Agglomeration Economies and Productivity Relationship in the Organised Manufacturing Sector of India

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CERTIFICATE

I do hereby declare that the dissertation entitled **"Agglomeration Economies and Productivity Relationship in the Organised Manufacturing Sector of India"** for the award of M. Phil is a bona fide work and it has not been submitted to any other University for the award of any other degree.

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DEDICATED

TO MY

DEAR

PARENTS

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Abbreviations

ASI: Annual Survey of Industries

FICCI: Federation of Indian Chambers of Commerce and Industry

GDP: Gross Domestic Product

ICT: Information and Communication Technology

L.I.: Localisation Index

LPROD: Log of Labour Productivity

L.Q.: Location Quotient

LRD: Longitudinal Research Database

MSA: Metropolitan Statistical Area

NIC: National Industry Classification

NIP: National Industrial Policy

NSS: National Sample Survey

NVA: Net Value Added

OLS: Ordinary Least Squares

TFP: Total Factor Productivity

U.N.: United Nations

U.I.: Urbanisation Index

Chapter 1

Introduction and Literature Review

1.1 Introduction

Does geography have any role to play in the location decision of firms and industries? Why do we find the presence of clusters of industries in some regions? The importance of geographical factors in economic theory is accepted for a long time but due to the difficulties inherent in modelling increasing returns, these factors have often been ignored. During the last decade or so, such factors have formed a key component of research on increasing returns and agglomeration economies. This research on agglomeration economies has been made possible by an improved understanding of three factors which influence the spatial concentration of population and economic activity (Lall et. al, 2001). These factors are technological or non pecuniary externalities[1], increasing returns to scale and spatial competition. The spatial concentration of population and economic activities can only be explained with the help of increasing returns to scale, (Fujita and Thisse, 1996). This simply means that if there were non-increasing returns to scale, each and every individual would produce for his own consumption and there would not be any incentive to concentrate production and economic activity in particular locations. Increasing returns imply that average costs of production decline as output is increased and certain locations would become more favourable than others.

Since agglomeration economies have been proven to play a significant role in the regional development analysis, it is important to understand the meaning of agglomeration economies in detail. Agglomeration economies are a form of external economies of scale. External economies of scale arise when the long-run average cost declines in response to changes taking place outside the firm like expansion in the city size or expansion in the industry size (things which are not under the control of the firm). While internal economies of scale exist when the long-run average cost declines in response to increase in the level of activity in the firm. The meaning and distinction between various kinds of economies is clear from examples presented on the subsequent page compiled from the distinction presented in the World Development Report, 2009, (Table 1). Agglomeration economies basically mean that a spatial concentration of economic activity generates positive effects on the productivity of the firms located in the area in question.

[1] Technological externalities are an economic situation where production functions of one firm is favourably or unfavourably affected by the production function of other firms.

Table 1.1: Types and Examples of Economies of Scale

Sno.	Types of economies of scale	Examples
1	**Internal**	
	a) *Pecuniary*	Able to purchase intermediate inputs at volume discounts
	b) Technological	
	i) Static	Falling AC because of fixed costs of operating a plant
	ii) Dynamic	Learning to operate a plant more efficiently over time
2	**External or Agglomeration**	
	a) Localisation	
	i) Shopping	Shoppers are attracted to places where there are many sellers
	ii) "Smith" Specialization	Outsourcing allows both the upstream input suppliers and downstream firms to gain from productivity gains.
	iii) "Marshall" Labour pooling	Workers with industry-specific skills are attracted to a location where there is greater concentration.
	b) Urbanization	
	i) "Jane Jacobs" innovation	The more that different thing is done locally, the more opportunity is for observing and adapting ideas from others.
	ii) "Marshall" labour pooling	Workers in an industry bring innovations to firms in other industries; similar to no. 2(iii) above, but the benefit arises from the diversity of industries in one location.
	iii) "Romer" endogenous growth	The larger the market, the higher the profit; the more attractive the location to firms, the more jobs there are;

Source: Adapted from World Development Report, 2009.

Agglomeration economies extend over at least three dimensions. The extents to which these economies extend are referred as its scope. This includes industrial scope, geographic scope, and temporal scope, (Rosenthal and Strange, 2003). This Industrial scope means the degree to which agglomeration economies extend across all industries and even among all industries in the city. Geographical scope means that agglomeration economies extend across cities and they increase in magnitude with the decrease in distance. Temporal scope means that the agglomeration economies of the past period may have an effect on the productivity and efficiency of firms in the present period. The present study precisely studies an important and old issue i.e. whether the clustering and concentration of economic activity has any kind of effect on the productivity level?

It has been observed by many developmental economists and historians that economic growth tends to be localised. An important example in this context is of East Asia. East Asia is viewed as comprising Japan and nine other countries i.e. South Korea, Taiwan, Hong Kong, Singapore, Philippines, Thailand, Malaysia, Indonesia and China. In 1990, the total population of East Asia was about 1.6 billion. With only 3.5 % of the total area and 7.9 % of the total population, Japan accounted for 72 % of the gross domestic product (GDP) and 67% of the manufacturing GDP of East Asia. So what are the reasons of this phenomenon? Strong regional inequalities within the same country also mean the existence of agglomeration at another spatial scale.

In the broadest sense, such economies occur when individuals benefit from being near to other individuals. Nearness can involve physical proximity but transport and communications play a crucial role because in most contexts speed and low costs in transport and communication provide a direct substitute for physical proximity. Such economies arise because of the production benefits of locating closer to other firms. But clustering and concentration of economic activity can also give rise to external diseconomies of scale. As cities become more and more crowded, there is shortage of infrastructure, increases in the wages due to shortage of skilled manpower and labour and certain other disadvantages. The literature traditionally emphasises three sources of agglomeration economies, following Marshall (1920): linkages between intermediate and final goods suppliers, labour market interactions, and knowledge spillovers.

According to Marshall (1920), the pooled labour market is beneficial both to the firms and employees (labour market economies). A large local base of a specific industry protects workers from business uncertainty and demand-shocks. Local industry concentration offers many other opportunities in the case of layoffs, which means that workers do not have to relocate nor lose their specific skills. On the other hand, the pooled labour force with specific skills lowers the search and recruitment costs of firms. The productivity of firms may even decrease if they are located in regions where certain types of workers are in short supply because they then have to recruit labour from other regions or use the less productive labour that is available locally. Secondly, the proximity of suppliers and customers, or the forward and backward linkages, respectively, help to create a local milieu or network conducive to more effective production and economic growth. High local demand allows a greater number of producers of intermediate inputs to break-even and an increased variety of intermediate goods in turn makes the production of final goods more efficient (Krugman 1991; Ciccone & Hall 1996). Finally, knowledge spillovers, particularly important in the high tech and innovative sectors, may appear in many ways. Knowledge and ideas about new products and production techniques can be transferred by imitation, business interactions, and inter-firm circulation of skilled employees or by informal exchanges, without monetary transactions.

Duranton and Puga (2004) classify the sources of agglomeration economies in terms of sharing, learning, and matching. These factors help in explaining why firms in particular industry locate close to each other. Sharing refers to the sharing of indivisible facilities, intermediate suppliers, workers and consumers by firms, which reduces fixed costs, allows specialisation and allows firms to pool risks. The result is higher profit for all, accompanied by easier access to a broader range of inputs. Matching benefits usually refer to the benefits of having lot of workers in close proximity to the employers which means that it is easier for different types of workers and different types of employers to find each other. It reduces the risk for both employers as well as the workers. Learning refers to the transfer of skills, information and knowledge to learn from each other. The ability to go beyond industry specific sharing, matching, and learning to citywide processes requires additional mechanisms. These include the effects of cumulative causation and the interpenetration of production and trade across industries. They also include gains from the cross-

fertilization of ideas. The concentration of workers and suppliers leads to a concentration of consumer demands.

Hoover (1937) and Isard (1956) have discussed the division of agglomeration economies into localisation and urbanisation economies. Localisation economies arise from a large number of firms in the same industry and the same place i.e. it is characterised by the geographical concentration of a specific industry. Spatial proximity is advantageous because immediate access to competitors in the same sector allows firms to remain up to date with the market information in dealing with consumers and suppliers. On the other hand, urbanisation economies arise from a large number of different industries in the same place i.e. industrial diversity of the local economic system. Agglomeration economies depend not just on size (a big city or industry) but also on urban interactions. They are traditionally classified as localization economies arising from within-industry economic interactions, and as urbanization economies, arising from between-industry interactions. The reasons for producers to gain from proximity to others depend on the sharing of capital inputs, information, and labour. They also depend on improving the matches between production requirements and types of land, labour, and intermediate inputs.

Localization economies come from geographically concentrated groups of firms, linked by the technology they use, the markets they serve, the products and services they provide, and the skills they require. Competitive pressures that force firms in the same sector to innovate or fail also lead to productivity growth. Conditions tend to be competitive when upstream and downstream firms and associated institutions in a particular industry (say, electronic machinery or petrochemicals)—including universities and trade associations "cluster" together. Other channels for localization economies are the less easily measured "Marshall- Arrow-Romer externalities," which come mainly from knowledge spillovers. As cities grow, urbanization economies become more important. Urban diversity can foster the exchange of ideas and technology to produce greater innovation and growth. Firms in different industries can share indivisible facilities or public goods, a wider variety of intermediate input suppliers, a larger pool of narrowly specialized workers, and risks.

Localisation economies are also known as Marshallian externalities in the literature whereas urbanisation economies are famous by the name of Jacobian externalities.

These latter types of economies are external to both the firm and the industry. (Jacobs 1969). They are a function of city size and are not related to the size of individual firm or cluster. These economies generate benefits for firms throughout the city, not just firms in the particular industry. But are such agglomeration economies only to be expected in the manufacturing sector? The vast empirical literature has focussed on the manufacturing sector while studying the impact of agglomeration economies on productivity. But the fact is that services are even more spatially concentrated than manufacturing—for two reasons. First, they tend to use less land per employee. Banks, insurance companies, hospitals, and schools can operate comfortably in high-rise buildings that economize on land and allow for high density. Second, because of external economies, business services have even greater potential for agglomeration, as firms serve one another: every bank needs advertising, every advertising firm a bank account. The potential for co dependence and agglomeration is thus intrinsic to services. Agarwalla, (2011) has found support for this claim. Her study shows the importance of agglomeration economies in the Indian services sector in influencing the productivity.

