pp. 2563- 2567.

Dhryemes, P.J. and P. Zarembka, 1970, "Elasticities for Substitution for Two-Digit Manufacturing Industries: A Correction", *Review of Economics and Statistics*, Vol. 52, No. 1, pp. 115-117.

Dhryemes, P.J., 1965, "Some Extensions and Tests for the CES Class of Production Functions", *Review of Economics and Statistics*, Vol. 47, No. 4, pp. 357 -366.

Dhryemes, P.J., 1967, "Adjustment Dynamics and the Estimation of CES Class of Production Functions", *International Economic Review*, Vol. 8, No. 2, pp. 209-217.

Ebenstine, A.Y. *et al.*, 2011, "A Spatial Analysis of Selected Manufacturing and Service Sectors in China's Economy using Country Employment Data for 1990 to 2000", *Regional Studies*, Vol. 45, No. 3, pp. 351-369.

Fernandese, A.M., and G. Sharma, 2012, "Determinants of Industrial Cluster in India", *International Growth Center*, Www. theigc.org/sites/default/files/gunjan_sharma1.pdf (accessed on March, 2012).

Fitchett, D.A., 1976, "Capital-Labor Substitution in the Manufacturing Sector of Panama", *Economic Development and Cultural Change*, Vol. 24, No. 3, pp. 577-592.

Ghos, A., 1975, "Concentration and Growth of Indian Industries, 1948-1968", *The journal of Industrial Economics*, Vol. 23, No. 3, pp. 203- 222.

Goldar, B., 2004, "Indian Manufacturing: Productivity Trends in Pre and Post-Reform Periods", *Economic and Political Weekly*, Vol. 39, No. 46/47, pp. 5033-5043.

Goldar, B., 2004, "Productivity Trends in Indian Manufacturing of the Pre and Post Reform Periods", *Working Paper No. 137*, ICRIER, pp. 1-34.

Griliches, Z., 1968, "Production Functions in Manufacturing: Some Additional Results", *Southern Economic Journal*, Vol. 35, No. 2, pp. 151-156.

Grossack, I.M., 1965, "Towards an Integration of Static and Dynamic Measures of Industry Concentration", Review *of Economics and Statistics*, Vol. 47, No. 3, pp. 301-308.

Grossack, I.M., 1972, "The Concept and Measurement of Permanent Industrial Concentration", *The Journal of Political Economy*, Vol. 80, No. 4, pp. 745- 760.

Gujurati, D.N. and Sangeeta, (ed.), 2007, "*Basic Econometrics*", Tata McGraw- Hill Edition, New Delhi.

Hoffman, W., 1958, "The Growth of Industrial Economies", Manchester: Manchester in India an Inter-State Analysis", *European Journal of Scientific Research*, Vol. 44, No. 3, pp. 387-399.

Jauqueline, M.H.M., 1991, "Some Aspects of Changes in the Structure Growth of Manufacturing Sector in Tamil Nadu, 1973-74 to 1986-87", *M. Phil dissertation submitted to Jawaharlal Nehru University,* New Delhi.

Kaur, K., 1983, "*Structure of Industries in India*", Deep and Deep Publication, New Delhi.

Kelly, W.A (jr.), 1981, "A Generalized Interpretation of Herfindhal Index*" Southern Economic Journal*, Vol. 48, No. 1, pp. 50-57.

Khan, A.H. and M. Rafiq, 1993, "Substitution among Labour, Capital, Imported Raw Materials, and Bank Credit in Pakistan's Manufacturing", *The Pakistan Development Review*, Vol. 32, No. 4, pp. 1259- 1266.

Laumaus, P. S., and M. Williams, 1981, "The Elasticity of Substitution in India's Manufacturing Sector", *The Journal of Development Economics*, Vol. 8, No. 8, pp. 325- 337.

Lianos, T.P., 1975, "Capital-labour Substitution in a Developing Country: The Case of Greece", *European Economic Review*, Vol. 6, No. 6, pp. 129-141.

Majumdar, S.K., 1996, "Fall and Rise of Productivity in Indian Industry: Has Economic Liberalisation had an Imapact?" *Economic and Political Weekly*, Vol. 31, No. 48, pp. 46-53.

Mathur, A., 1992, "Regional Economic Change and Development Policy in India*", Indian Journal of Applied Economics*, Vol. 1, No. 2.

Michelini, C and M. Pickford, 1985, "Estimating the Herfindhal Index From Concentration Ratio Data", *Journal of the American Statistical Association*, Vol. 80, No. 390, pp. 301-305.

Mulat, T., 1980, "Capital Labour Substitution in the Ethiopian Manufacturing Industries", *The Developing Economies*, Vol. 18, No. 3, pp. 275- 287.