Localization and urbanization economies can be considered as centripetal forces leading to concentration of economic activities. Acting in the opposite direction is a number of centrifugal forces. These include increased costs resulting from higher wages driven by competition among firms for skilled labour, higher rents due to increased demand for housing and commercial land, and various negative externalities such as congestion. These costs offset some or all of the benefits of being located in an agglomeration. (Lall et. al, 2001). This view agrees with the very early work in economic geography. Vidal de la Blache, a famous French geographer argued that all societies, rudimentary or developed, face the same dilemma: individuals must get together to benefit from the advantages of division of labour, but various difficulties restrict the gathering of many individuals.

1.2 Literature Review

Past studies carried out in the area of agglomeration economies focus on mainly two things. One is the nature, scope and presence of agglomeration economies like the studies by Graham (2009), Ellison and Glaeser (1997). Rosenthal and Strange (2003) explore the nature and scope of agglomeration economies in the U.S. manufacturing

sector. They differ from the previous studies in the sense that they analyse the industrial, geographic and temporal scope of economic agglomeration economies. Their study studies the micro foundations of agglomeration economies in a great detail. Other important area of research in the field of agglomeration economies concerns the relationship between agglomeration economies and productivity in the manufacturing industries and on the relative importance of localisation or urbanisation economies in influencing the productivity. As Rosenthal and Strange (2003) put it, "the oldest debate on agglomeration economies concerns whether they are related to the concentration of an industry or to the size of the city itself". There is a great work which has been carried out on the linkages of agglomeration economies and productivity and this is the area which has been analysed in detail in this study. Measuring the effects of agglomeration economies and distinguishing between urbanisation and localisation economies is not an easy task. It is possible that a city location is not a result of urbanisation economies but localisation economies or even both of these

A recent body of literature on agglomeration economies consists of the links between agglomeration, productivity and transport investment. If improvements in transport systems give rise to changes in the mass of economic activity accessible to firms, for instance by reducing travel times or the cost of travel, then they can induce positive benefits via agglomeration economies. Graham (2009) presents the empirical results from an econometric analysis of the relationship between productivity and accessibility to economic activity of the different sectors of the U.K. economy. His results show that agglomeration economies do exist and they can be substantial particularly for services. Venables also shows that there are important links between transport investment and agglomeration economies which have been often ignored by many previous studies.

Sveikauskas (1975) and Segal (1976) examined whether production resources are more efficient in large than small cities by using the production function approach. Sveikauskas (1975) found that in the average industry the level of labour productivity is six percent higher where the size of the city is doubled. However, he emphasises that the causality behind observed relationship is unclear as it might be that city size itself causes high productivity or that individual cities systematically grow to large

size because they are already more productive. In the study by Segal (1976), an agglomeration effect, imbedded in the constant term of the production function for the largest cities, made labour and capital (total factor productivity) eight percent more productive.

Henderson (1986) analysed the nature and extent of agglomeration economies in manufacturing industries, applying the production function method to cross-sectional data from the United States and Brazil. His results indicate the predominance of localisation rather than urbanisation economies of scale. It is also worth mentioning that localisation economies appeared to be stronger for heavy than for light industries. A recent study by Capello (2002) analysed the role played by urbanisation and localisation economies on the factor productivity of firms. The production function method was applied to a sample of firms in the high tech sector in Milan, Italy. The results indicated that localisation economies play a more important role than urbanisation economies. He also found that localisation economies have a positive impact on small firms while urbanisation economies are more advantageous for large firms.

Ciccone and Hall (1996) have explained the differences in labour productivity across the US states paying attention to the spatial density of economic activity as the source of increasing returns. In order to explain the differences in labour productivity, they have estimated two models- one based on geographical externalities and other on the diversity of local intermediate services. Both models lead to a relation between county employment density and productivity at the state level. Urban density, rather than size, was considered a more accurate determinant of the level of agglomeration. Their results suggest that rising employment density over time may be an important factor in growth. According to the results, doubling employment density in a county increases average labour productivity by six percent.

The relative impact on productivity of localization and urbanization together are examined by Nakamura (1985) and Henderson (2003). Nakamura considers Japan, while Henderson considers the U.S. and Brazil. Both estimate production functions separately for two-digit manufacturing industries. Urbanization is proxied by total employment in the city. Localization is proxied by employment in the industry. While there is evidence of urbanization economies in several industries, there is evidence of

localization economies in more. Some industries exhibit no evidence of external economies at all. Nakamura summarizes his work as finding that a doubling of industry scale leads to a 4.5% increase in productivity, while a doubling of city population leads to a 3.4% increase. Henderson finds almost no evidence of urbanization economies and substantial evidence of localization. Taken together, Henderson and Nakamura are more favourable to the existence of localization economies than urbanization.

Beeson (1987) used US state level data from the manufacturing sector to evaluate the relationship between agglomeration economies and productivity growth. Her two stage estimation method differs from the usual methods applied in this field. First, the average growth rates of total factor productivity, technical change and scale economies were estimated and then these estimates were used as dependent variables in the analysis of the relationship between agglomeration and productivity growth. Rate of technical change and economies of scale were found to be related to agglomeration, but overall productivity growth was not. Hence, those individual effects tend to be offsetting.

Böckerman (2002) shows that regional labour productivity was related to industry structure, demographic factors and the variables that capture the reorganisation of labour markets. Highly concentrated Information and Communication Technology (ICT) manufacturing was shown to be the main factor behind productivity growth. But in contrast to the US and European empirical results, an increase in the density of economic activity had no impact on the growth of labour productivity. Another study on Finland's manufacturing sector by Sausalito and Loikkanen analyse the differences in private sector efficiencies. They find out that larger regions as measured by the population size seem to bring agglomeration economies which enhance productivity and efficiency.

In another attempt to find out whether localisation or urbanisation economies support regional innovation and growth, a study on Netherlands by Panne and Van Beers (2006) arrives at the result that regions endowed with specialized production structures accommodate more innovators than do diversified regions. That is their result supports localisation economies more than the urbanisation economies and concludes that the former is much more important in influencing the productivity of an industry.

Rigby and Essletzbichler (2002) use the U.S. manufacturing plant level data to estimate the impact of agglomeration economies on industry productivity across US metropolitan areas. This analysis seeks to remedy three shortcomings of previous empirical studies of agglomeration economies: reliance on aggregate spatial or sectoral data; lack of attention to spatial dependence in data; and representation of agglomeration economies with vague proxies such as city size. This study shows how a number of establishment, industry, and city-specific factors influence labour productivity in the U.S. cities and paying particular attention to separating the influence of different kinds of agglomeration economies on firm efficiency.

Baldwin et. al. (2008) studied the agglomeration economies in the Canadian manufacturing sector by using a micro-panel data. They have used the plant level data between 1989 and 1999 to identify the main sources of urban increasing returns and to examine the geographical distance across which externalities flow between businesses in the same industry. The authors have used the growth accounting framework to study the agglomeration economies. The main findings of this study are that all the sources of agglomeration economies are important. At the plant level the results show that plant productivity is significantly influenced by the occupational distribution of workers, the density of the buyer-supplier network and the count of own-industry establishments within the region in which the plant is located. The labour-matching effect is empirically the largest.

Braunerhjelm and Borgman (2004) implemented Swedish data cross-tabulated on 143 industries (four-digit level) and 70 labour market regions for 1975-99 to examine empirically the degree of concentration in the production of goods and services, the relationship between concentration and regional growth, and the role of regional entrepreneurship. Ellison-Glaeser indexes and Gini location quotients reveal a geographical concentration in Swedish industry that is stronger than in the USA. The econometric results imply a 2-6% higher growth in regionally concentrated industries. The effect is more pronounced for knowledge-intensive manufacturing, network industries and industries intensively using raw material. It is also found that regional entrepreneurship and regional absorption capacity are important explanations of regional growth, whereas the impact of the skill-level and economies of scale is more mixed.

Lall, et. al. (2007) assess the impact of the rapid Turkish urbanization process on the country's sector productivity. The authors have combined the two digit level manufacturing data with some geographical, infrastructural and socio-economic indicators. The estimation results suggest that both localization and urbanization economies, as well as market accessibility, are productivity-enhancing factors in Turkey, although the causation link between productivity and these agglomeration measures is not clearly established. The sector by sector estimation confirms this result although the localization economies effect is negative for the non-mineral sector and the urbanisation economies effect is weak for the natural resource-based sectors. Their results argue for framing policies on the improvement of the accessibility to markets, the improvement of the business environment to ease the creation and development of new firms, and a well managed urbanisation process to realise the full economic potential of cities.

Ciccone (2000) finds that Agglomeration effects in European countries like France, Germany, Italy, Spain and the U.K. are only slightly smaller than similar effects in the U.S. the estimated elasticity of (average) labour productivity with respect to employment density is 4.5 percent compared to 5 percent in the U.S.

Xuehua and Xi (2005) make use of Cobb-Douglas production function to estimate the agglomeration economies in the Chinese manufacturing sector. They estimate the agglomeration effects for eight 2-digit industries from 1990 to 2005 creating a panel data model. The result shows there are distinct agglomeration economies in manufacturing industry, however there are remarkable differences among different industries. They find that contributing rates of industrial agglomeration to production among the eight industries varied from 0.0968 to 0.3767. The agglomeration economies are not only appeared in high-tech industries, but also appeared in traditional labour intensive industries.

Andersson and Loof (2009) have studied the relationship between agglomeration economies and productivity for the Swedish manufacturing sector at the firm level using static and dynamic model. The main objectives of their study include analysing whether firms located in larger regions are more productive than those in smaller regions, whether there is any relationship between region size and productivity between small and large firms and also in finding out the learning effect from

agglomeration economies. This paper deals with heterogeneity and endogeneity issues. The authors conclude that firms located in larger regions are more productive when controlling for size, human capital, physical capital, ownership structure, industry classification and time trend. The results show that there is a positive relationship between the size of a region and labour productivity at the level of individual firms. But they find that this relationship holds if several attributes of individual firms that are likely to influence their labour productivity are controlled. Their results suggest that firms become more productive by locating in agglomerations while the role of agglomeration phenomenon does not seem to have a clear coupling to firm size.

Studies on agglomeration economies and productivity relationship are very limited in the Indian context. Mitra (2000) using the panel data for fifteen major states in India provides evidence in favour of the existence of urbanization economies. In eleven of seventeen two-digit industry groups, total factor productivity growth is responsive to urban population or industrial spread. Although the impact of these variables taken to capture agglomeration economies on total factor productivity growth is not monotonic, economic policy would yield a sub-optimal outcome by ignoring the positive effect of the size factor. Urban population or industrial spread benefits firms by possibly improving the quality of labour and enhancing the productive utilisation of resources. He analyzes agglomeration economies in total factor productivity for Indian manufacturing industry and found that for the manufacturing sector overall, there is a U shaped relationship between level of urbanization and total factor productivity. Magnitude of the coefficient of level of urbanization found by Mitra (2000) is -0.035, and that of square of level of urbanization is 0.00011, values which are consistent with the estimates. At the sub-sector level Mitra (2000) found that the relationship holds for sectors such as woollen textiles, jute textiles, machinery other than transport, rubber, petroleum, and coal products. Alagh, Subhramanian and Kashyap (1971) have examined the industrial structure of the different regions and changes in the industrial diversification of regions. But as such no comprehensive work has been carried which focuses on the relative importance of localisation and urbanisation economies in fostering regional productivity by possibly improving the quality of labour and enhancing the productive utilization of resources.

With respect to the analysis of agglomeration-economies and productivity relationship in the Indian context, Lall et. al (2001) examine the impact of improved market access, intra-industry localization economies and inter-industry urbanization economies on Indian's manufacturing firms' productivity. This analysis is based on the plant-level database, but this study does not focus on the fact that whether localisation or urbanisation economies are more significant in promoting growth and productivity. They find considerable variation in the sources and effects of agglomeration economies between sectors. For most sectors they find the effects of agglomeration economies to be factor augmenting. In particular, the results indicate that access to markets is an important determinant of firm level productivity. In contrast, benefits of locating in dense urban areas do not appear to offset associated costs. As market size can be maximized by either locating in large urban areas or on high access transport corridors, firms employing standardized production processes (as in Indian industry) would tend to offset costs of high density (high wages and rents) by moving to secondary centres. Some other studies with respect to India have focussed on the role and importance of infrastructure in boosting productivity.

Another very recent work in the Indian context on agglomeration economies and productivity has been carried out by Agarwalla (2011) .She has used the data of 25 Indian states between 1980-81 to 2006-07 to examine the presence of agglomeration economies and to ascertain whether they have contributed the growth of total factor productivity. The growth accounting framework is applied with agglomeration parameters included in the shift term of a general production function, coefficients of which are estimated through the use of panel data regression model. The main sources of agglomeration economies considered are – of intra-industry localisation economies and inter-industry urbanisation economies. The level of urbanisation and urban diversity are used to measure urbanisation economies and location quotients have been calculated to measure the localization economies. The agglomeration economies originating from the services sector are also estimated. The main findings of this study indicate the presence of urbanisation economies, though its scope and magnitude differs across various sectors. Services sector exhibit lesser urbanisation economies as compared to the manufacturing sector. The results of the study support polices towards diversification of the industrial sector, though in some sectors specialisation also seems to be the dominant force.

Thus it follows from the review of literature that agglomeration economies do have an impact on the level of productivity. In the Indian case, very limited work has been carried out on this aspect. Mitra (2000), Aggarwalla (2011) have analysed this relationship at the state level; however, there are very few studies which have analysed this relationship at a further disaggregated level. The present study attempts to study the agglomeration economies and productivity relationship at the level of NSS regions which are relatively smaller units as compared to the states. Also, in the Indian context, the relative importance of localisation and urbanisation economies is not examined in a great detail. This study examines the relative importance of these economies on the level of productivity. The other main contribution of this study is the inclusion of the eight important sub-sectors on the manufacturing sector. The selection of these eight sub-sectors is made as they contribute significantly to the manufacturing employment and net value added (NVA). The share of these sub-sectors in the manufacturing employment for the two time periods studied is in the range of 55-60% and their contribution the NVA is in the range of 45-50%. These figures point out to the importance of these sub-sectors in the Indian manufacturing sector.

1.3 Objectives and Research Questions of the Study:

Though a vast amount of literature has discussed the issue of agglomeration economies and productivity, the other important aspect of the problem concerning the relative importance of localisation and urbanisation economies has not been extensively analysed. The main objective of the study would be to analyse the relative importance of localisation and urbanisation economies for the Indian manufacturing sector with the use of the ASI data. The results of this study would have important policy implications as to decide upon whether to promote localisation or urbanisation in the manufacturing sector in order to boost the productivity. In this study the existence and magnitude of agglomeration economies in the regional growth process will be examined on the basis of the production function approach (as discussed by Segal 1976; Nakamura 1985; Henderson 1986; Capello 2002).

So, the following main research questions emerge from the above-said discussion about the agglomeration economies and productivity relationship:

1. Is there any effect of localisation economies on the productivity? If yes, then what whether it is positive or negative?
2. Is there any effect of urbanisation economies on the productivity? If yes, then what whether it is positive or negative?
3. How significant is the role of localisation economies relative to urbanisation economies in the Indian manufacturing sector?

These questions have not been explored in great detail by the previous studies (which are very limited in the Indian case) on the relationship between agglomeration economies and productivity in the Indian manufacturing sector. Also this study makes a departure since it examines all the major Indian states dividing into regions (as defined by the NSS). So in total 15 major states covering 56 regions[2] and eight industries at the 2 digit level of National Industry Classification (NIC) are analysed for the years 1999-00 and 2004-05. Very limited work has been carried out on this aspect of agglomeration economies and productivity relationship in the recent years for India and this study tries to suggest the importance of a regional policy based on specialisation and diversification. These questions have deep roots within urban and regional economics (which focuses on the allocation of resources across space), extending back to the work of Marshall (1920), Isard (1957) and Hoover. The primary issues are the identification of the sources of agglomeration and an evaluation of their significance of interest in agglomeration.

The results of this study are likely to have important policy implications from the point of regional development. The relative importance of localisation and urbanisation economies in influencing the productivity can be helpful in deciding whether to promote industrial policies which promote specialisation or diversification. It will be also of utmost importance to see that whether the effect of these economies on the productivity varies with the size of the regions. That is whether industries which are located in smaller regions generate more favourable outcomes than those located in the larger regions.

[2] Regions are hierarchical domains of study below the level of State/ Union Territory in the NSS. Regions are assigned 3 digited codes termed as SR (State Region) code where the first two digits indicate State/ Union Territory and the third indicates region number within a State/ Union Territory. The composition of regions as used in the 61st round of NSS (2004-05) is shown in appendix Table2.

1.4 Organisation of the Study:

The structure of the study is as follows. In addition to the first chapter which covers the introduction of the topic, a brief literature review, main objectives and research questions of the proposed study; the empirical framework and alternative approaches used in the measurement of agglomeration economies along with the variables used are discussed in chapter 2. Chapter 2 also provides with the description of eight major 2 digit industries which are selected for the study. Chapter 3 provides a brief introduction about the sub-sectors by analysing their location quotients for the year 1999-2000. It also examines the agglomeration economies and productivity relationship for these sub-sectors during this period. Chapter 4 discusses the labour productivity in the manufacturing sub-sector for the different states in the year 2004-05. This chapter also explain the specialisation of various sub-sectors for the year 2004-05 and then examines the agglomeration economies and labour productivity relationship for this period. The last chapter contains the concluding section and discusses some policy implications.

Chapter 2

Empirical Framework and Methodology

2.1 Introduction

This section of the chapter gives a brief introduction of the most widely used methodology in the literature to measure the agglomeration economies, i.e. the production function approach and then explains the methodology which is adopted in this study. The rest of the chapter is organised as follows. Section 2.2 discusses the alternative approaches to measure agglomeration economies and points the merits and limitations of those approaches. Section 2.3 provides a brief introduction of the variables which have been used in the present study to examine the agglomeration economies and productivity relationship. The last section of the chapter, namely section 2.4 then discusses the various data sources and provides a brief description of the eight manufacturing sub-sectors which have been analysed in the study.

There are numerous views on the measurement of agglomeration economies and productivity in the economic geography literature. Since these agglomeration economies are a type of external economies, they cause the production function of a firm to shift. So this kind of technical progress can be Hicks neutral, Harrod neutral or Solow neutral technical progress. Hick's neutral technical progress augments the productivity of all factors in the same proportion whereas Harrod neutral progress is labour saving. Following Henderson, it is assumed that the technical progress is Hicks neutral.

Since agglomeration economies enhance productivity, we begin by estimating a production function. The production function approach is the most popular and widely used approach for the measurement of agglomeration economies. In the literature, two different approaches are used in the measurement of agglomeration economies through production functions: as parallel shifts in the production function (the constant term) or as differences in the returns to scale parameters (Eberts & McMillen 1999). In this study the former is applied. The model which is used here employs a Cobb-Douglas production function which ensures the sum of exponents of labour and capital equal to 1. The factor which represents the agglomeration economies is also used in addition of the basic production function. This approach is based on the previous studies by Sveikauskas (1975), Segal (1976), Moomaw (1983), Henderson (1986) and Capello (2002). The production function which is to be estimated is of the following functional form:

$$Y_{ij} = A_{ij} (K_{ij}^{\alpha_1} L_{ij}^{1-\alpha_1}) \text{ ----------(1)}$$

Where Y_{ij} is value added in manufacturing sector i in region j, K_{ij} is capital stock in sector i in region j, L_{ij} is the employment in sector i region j. A_{ij} is the Hicks-neutral efficiency function that allows for shift in the production function.

Now an issue here concerns the measurement of various inputs like labour, capital, material etc. Most of the data sets provide information on the no. of workers, capital stock etc. But certain data sets do not provide information on the materials consumed and also the capital stock used. In such cases the variables which are omitted due to inadequate data may bias the regression estimates. This can lead to the problem of 'measurement error.' So there should be a way to control for these inputs for which data is not available while estimating the production functions. The issue of measurement error has been central to the literature since the outset. Because this is an old issue and one that has already been surveyed with considerable care (Elberts and McMillen (1999)), our treatment will be relatively brief. First, it is clear that the absence of data on capital can affect the estimates. For instance, Sveikauskas (1975) lacks data on capital. As Moomaw (1983) points out, however, if capital is used more intensively in large cities, then the error terms will be positively correlated with the city size terms, leading to upward bias in coefficient estimates. In fact, Moomaw shows that this can inflate estimates by a factor of four. Second, land is also an important input, and its contribution to production is also difficult to measure. Land will be used less intensively in large cities, so presumably this omission would lead to downward bias in the estimates.