Nath, S.K., 2005, "*Industrial Statistics of India: Status and Issues*", Expert Group Meeting on Industrial Statistics New York, 19-23 September, Two United Nations Plaza, Conference Room 23rd floor*,* ESA/STAT/AC.105/7.

Nayyar, D., 1978, "Industrial Development in India: Some Reflections on Growth and Stagnation", *Economic and Political Weekly,* Vol. 22, No. 31-33, pp. 3121-31.

Panda, M., 2008, "Economic Development in Orissa: Growth without Inclusion?" *Working Paper-025,* Indira Gandhi Institute of Development Research, Mumbai.

Papola, T.S., 1980, "Spatial Diversification of Industries", A Study of Uttar Pradesh", *Development Bank of India.*

Papola, T.S., *et al.*, 1979, "Studies on Development of Uttar Pradesh", *Giri Institute of Development Studies*, Lucknow.

Roskamp, K.W., 1977, "Labour Productivity and the Elasticity of Factor Substitution in West German Industries 1950-1960", *Review of Economics and Statistics*, Vol. 59, No. 3, pp. 366-371.

Sahu, P.K., 2005, "Employment and Investment in Organised Manufacturing Sector in India: An Interstate Analysis", *M.Phil dissertation submitted to Jawaharlal Nehru University*, New Delhi.

Saikia, D., 2011, "Does Economic Integration Affect Spatial Concentration of Industries? Theory and a Case Study for India", *Romanian Economic Journal*, No. 42, pp. 90-114.

Sankar, U., 1970, "Elasticities of Substitution and Returns to Scale in Indian Manufacturing Industries", *International Economic Review*, Vol. 11, No. 3, pp. 399-41.

Seth, K., 1987, *"Industrialization in India, Spatial Perspective"*, Commonwealth Publishers: New Delhi, India.

Seth, S., 2012, "Cos Prefer More Capital over Labour, Create Less Jobs", The Economic Times, 4th Feb., 2012, pp.8.

Seth, V.K and Dev R. Gulati, 1974, "Location Dynamics of Indian Manufacturing Industries—A Study of Inter-Temporal Shifts in Labour and Capital Concentration", *Indian Journal of Industrial Relation*, Vol. 9, No. 4, pp. 493-506.

Siddharthan, N.S., 2012 (June 14), "Reforms Yes, but of the right type", *The Hindu*, pp. 12

Singh, H., 1987, "*Regional Disparity in Industrial Growth*", Anmol Publication, New Delhi.

Singh, L. and K.C. Singhal, 1985, "Capital-Labour Substitution in Punjab Industry", *Indian Journal of Industrial Relations*, Vol. 21, No. 2, pp. 206-218.

Stigler, G.J., 1947, "Trends in Output and Employment", New York: *National Bureau of Economic Research.*

Sutcliffe, W.B., 1971, "*Industry and Underdevelopment*", Addison-Wesley Publishing Company: London.

Tinbergen, J., 2005, "*Econometrics*", e- book, Routledge, London.

Tiwari, P., Syamwil, I.B. and M. Doi, 2003, "Spatial Pattern of Japanese Manufacturing Industry in Four ASEAN countries", *Papers in Regional Science*, Vol. 82, No. 3, pp. 403-415.

Trivedi, *et al.*, 2011, "Productivity Efficiency and Competitiveness of the Indian Manufacturing Sector", www.rbi.org.in/scripts/PublicationView.aspx?id=13366#21, (accessed on March, 2012), pp. 1-82.

Unel, B., 2003, "Productivity Trends in India's Manufacturing Sector in Two Decades", *IMF Working Paper-03/22.*

Upender, M., 1996, "Elasticity of labour productivity in Indian Manufacturing Sector", *Economic and Political Weekly*, Vol. 31, No. 21, pp. 7-10.

Vyasulu, V. and A. V. Arun Kumar, 1997, "Industrialisation in Orissa: Trends and Structure", *Economic and Political Weekly*, Vol. 32, No. 22, pp. 46-53.

Weiss, R.D., 1977, "Elasticities of Substitution Among Capital and Occupation in U.S. Manufacturing", *Journal of the American Statistical Association*, Vol. 72, No. 360, pp. 764-771.

Williams, R.L., 1974, "Capital-Labour Substitution in Jamaican Manufacturing", *The Developing Economies*, Vol. 12, No. 2, pp. 169-181.

Xiao, Y. J. and F. Young Heng, 2008, "Utilizing Location Quotient Technique to Analyze Preponderant Industry in Boji City, Shanxi Province", Xi'an University of Architecture and Technology, P.R. China, *Science Innovation Academic Frontier*, pp. 63-67.