A more recent effort to estimate the production function directly is Henderson (2003). This paper is a model of a productivity-based study of agglomeration, coming closest to the ideal that we discussed at the beginning of the section. In this paper, Henderson constructs a panel of plant-level data from the Longitudinal Research Database (LRD) including measures of the capital stock, materials and labour. Using the LRD's micro-data, Henderson controls for industrial scope in the usual way by dividing activities into those that take place within a given industry and those that do not. Henderson also draws on the panel structure of the data to address issues related to the temporal scope of agglomeration. For the most part, Henderson considers county and MSA-

level indicators, rather than using variables that directly reflect proximity. An exception to this is some analysis of neighbouring counties. While Henderson's work is also noteworthy for the careful treatment of the data, the strength of the empirical work rests primarily with the use of plant-level information and detail on purchased factor inputs available from the confidential LRD files. While these data appear to offer some of the best opportunities for making contributions to the understanding of agglomeration, access to them is tightly guarded. This means that many researchers choose to work with other less ideal data.

The variable 'A' introduced above which represents agglomeration economies needs to be controlled for. The literature has followed several approaches to do this. The commonly adopted practice is to include a measure of the city's population to capture urbanization economies and a measure of the employment in a particular industry to capture localization economies. This is the approach which has been followed in this study. But there are other alternative approaches followed by researchers to estimate the agglomeration economies. Some have also looked at urban diversity directly and at a city's specialization in a particular industry, as measured by the share of employment in that industry rather than the level, (Ciccone and Hall, 2002).

The A which represents agglomeration economies will be estimated in this study through:

$$A_{ij} = e^{\alpha_2 U.I. + \alpha_3 L.I + \alpha_4 SIZE + u} \text{---------- (2)}$$

Dividing the basic production function by the number of employees and taking the natural logs with the assumption of constant returns to scale forms the following estimation model:

$$LPROD_{ij} = \text{Constant} + \alpha_1 LRATIO_{ij} + \alpha_2 U.I._{ij} + \alpha_3 L.I._{ij} + \alpha_4 Size_{ij} + u \text{----- (3)}$$

Thus the log of regional labour productivity (LPROD) will be the dependent variable in the model, whereas capital-labour ratio (LRATIO), the urbanisation index (U.I.), the location index (L.I.) will be used as independent variables in the model. This will

enable us to identify the role which the size of the firms plays in influencing the productivity along with the agglomeration economies. The detailed description about the variables used is presented in the next section. The coefficients can be interpreted as follows. If one or other (or both) coefficients of the agglomeration indices ($\alpha 2$, $\alpha 3$) turns out to be positive and statistically significant, it means that productivity is higher in the regions where urbanisation (diversity) and/or localisation (specialisation) level is high.

2.2 Alternative approaches for measuring Agglomeration Economies

Though the production function approach is the most widely used technique for the measurement of agglomeration economies, there are certain other methods used by researchers for this. The use of these so called indirect approaches was made as early in 1970s by Edel (1972), Baumol (1967) and Marcus (1965). These approaches are based on the strong assumption that there exists a relationship between agglomeration economies and other factors such as population, land values, or growth rate of industries. The main problem of this approach is that its result depends largely on the model's assumption. The assumption of a relationship between agglomeration economies and related factors is criticised by Richardson (1973) and Carlino (1978) for its arbitrariness.

The use of these indirect approaches for measuring agglomeration economies has also been made in the recent literature on this field. The first of these is to consider growth. Glaeser et al (1992) and Henderson et al (1995), for example, examine the impact of MSA-level agglomeration on employment growth. In the case of Glaeser et al (1992), growth is measured using data from the County Business Patterns while Henderson et al (1995) rely on the Census of Manufactures. The idea here is that agglomeration economies enhance productivity and productive regions (e.g. MSAs) grow more rapidly as a result.

But studying the growth of total employment is not free from certain problems and these present different challenges than estimating productivity directly. Data on total employment are often readily available and the analysis lends itself to linear regressions. However, existing employers are constrained by prior choices, most

importantly the level and kind of capital previously installed. Those fixed factors affect how the employer values the marginal worker, and consequently how it changes its employment level in response to a change in its environment. In principle, this difficulty can be overcome by looking at changes in total employment over a sufficiently long time frame so that there are no fixed factors and all establishments are effectively new. Even then, one still has to address endogeneity problems: not only is the growth of total employment in a given area sensitive to the composition of employment in the area (an agglomeration effect), but growth affects the level and composition of employment. Implementing this approach, therefore, ideally requires a long panel and effective instruments to control for endogenous variables.

A different approach to studying the scope and effect of agglomeration on productivity has been to focus on births of new establishments and their employment. This approach was taken by Carlton (1983) and by Rosenthal and Strange (2003). The idea here is that entrepreneurs seek out profit-maximizing locations and are disproportionately drawn to the most productive regions. As with the other approaches, focusing on births has both advantages and disadvantages. On the positive side, data on purchased factor inputs (e.g. capital stock, labour, materials, and land) are not required, new establishments are largely unconstrained by previous decisions, and new establishments make their location and employment decisions taking the existing economic environment as exogenously given. Studying plant births also presents difficulties. The principal drawback is that many locations do not receive any births in a given period which can lead to technical challenges on the econometric side. In addition, births are more likely to occur in areas where there is already an existing concentration of industrial activity as spinoffs. Rosenthal and Strange (2003) control the zeros problem by using Tobit models and comparing results to those from probit models that look for positive versus zero births. In addition, Rosenthal and Strange (2003) control for "churning" effects by studying zip code level employment data and including MSA fixed effects as control variables.

Another popular way to examine the agglomeration economies is the study of wages. Recent examples of this approach include Glaeser and Mare (2001) and Wheaton and Lewis (2002). Glaeser and Mare (2001) look at wages instead of growth. They find that wages are higher in larger cities – an urbanization effect. This urban wage

premium is larger the longer a worker has stayed in a large city. Even when the worker moves to a smaller city, some of the urban wage premium remains. An advantage of this approach is that wage data are readily available. Moreover, by focusing on wages this makes feasible the use of a variety of widely available datasets. The last approach (but not so often used) is to use rents. If firms are paying higher rents in a particular location all else equal, then the location must have some compensating productivity differential. Dekle and Eaton (1999) use this approach to measure agglomeration economies in Japan. One difficulty with implementing this approach is finding reasonably refined data on rents. A separate model is fitted for each of the eight sub-sectors (discussed below) in order to identify the impact and magnitude of agglomeration economies on the labour productivity. All the eight industry models are analysed separately.

2.3 Variables used for Measuring Urbanisation and Localisation:

This section describes the different variables which have been used to capture urbanisation and localisation economies and all the other variables which have been used in the study.

2.3.1 Urbanisation Economies

The United Nations (U.N.) has defined urbanisation as movement of people from rural areas to urban areas with population growth equating to urban migration. In simple words, urbanisation is the percentage of total population living in the urban areas. People move into cities to seek economic opportunities. A major contributing factor is known as "rural flight". In rural areas, often on small family farms, it is difficult to improve one's standard of living beyond basic sustenance. Farm living is dependent on unpredictable environmental conditions, and in times of drought, flood or pestilence, survival becomes extremely problematic. In modern times, industrialization of agriculture has negatively affected the economy of small and middle-sized farms and strongly reduced the size of the rural labour market. Cities, in contrast, are known to be places where money, services and wealth are centralized. Businesses, which generate jobs and capital, are usually located in urban areas. Whether the source is trade or tourism, it is also through the cities that foreign money

flows into a country. It is easy to see why someone living on a farm might wish to take their chance moving to the city and trying to make enough money to send back home to their struggling family. But there also costs of urbanization in terms of lack of physical and social infrastructure, pollution, higher rents etc.

As pointed out earlier, urbanisation economies arise from a large number of different industries in the same place i.e. industrial diversity of the local economic system. This concentration of several industries has a positive influence on the firm's productivity. The gains to firms arise in the form of better infrastructure of transportation (including roads, airport and cargo facilities), communication facilities, and proximity to markets and convenient access to financial and professional services. The vast amount of literature supports the view that urbanisation economies have a positive effect on the productivity. Sveikauskas (1975) found that in the average industry the level of labour productivity is six percent higher where the size of the city is doubled. In the study by Segal (1976), an agglomeration effect, imbedded in the constant term of the production function for the largest cities, made labour and capital (total factor productivity) eight percent more productive.

Size is usually correlated with diversity as larger urban areas can support a wider range of activities, Lall et. al, (2001). It is believed that larger cities can support a wide range of manufacturing activities and provide more room for diversification as compared to the smaller cities. Many previous studies have used urban size that is, the urban population to measure urbanisation economies while some have used urban density and level of urbanisation to capture the urbanisation economies. Urban density means the urban population per square kilometre of area has been used by Lall, 2001 to measure the impact of urbanisation economies on manufacturing productivity. This paper argues that urban density is much better indicator for examining the urbanisation economies than the urban size since density reflects spatial concentration. It takes into account of potential interactions. A recent study makes use of urbanisation level (which is the percentage of total population living in the urban areas) to study the impact of urbanisation economies on the productivity. (Agarwalla, 2011).

In this study, a population index (also called the urbanisation index) is constructed to examine the urbanisation effects following (Mukkala, 2003). The study uses the urban

population as an indicator as used in many past studies but not in the absolute value but by creating a population index relative to the country's total population. It is assumed that that the higher the population in the region, the more diversified the economic structure of that region. Urbanisation Index (URBIND) is formed by calculating dividing the total urban population in the region by the total population in that region. It shows the percentage of population which is residing in the urban areas in that particular region.

Urbanisation Index = Total Urban Population/total population

Thus, the urbanisation index indicates how large the difference is between the actual population of the region and the expected (average) population. Higher the value of this index indicates that the region is more diversified since larger regions provide more scope for a variety of activities. The detailed steps in the calculation of this index include first the calculation of the total population in the each of the regions. Then, urban population is each region is arrived at in the similar manner. Next, in order to arrive at the urbanisation index in these 53 regions, the urban population in each region is divided by the total population in that region.

2.3.2 Localisation Economies

These economies are characterised by the geographical concentration of a specific industry. The co-location of firms to each other generates positive effects which increase the productivity of all firms in the industry. For example the availability of skilled manpower and labour to firms, transfer of technology and knowledge and proximity of buyers and suppliers- all positively affect the productivity of the firms. Henderson (1986) and Capello (2002) provide ample evidence of the localisation economies in influencing the productivity of the firms.

However, there is no. of centrifugal forces operating which can lessen the benefits from localisation economies. For example, increased competition between firms for labour and land can cause wages and rents to increase; congestion and crowding in can reduce the availability of infrastructure and also raise the transport costs. Those

firms in the industry which use low-skilled workers and sub-standard production techniques may find these costs to be much more than the gains from concentration.

In the literature, there are various measures used to measure localisation of a particular industry in a region. The most popular and commonly used economic analysis method is the use of location quotients. Location quotients are calculated for industries to determine whether or not the local economy has a greater share of each industry than expected when compared to a reference economy. If an industry has a greater share than expected of a given industry, then that "extra" industry employment is assumed to be Basic because those jobs are above what a local economy should have to serve local needs. For example, suppose a local economy has 15% of its workforce in computer manufacturing and the national economy has only 0.15% of its workforce in computer manufacturing. This technique assumes that the local economy would have that same percentage of its workers in the computer manufacturing industry to serve its local needs for computers. Any employment over and above the expected percentage (in this case 0.15%) is therefore considered to consist of basic sector jobs because these workers are assumed to be exporting their goods and services to non-local areas. If the percentages had been identical or if the local percentage had been less than the reference percentage, then the analyst would conclude that the local area has no basic sector employment for that industry. The Location quotient (L.Q.) is measured as:

$$\textbf{Location Quotient (L.Q.)} = \sum E_{I,R} / \sum E_R / \sum E_I / \sum E$$

Where $E_{I,R}$ represents employment in I^{th} industry and R^{th} region. E_R is the total employment in region R. E_I is national employment in sector I, and E is total employment in India. The term 'Localisation Index (L.I.) is used interchangeably with L.Q. in the present study.

If the value of L.Q. is less than 1, it suggests that local employment is less than was expected for a given industry. Therefore, that industry is not even meeting local demand for a given good or service. Therefore all of this employment is considered non-basic by definition. If it is equal to 0, suggests that the local employment is exactly sufficient to meet the local demand for a given good or service. Therefore, all

of this employment is also considered non-basic because none of these goods or services are exported to non-local areas. And a L.Q of greater than 1 means that local employment is greater than expected and it is therefore assumed that this "extra" employment is basic. These extra jobs then must export their goods and services to non-local areas which, by definition, make them basic sector employment.

It is expected that these localisation economies positively influence the productivity of the firms as shown by many past empirical studies. However, the exact magnitude and sign will be known from the empirical estimation as there are also additional costs which are associated with this concentration of firms in the industry.

There are some limitations with this approach of measuring localization economies. The available data only permit us to identify each firm at the level of the region. Given the large size of many Indian regions .this may still be too coarse to capture localization effects, (Lall, et. al, 2001). The location quotient represents the potential for exchanges in the form of knowledge transfers and labour pooling, which tend to be quite localized in small spatial extents. If the precise location of each firm had been available, we would have used a finer geographic extent to measure externality benefits of own industry concentration.

2.3.3 Capital-labour ratio

The ratio of capital to labour is taken as an explanatory variable in the model. Since capital intensity influences the productivity of labour, K/L ratio is included in the model to explain the changes in the labour productivity. A priori, it is assumed that with an increase in the capital-labour ratio, labour productivity is enhanced. Labour here means the total no. of employees which is obtained from the ASI data. Because capital is durable, the value of using it in any given year is not the same as the value of owning it. There are thus different measures of capital depending on the purpose of accounting. Some economists have made the use of fixed capital while others have used physical working capital to arrive at the K/L ratio. In this study, capital is taken to mean fixed capital and this is obtained from the ASI data. In order to avoid fluctuations, log of K/L ratio is used as the independent variable.

2.3.4 Size variable

The average size of firms is used as an independent variable calculated by dividing the no. of firms by the no. of employees in that particular sector and region. This variable is included to take into account the productivity differences between different sized firms. No. of employees and no. of firms have been obtained from the ASI data and a simple ratio is calculated.

2.3.5 Regional Labour productivity

In the literature, there are two different measures of productivity- labour productivity and total factor productivity. Labour productivity means output produced per unit of labour. Total factor productivity (TFP), on the other hand is the portion of increase in output which is not explained by the inputs. Its level is determined by how efficiently and intensely the inputs are utilised in the production, often called as Solow Residual. Out of these two measures, which measure is the best has been the subject of academic debate since a long time. On the one hand there are those who argue that TFP is the appropriate measure of productivity growth, and that labour productivity is a much cruder measure (May, 2000). On the other hand, there are those who argue that TFP depends too much on arbitrary assumptions, and that labour productivity is more closely related to current living standards, which is what society ultimately cares about.

Examining the trend of labour productivity is very important for the countries having low living standards as it is a proximate measure of standard of living (Reddy, 2005). Labour input could be total employment, number of workers and total numbers of hours worked. Depending upon the choice of labour input labour productivity would be different for different circumstances. However, one thing is very clear that whatever measure of output and input is used the estimation of labour productivity is very simple and straightforward. On a macroeconomic level, labour productivity depends on both GDP and employment. GDP remaining constant, if the rate of growth of labour force declines due to slow growth of population it will also increase labour productivity. On the other hand, if GDP increases faster than the employment then also labour productivity will rise (Piana, 2001). However, in the short run, labour productivity measures can be volatile in particular at a disaggregated level, as they are

strongly affected by the business fluctuations and shifts in the product composition due to changing competitive pressures (Ark, 1996). In an open economy labour productivity is further influenced by the terms of trade and real exchange rate along with capital intensity. Again, the major problem with this measure is that, when the quality of labour force remains same over a period time. Labour productivity still can rise due the quality of capital or simply due to the increase of capital assets. Under that circumstance the rise in labour productivity should not be attributed to labour. However, in spite of these limitations it is most the most accepted indicator of potential consumption. When the labour force grows at a constant rate to population, in that situation rate of growth of labour productivity will be equal to the rate of growth of per capita income, which is leading indicator of standard of living. Rise in the labour productivity helps in reducing the poverty of a country as the productive unit to can reward its participants more with the increase in its labour productivity. Hence, it can be termed as the direct indicator of potential consumption (Balakrishnan, 2004).

Kohli (2004)[3] has very well documented this relationship between labour productivity and TFP. He argues that TFP encompasses all factors of production and it is an essential component of the productivity of labour. Economists argue that both these measures have their own importance and neither of them gives a complete picture. Under what circumstances one would want to rely more on TFP growth as a guide to trends in productivity, and under what circumstances one might prefer to rely more on labour productivity has been extensively researched by many economists[4]. Consider a simple Cobb-Douglas production function:

$$Y = AK^{\alpha}.L^{1-\alpha} \qquad 0 < \alpha < 1$$

Where Y is output, K is capital and L is the labour input. Let g_y be the growth rate of output, g_K the growth rate of capital, g_L the growth rate of labour and α is the share of capital. Then

$$\text{TFP or Solow residual} = g_y - \alpha.g_K - (1-\alpha).g_L$$

[3] See Kohli (2004), Labour productivity vs. Total factor productivity for a detailed explanation.
[4] See Sargent and Rodriguez (2000)

Thus the TFP growth is the growth rate of output less the growth rate of inputs weighed by their relative shares as shown by the above equation. The growth accounting procedure is the most widely used approach to estimate the level of TFP.

There is no general agreement among the economists about the measure of productivity which is best. Sargent and Rodriguez (2000) explain and highlight the conditions under which labour productivity may be a better measure and conditions under which TFP may be a better measure. They suggest that, whether we should go for labour productivity or total factor productivity depends mainly on the time period of interest and quality and comparability of capital stock data. Therefore, if we want to through light on the productivity trend of the economy for a period say less than a decade or so, then we should rely on the labour productivity. On the other hand, if anyone wants to examine the long term productivity trends of the economy then TFP will certainly be better choice than labour productivity. Again, if there are any biases in the capital input measurement under that situation labour productivity is considered to give a better picture than the total factor productivity.

The present study tales labour productivity as a measure of productivity. Some researchers have used value added, gross or net to compute labour productivity (Mukkala, 2003), while others have relied on the use of total output. The latter variable is taken in the present study to compute productivity. Log of regional labour productivity is used to in order to avoid the fluctuations and to normalise the values. Table 2.1 summaries the entire discussion with respect to the variables included in the study.

Table 2.1: Summary Table of the variables used

Variable name	Description
LOCIND (L.I.)	Localisation index representing localisation economies
URBIND (U.I.)	Urbanisation index representing urbanisation economies
URB square	Square of U.I. representing diseconomies from urbanisation.
Log K/L	Log of the capital-labour ratio
Size	No. of employees in the sector divided by no. of firms
Log lab prod	Dependent variable- log of labour productivity.

Source: Author's Compilation.

2.4 Data Sources

The data on the Indian manufacturing sector for the both the time periods considered in the study, namely 1999-00 and 2004-05 is obtained from Annual Survey of Industries (ASI)[5]. The data on various variables like output, capital, no. of workers, no. of firms, value added etc. is used in the analysis. The detailed descriptions and definitions of all these variables are presented in the appendix table. Since the ASI provides data on the district level, therefore various districts were clubbed together to arrive at the corresponding figures for the NSS regions according to the regions classification given by the NSSO. Certain observations on which complete data could not be obtained were excluded from the analysis. For calculating the population index of all the regions, NSS data from 55th round which provides the estimates of population for the first time period i.e. 1999-2000 and NSS data from the 61st round which provides the population estimates for the 2nd time period i.e. 2004-05. (2001) data is used. The unit level NSS data is extracted in order to arrive at the population figures of the different regions. The NSS provides better and more accurate population estimates for the present study.

This analysis is carried out for eight manufacturing sub-sectors at the two digit level of NIC (National Industry Classification). These include:

Table 2.2: Details of the Manufacturing Sub-sectors.

Sector	Sub-sectors
NIC 15	Food Products and Beverages
NIC 17	Textiles
NIC 21	Paper and Paper Products
NIC 22	Publishing, Printing and Reproduction
NIC 26	Non-metallic Mineral Products
NIC 27	Basic Metals
NIC 29	Machinery and Equipment
NIC 31	Electrical Machinery and Apparatus

Source: Author's compilation.

[5] See Appendix Note: 1for detailed discussion about ASI.

Chapter 3

Regional Specialization and Agglomeration Economies-Productivity Relationship in the Manufacturing Sector: 1999-00

3.1 Introduction:

This chapter is organised as follows. The first section of the chapter provides a brief introduction with respect to prevailing situation in the manufacturing sector and the benefits which can be reaped in from agglomeration economies. Section 3.2 discusses the labour productivity in the overall manufacturing sector at the state-level for the year 1999-00. The labour productivity for the various sub-sectors is also discussed in this section. Section 3.3 examines the extent of regional specialisation which the regions included in the study have in the eight manufacturing sub-sectors. The last section of the chapter then empirically examines the agglomeration economies and productivity relationship for the each sub-sector separately.

The economic reforms of 1991 have provided a great uplift to the productive capacity of the industries which make up the economies of our cities. But the impact of economic reforms on the manufacturing sector can only be fully tapped if the productivity is kept at a higher level. In order to keep the Indian economy on a path of high and sustained growth, manufacturing sector needs to play a vital role. The last and an under-utilised frontier to boost the manufacturing sector's productivity is the way we spatially organise our cities. Until very recently the economic planning of our cities has fallen between all levels of government. State and Local Governments have long been focused on providing housing (with varying degrees of success) and a supply of land to house employment. However, there has been little attention paid to the distribution and type of employment across the urban landscape. There has also been a lack of alignment between the location of population growth and the location of employment. Much of this is due to a lack of basic data and empirical evidence with which to understand how our cities currently function in a spatial sense. To develop this understanding there is already a considerable amount of international literature which focuses on the relationship between labour productivity and agglomeration (the density of economic activity).

Increasing the level of agglomeration via improved transport linkages, increasing employment densities within existing employment clusters, or expanding the area of employment clusters can boost labour productivity. This labour productivity boost is brought about in a number of ways such as economies of scope and scale, access to skilled labour and knowledge transfer. Different industries gain differing increases in

labour productivity from increases in agglomeration. This relationship partially explains the vigorous competition for centrally located sites amongst service-based firms. The premium paid for such sites is more than compensated by the increased labour productivity from their operations in these strategic locations. This also explains why it is difficult to attract these types of businesses to suburban locations, notwithstanding the sound urban planning arguments for setting such a goal.

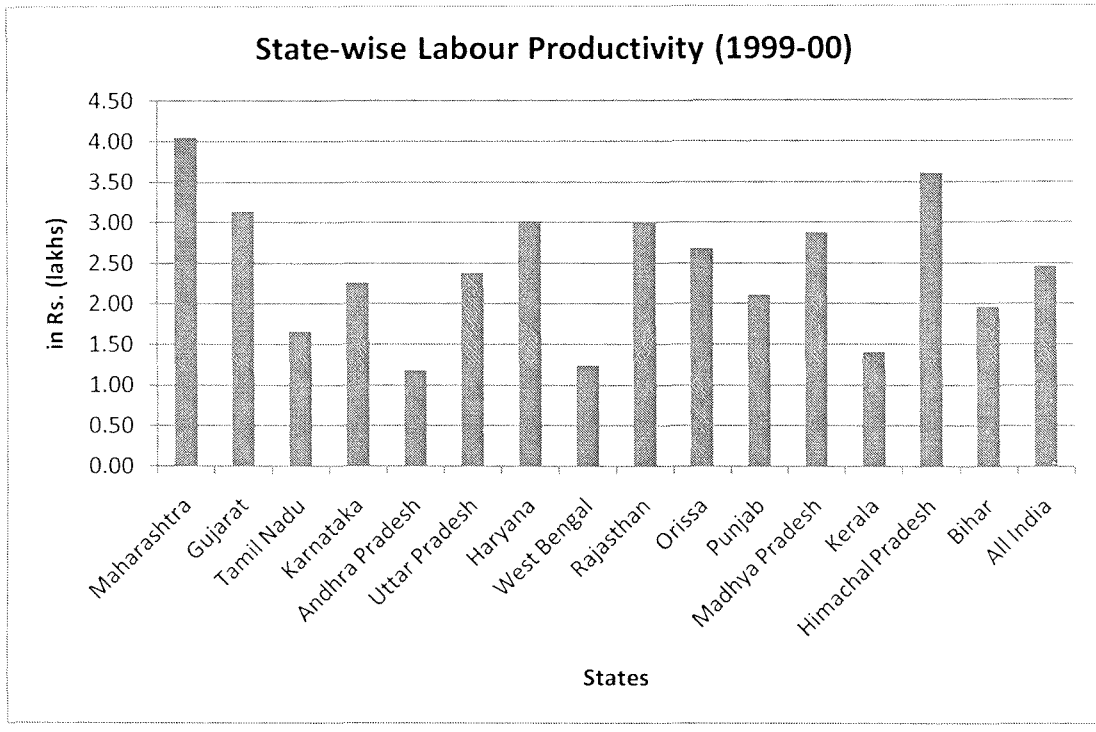
Therefore, it is important to understand the agglomeration economies and labour productivity relationship in the Indian organised manufacturing sector. This can provide important insights where clustering boosts labour productivity in the manufacturing sector to a significant extent and whether urbanisation economies or localisation economies play a vital role. However, before examining this relationship, it is also important to have a look at the level of labour productivity for the overall manufacturing sector in the year 1999-2000 and also the labour productivity in the eight manufacturing sub-sectors.

3.2 Labour Productivity in the Indian Manufacturing Sector (1999-2000)

The following chart 3.1 shows the level of labour productivity in the 15 major states considered in this study for the year 1999-2000. The labour productivity is calculated by simply dividing the net value added by the no. of workers.

Wide inter-state variation can be observed among these states as western and southern states like Maharashtra, Gujarat, and Karnataka show high levels of labour productivity. Highest labour productivity is seen for the state of Maharashtra and lowest is observed for the southern state of Andhra Pradesh. West Bengal, Kerala and Bihar are the other few states where the level of labour productivity is lower in comparison to the all-India level. Northern states like H.P., Punjab and Haryana exhibit labour productivity which is higher than the all-India level for the year 1999-2000. Next, we look at the level of labour productivity in the eight sub-sectors at the all-India level.

Chart 3.1 Labour Productivity in the Manufacturing Sector



Source: Calculated from Summary Results, ASI (2004-05)

Table 3.1 shows the level of labour productivity in the eight selected sub-sectors of manufacturing for the year 1999-00. The labour productivity is found to be highest in the sub-sector of Basic Metals, closely followed by Electrical Machinery and Apparatus sub-sector and Publishing and Printing sub-sector. Lowest labour productivity is seen in the case of textiles industry which is a very traditional sub-sector. For the Food and Beverages industry and Paper and Paper Products industry, labour productivity is around the similar level. Agglomeration economies are expected to have a positive influence on the labour productivity of these sub-sectors. It is important that concentration and clustering of economic activities raises the productivity in low productivity sub-sectors like textiles industry so that they can benefit and contribute to significant growth of the overall manufacturing output and productivity.

Thus, it is clear that high productivity of the manufacturing sector is concentrated in the western and southern states and in those regions which specialise in the manufacture of Electrical Machinery, Non-metallic Mineral Products and Basic Metals. The states with the lowest manufacturing productivity are those with a

relatively large agricultural sector and which specialise in the manufacture of Textiles and Food and Beverages.

Table 3.1: Labour Productivity in the eight sub-sectors for the year 1999-00

NIC	Industry	Labour productivity (Rs lakh)
15	Food and Beverages	1.613
17	Textiles Products	1.043
21	Paper and Paper Products	1.480
22	Publishing, printing	3.171
26	Non-metallic mineral products	2.016
27	Basic Metals	3.845
29	Machinery and Equipment	3.306
31	Electrical Machinery & Apparatus	3.394

Source: Author's calculation from ASI data, 1999-00.

An in-depth knowledge of the productivity and localisation patterns for each of the sub-sector provides more important insights to understand the dynamics of agglomeration economies and productivity relationship. In the next section of this chapter, the location quotients are analysed for each of the eight industry sub-sectors. The extent of regional specialisation in each sub-sector is examined and discussed which enables us to identify the regions which are specialising in these sub-sectors. Then the last section of this chapter discusses the agglomeration economies and productivity relationship for each if the sub-sectors.

3.3 Analysis of Localisation in the Different Manufacturing Sub-sectors:

It is important to look at the level of localisation and specialisation of industrial activities in the eight sub-sectors. The regional location quotients are calculated to analyse the level of specialisation for each of the eight sub-sectors in the 56 NSS regions covered in this period of study i.e. 1999-2000. As mentioned before, a value of location quotient which is greater than one it indicates that the region is more specialised in a given sector than on the average in the country, and, alternatively, if the value is below one the sector is less represented in the region than nationally. In this section, the specialisation of the regions is analysed for the following eight sub-sectors namely, Food products and Beverages (NIC 15), Textiles (NIC 17), Paper and

paper products (NIC 21), Publishing, printing and reproduction of electronic media (NIC 22), Non-metallic mineral products (NIC 26), Basic metals (NIC 27), Machinery and equipment (NIC 29) and Electrical machinery and Apparatus (NIC 31.)

3.3.1 Food and Beverages Industry:

Food and Beverages industry is one of the fastest moving industrial sectors in India. With the advancement of this sector along with a thorough change in food consuming pattern of Indians, there have been a sea change in food processing and packaging industry. The food industry in India comprises the food production industry and the food processing industry.

Table 3.2 Localisation Index for Food and Beverages Industry (15)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.478	GUJ Eastern	0.270
Punjab Southern	2.287	GUJ Plains Northern	0.607
H.P.	0.225	GUJ Plains Southern	0.146
HR Eastern	0.967	GUJ Dry Areas	0.467
HR Western	1.785	GUJ Saurashtra	1.196
RAJ Western	0.430	MH Coastal	0.217
RAJ North-eastern	0.229	MH Inland Western	0.394
RAJ Southern	0.459	MH Inland Northern	1.446
RAJ South-Eastern	0.849	MH Inland Central	1.836
UP Himalayan	1.098	MH Inland Eastern	1.013
UP Western	1.481	MH Eastern	0.168
UP Central	1.421	AP Coastal	1.645
UP Eastern	0.937	AP Inland Northern	0.984
UP Southern	0.215	AP South Western	1.692
BIHAR Southern	0.048	AP Inland Southern	1.415
BIHAR Northern	0.441	KAR Coastal Ghats	1.351
BIHAR Central	0.434	KAR Inland Southern	0.679
WB Himalayan	2.295	KAR Inland Northern	1.365
WB Eastern Plains	1.818	KER Northern	0.625
WB Central Plains	0.405	KER Southern	1.257
WB Western Plains	1.348	TN Coastal Northern	0.686
ORI Coastal	0.787	TN Coastal	2.002
ORI Southern	2.556	TN Southern	1.073
ORI Northern	2.353	TN Inland	0.711
MP Vindhya	2.341	MP Malwa	0.631
MP Central	0.673	MP South	0.429
MP Northern	0.876	MP South Western	2.783

Source: Author's Calculation.

The food processing industry is one of the largest in India – it is ranked fifth in terms of production, consumption, export and expected growth. In the year 1999-2000, this sub-sector employed 10, 41,353 workers. This accounted for about 16.58% of the total manufacturing employment (Summary results, ASI). This sub-sector accounted for about 10.83 % of the value added generated in the manufacturing sector. These statistics clearly highlight the importance of this sub-sector in the Indian manufacturing. Table 3.2 presents the location quotients (L.Q.) for the food and beverages sub-sector. The southern states like Tamil Nadu (T.N.), Kerala and Andhra Pradesh contain regions which are highly specialised in the manufacture of food and beverages.

States like Bihar, Rajasthan and U.P. include regions where the value of L.Q. is less than 1 indicating the lack of specialisation in these regions. The region of Himachal Pradesh has a low value of L.Q. which is less than one whereas both the regions of the state of Haryana are fairy specialising in the manufacture of food and beverages. Most of the regions in the state of M.P. have a value of L.Q. which is less than one and the same holds true for the state of Gujarat. So, overall it can be said that southern and western regions are relatively more specialised than the other regions in the country in the food and beverages sub-sector.

3.3.2 Textiles Industry:

According to the Annual Report, 2009-10 of the Ministry of Textiles, the Indian textile industry contributes about 14 per cent to industrial production, 4 per cent to the country's gross domestic product (GDP) and 17 per cent to the country's export earnings. Therefore, it is important to study this industry in detail and see which of the regions. It provides direct employment to over 35 million people and is the second largest provider of employment after agriculture.

In the year 1999-2000, the textiles industry employed about 10, 84,375 workers which constituted about 17.26 % of the total manufacturing employment. This sub-sector accounted for the highest share in the manufacturing employment. However, the net value added generated from this sub-sector constituted about 7.3 % of the total net value added (NVA) in the manufacturing sector. This implies that despite being the largest employment provider, the share in NVA of this sub-sector is not highest because of the low level of labour productivity as compared to the other sub-sectors.

Table 3.3: Localisation Index for Textiles Industry (17) in all the regions

Regions	L.Q.	Regions	L.Q.
PB Northern	0.705	GUJ Eastern	4.952
PB Southern	0.189	GUJ Plains Northern	2.141
HP	0.648	GUJ Plains Southern	0.001
HR Eastern	1.540	GUJ Dry Areas	1.227
HR Western	2.059	GUJ Saurashtra	0.131
RAJ Western	5.400	MH Coastal	1.376
RAJ North-Eastern	1.730	MH Inland Western	0.781
RAJ Southern	0.113	MH Inland Northern	0.501
UP Himalayan	0.000	MH Inland Eastern	0.263
UP Western	0.516	AP Coastal	0.193
UP Central	1.164	AP Inland Northern	0.038
UP Eastern	0.658	AP South Western	0.022
UP Southern	1.554	AP Inland Southern	0.473
BIHAR Southern	0.217	KAR Inland Southern	0.301
BIHAR Central	0.431	KAR Inland Northern	0.918
WB Eastern Plains	0.157	KER Northern	1.373
WB Central Plains	1.939	KER Southern	0.798
WB Western Plains	1.682	TN Coastal Northern	0.998
ORI Coastal	0.741	TN Coastal	1.792
ORI Southern	0.830	TN Southern	2.181
ORI Northern	0.119	TN Inland	4.854
MP Central	0.180	MP South Western	0.1167
MP Malwa	1.827		

Source: Author's Calculation.

Table 3.3 shows the location quotients for the textiles industry in all the regions. Some regions where L.Q. cannot be found due to the absence of the sub-sector in those particular regions have not been reported. The table shows that the southern regions in the state of A.P. and Karnataka do not specialise in the manufacture of textiles. The value of L.Q. in these regions is less than one, however all the regions in the state of T.N. specialise in this sub-sector. The northern regions in the states of Punjab and H.P. do not have any significant degree of specialisation as shown by the L.Q. which is less than one. Haryana and Rajasthan include regions which have a value of L.Q. which is greater than one, thus reflecting a significant extent of specialisation. West Bengal and Gujarat also contain regions where there is an evidence of specialisation in the textiles sub-sector. Bihar, Orissa and Maharashtra contain regions which are not specialised in the textiles industry and the level of

regional localisation and specialisation in these regions is less as compared to all-India level.

3.3.3 Paper and Paper Products Industry:

The Indian paper industry is accorded 'core sector' status since paper is categorised as an essential commodity by the government[6]. The progress of paper industry is inextricably linked to the national priorities and with the changing times, its fortunes fluctuate. Paper industry in India is the 15th largest paper industry in the world. It provides employment to nearly 1.5 million people and contributes Rs 25 billion to the government as revenues. The government regards the paper industry as one of the 35 high priority industries of the country. Indian paper industry has been de-licensed under the Industries (Development & Regulation) Act, 1951 with effect from 17th July, 1997.

Table 3.4: Localisation Index for Paper and Paper Products Industry (21)

Regions	L.Q.	Regions	L.Q.
PB Northern	0.371	MH Coastal	0.953
PB Southern	0.926	MH Inland Western	1.495
HP	0.335	MH Inland Northern	3.427
HR Eastern	1.306	MH Inland Central	2.357
HR Western	0.964	MH Inland Eastern	0.408
RAJ	0.208	AP Coastal	0.951
UP Himalayan	0.000	AP Inland Northern	0.456
UP Western	1.490	KAR Coastal Ghats	0.556
UP Central	0.651	KAR Inland Eastern	0.741
UP Eastern	1.453	KAR Inland Southern	3.360
UP Southern	0.262	KAR Inland Northern	0.033
BIHAR Central	1.745	KER Northern	1.169
WB Central Plains	6.878	KER Southern	0.381
WB Western Plains	0.908	TN Coastal Northern	1.776
ORI Coastal	0.448	TN Southern	1.636
MP Malwa	1.790	TN Inland	0.641
GUJ Eastern	3.810	GUJ Dry Areas	0.335
GUJ Plains Northern	0.602	GUJ Saurashtra	0.111
GUJ Plains Southern	0.067		

Source: Author's Calculation.

[6] See Schumacher and Sathaye (1999), India's Pulp and Paper Industry

Growth of paper industry in India has been constrained due to high cost of production caused by inadequate availability and high cost of raw materials, power cost and concentration of mills in one particular area. Government has taken several policy measures to remove the bottlenecks of availability of raw materials and infrastructure development. For example, to overcome short supply of raw materials, duty on pulp and waste paper and wood logs/chips has been reduced. According to the summary results of ASI for the year 1999-2000, this industry provided employment to 1, 37,358 people which constituted about 2.18% of the total manufacturing employment. This sub-sector accounted for about 1.31 % of the value added originating in the manufacturing sector.

Among the eight sub-sectors studied, paper and paper products industry in the year 1999-00 had a very low labour productivity, only second to the lowest labour productivity sub-sector. Table 3.4 shows the level of regional localisation in this sub-sector. In the regions of the states of Punjab and Haryana, the value of L.Q. lies below one suggesting the absence of specialisation in these regions. However, both the regions in state of Haryana are fairly specialised. The regions in the southern states of Andhra Pradesh, and Karnataka do not specialise in the paper and paper products industry. However, Kerala, T.N. and Maharashtra contain regions which are more specialised on average than the country as a whole. The regions in Bihar and M.P also have a value of L.Q. which is greater than one indicating the presence of specialisation in these regions as compared to the all-India level. In general, it can be said that southern and central regions in the country are more specialised than the northern regions.

3.3.4 Publishing, printing and reproduction of electronic media:

The Indian Publishing and Printing Industry have undergone many revolutionary changes in the past 15 years. In 1991 India initiated a process of reforms which aimed at shedding protectionism and embracing liberalization of the economy. Privatization was emerged with the aim of integrating the Indian economy with the world economy. This drastic change in the country's economy opened the doors for the Indian Print Industry to modernize, by investing in the latest of technology and machinery. For the last 15 years the average compound annual growth rate has been higher than 12%. Post 1990 the trend was to acquire the latest and the best equipment & machines. The

Indian Publishing and Printing Industry is one of the greatest in the world and the country is counted among the top seven publishing nations. Since, this industry forms a crucial and vibrant component of the manufacturing sector, it is important to analyse the regions which specialise in this industry.

In the year 1999-2000, this sub-sector employed 75,558 workers which constituted about 1.2 % of the total manufacturing employment. The value added from this sector accounted for about 1.54% of the total NVA originating from the manufacturing sector. Table 3.5 shows the location quotients for all the regions.

Table 3.5: Localisation Index for Publishing, Printing and Media Industry (22)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.414	GUJ Eastern	0.120
HP	0.059	GUJ Plains Northern	1.397
RAJ Southern	0.441	GUJ Plains Southern	0.051
UP Himalayan	0.046	GUJ Saurashtra	0.103
UP Western	0.056	MH Coastal	4.230
UP Central	0.364	MH Inland Western	1.069
UP Eastern	0.459	MH Inland Eastern	0.376
UP Southern	0.695	AP Inland Northern	0.032
BIHAR Southern	0.868	AP South Western	0.983
BIHAR Central	0.671	AP Inland Southern	0.616
WB Central Plains	1.642	KAR Inland Southern	1.061
ORI Coastal	0.679	KAR Inland Northern	0.046
MP	0.519	KER Northern	1.705
MP Northern	0.221	KER Southern	0.366
MP Malwa	1.048	TN Southern	3.171
MP South	0.111	TN Inland	0.001
TN Coastal Northern	2.979	TN Coastal	0.466

Source: Author's Calculation.

It is clear from the table that none of the regions in the northern states like Punjab, H.P. specialise in the publishing and printing sub-sector. Most of the regions for this sub-sector have a value of L.Q. which is less than one indicating that very few regions specialise in the manufacture of publishing and printing sub-sector.

Only regions in the states of T.N., Maharashtra, and Gujarat have some significant degree of specialisation in this sub-sector. The highest value of L.Q. is observed for one of the regions of Maharashtra, above 4 indicating the very high degree of

specialisation. The regions in Bihar and U.P. also have L.Q. which is less than one. So overall, it can be said that only western and southern regions have regional localisation in this sub-sector and a majority of the regions lack specialisation.

3.3.5 Non-metallic Mineral Products Industry:

The Non-metallic Mineral Product Manufacturing subsector transforms mined or quarried non-metallic minerals, such as sand, gravel, stone, clay, and refractory materials, into products for intermediate or final consumption. Processes used include grinding, mixing, cutting, shaping, and honing. Heat often is used in the process and chemicals are frequently mixed to change the composition, purity, and chemical properties for the intended product.

Table 3.6: Localisation Index for Non-metallic mineral products industry (26)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.040	MP Malwa	1.051
Punjab Southern	0.024	MP South	3.580
H.P.	0.408	GUJ Eastern	0.291
HR Eastern	0.864	GUJ Plains Northern	0.501
HR Western	0.156	GUJ Plains Southern	3.590
RAJ Western	0.923	GUJ Dry Areas	2.950
RAJ North-eastern	1.240	GUJ Saurashtra	0.928
RAJ Southern	3.488	MH Coastal	0.533
RAJ South-Eastern	3.090	MH Inland Western	0.462
UP Himalayan	1.588	MH Inland Northern	0.278
UP Western	0.821	MH Inland Eastern	1.031
UP Central	0.069	MH Eastern	4.307
UP Eastern	1.413	AP Coastal	1.405
UP Southern	0.360	AP Inland Northern	2.282
BIHAR Southern	2.584	AP South Western	1.534
BIHAR Northern	3.786	AP Inland Southern	1.983
BIHAR Central	2.290	KAR Inland Eastern	2.168
WB Central Plains	0.246	KAR Inland Southern	0.502
WB Western Plains	0.725	KAR Inland Northern	0.666
ORI Coastal	1.591	KER Northern	1.688
ORI Northern	0.536	KER Southern	1.537
MP Chhattisgarh	0.019	TN Coastal Northern	0.416
MP Central	3.967	TN Coastal	0.194
MP Northern	1.535	TN Southern	0.611
		TN Inland	0.272

Source: Author's Calculation.

For example, glass is produced by heating silica sand to the melting point (sometimes combined with cullet or recycled glass) and then drawn, floated, or blow moulded to the desired shape or thickness. Refractory materials are heated and then formed into bricks or other shapes for use in industrial applications. India with diverse and significant mineral resources is the leading producer of some of the minerals. Of the 89 minerals produced in India, 4 are fuel minerals, 11 metallic, 52 non-metallic and 22 minor minerals. The share of the mineral sector in the gross domestic product (GDP) of the country is around 3.5 per cent while accounting for 10 per cent share in the index of industrial production.

Though 80 % of the mines are in the private sector, yet 91% of the production in terms of size comes from the government owned mining ventures. The principal non-metallic minerals found in the country include asbestos, dolomite, gypsum, and limestone. In the year 1999-2000, this sub-sector employed 3, 59,946 workers. This accounted for about 5.73 % of the total manufacturing employment (Summary results, ASI). This sub-sector accounted for about 4.69 % of the value added generated in the manufacturing sector.

Table 3.6 presents the location quotients for this sub-sector. It is clear from the table that regions in the northern states of Punjab, Haryana and Himachal Pradesh have location quotients of less than one meaning that these regions are not as specialised in the sub-sector of non-metallic mineral products as compared to the level of specialisation for the country as a whole. However, all the regions in the state of Rajasthan and Himalayan and Eastern regions of U.P. are relatively more specialised. Bihar is a highly specialised state as both the regions in it show a value of L.Q. which is greater than one. Orissa, M.P., A.P. and Kerala also contain most of the regions which are highly specialised. Maharashtra has the presence of four specialised regions whereas only one out of the three regions in Karnataka are highly specialised in the manufacture of non-metallic mineral products. The southern state of T.N. is the only state which has none of the specialising regions. Thus the degree of regional specialisation in this sub-sector varies across the different states with mostly regions in the central and southern states being relatively more specialised than others.

3.3.6 Basic Metals Industry:

The basic metal and metal products industry is primarily composed of manufacturers in the iron and steel sector with manufacturers of other metal based products. A competitive basic metal industry provides inputs that are critical to infrastructure development and contributes to the generation of jobs, economic growth and promotion of other industrial activities. With most of the basic metal products being characterized by bulk (giving the industry one of the highest average transport costs for both materials and final products among manufacturing firms), a domestic steel industry is needed to lessen the cost in satisfying the demands of numerous local manufacturing firms in the downstream sectors. Ascertaining a strong domestic basic metal products industry should therefore be a key concern in developing the competitiveness of a country in meeting the challenges of globalization.

Table 3.7: Localisation Index for Basic Metals Industry (27)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.781	GUJ Eastern	0.066
Punjab Southern	1.211	GUJ Plains Northern	2.912
H.P.	8.133	GUJ Plains Southern	0.339
HR Eastern	0.723	GUJ Saurashtra	2.080
HR Western	0.730	MH Coastal	1.132
RAJ Western	0.288	MH Inland Western	3.805
RAJ North-eastern	2.736	MH Inland Northern	0.192
RAJ Southern	0.706	MH Inland Eastern	1.321
UP Himalayan	3.022	MH Eastern	1.731
UP Western	0.855	AP Coastal	0.123
UP Central	1.146	AP Inland Northern	0.327
UP Eastern	0.000	AP South Western	0.082
UP Southern	1.894	AP Inland Southern	0.002
BIHAR Southern	3.244	KAR Inland Eastern	1.645
BIHAR Central	1.792	KAR Inland Southern	0.270
WB Eastern Plains	2.151	KAR Inland Northern	0.244
WB Western Plains	2.826	KER Northern	0.406
ORI Coastal	1.356	KER Southern	0.137
ORI Northern	0.289	TN Coastal Northern	1.587
MP Chhattisgarh	1.038	TN Coastal	0.019
MP Malwa	0.884	TN Southern	0.264
MP South Western	0.701	TN Inland	0.275
MP Northern	7.966		

Source: Author's Calculation.

The Indian basic metals industry is growing up with the innovative techniques as it is helping the product market to enlarge. Some of the popular methods used for the production of basic metals are open hearth, oxygen furnaces, blast furnaces, electric arc furnaces, etc. The basic metals industry is a crucial component of the Indian manufacturing sector as it provides essential inputs to other sectors and also provides significant employment. As seen earlier, this sector in the year 1999-00 showed the highest labour productivity among all the sub-sectors. This sector provided employment to 4, 79,567 workers in the manufacturing sector which accounted for about 7.64 % of the total manufacturing employment in the year 1999-00. This sub-sector accounted for about 11.90 % of the value added generated in the manufacturing sector which is quite significant in comparison to other sub-sectors. Table 3.7 shows the location quotients for the different regions

The above table shows that some northern regions in the states of H.P., Punjab have fairly high degree of regional specialisation in the manufacture of basic metals. Majority of the regions in the states of Haryana, U.P., A.P., Rajasthan, Kerala, and T.N. have a L.Q. which is less than 1 implying the low degree of specialisation in these regions. Bihar and West Bengal contain the regions which are highly specialised as witnessed by L.Q. values which are greater than one. Most of the regions in the states of Maharashtra and Gujarat are more specialised than the country as a whole. But,, surprisingly, the trio of Karnataka, Kerala and T.N. are not much specialised. Therefore, it is clear that a significant degree of regional specialisation in present in the regions of states like Maharashtra, Gujarat, West Bengal, Bihar and H.P. However, the state of A.P. which is a industrially developed state does not contain the existence of a single region which specialise in the manufacture of basic metals. It is important to see whether this kind of regional specialisation boosts labour productivity in these regions and to what extent.

3.3.7 Machinery and Equipment Industry:

Machinery and equipment tools make up the core around which all industrial manufacturing is built. Developing nations like India have to put special stress on machine tools, accessories, components etc. India has progressed immensely in the previous decades and there has been a huge rise in the number of machinery

exporters, manufacturers, machinery equipment & components exporters, machinery and machinery spares and accessories suppliers in all parts of India. The Machinery and Equipment industry consists of companies engaged in the manufacturing of basic power and hand tools, hardware, small-scale machinery and other industrial components. This sector provided employment to 2, 98,495 workers in the manufacturing sector which accounted for about 4.76 % of the total manufacturing employment in the year 1999-00. This sub-sector accounted for about 6.36 % of the value added generated in the manufacturing sector. Table 3.8 shows the location quotients for this sub-sector in the different regions.

It can be seen that regions in Punjab, Haryana, U.P., Maharashtra, and some of the regions in Gujarat, Kerala, Karnataka and Rajasthan have a fair degree of specialisation as the L.Q. values exceed one.

Table 3.8: Localisation Index for Machinery and Equipment Industry (29)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	2.136	GUJ Eastern	1.244
HP	0.192	GUJ Plains Northern	0.705
HR Eastern	1.524	GUJ Plains Southern	0.736
RAJ Western	0.086	GUJ Dry Areas	0.436
RAJ North-eastern	1.469	GUJ Saurashtra	1.911
RAJ Southern	0.018	MH Coastal	2.734
UP Western	0.650	MH Inland Western	1.206
UP Central	2.231	MH Inland Northern	1.728
UP Eastern	1.914	MH Inland Central	0.011
UP Southern	2.556	MH Inland Eastern	1.932
BIHAR Southern	0.697	AP 1	0.443
BIHAR Northern	0.192	AP 2	0.457
BIHAR Central	0.329	KAR Coastal Ghats	0.295
WB Eastern Plains	0.821	KAR Inland Eastern	0.672
WB Central Plains	1.611	KAR Inland Southern	3.299
ORI Coastal	0.571	KAR Inland Northern	2.732
ORI Northern	0.117	KER Northern	1.008
MP Chhattisgarh	0.470	KER Southern	0.516
MP Vindhya	0.376	TN Coastal Northern	1.750
MP Central	0.742	TN Coastal	0.236
MP Malwa	0.719	TN Inland	0.947

Source: Author's Calculation.

Whether this fair degree of specialisation in the manufacture of machinery and equipment has any impact on the labour productivity is empirically examined in the next section. States like Bihar, M.P., Orissa and T.N. have the existence of most of the regions which are not specialised. Therefore, it can be said the regions specialising in this sub-sector are located mainly in the north-western and southern areas of the country.

3.3.8 Electrical Machinery and Equipment:

The electrical equipments and machinery such as motors, transformers, switchgears etc. are used by all sectors of the Indian economy and for this reason, this constitutes an important sub-sector which needs to be studied in detail. Some major areas where these are used are the multi crore projects for power generation including nuclear power stations, petrochemical complexes, chemical plants integrated steel plants, non-ferrous metal units etc.

Table 3.9: Localisation Index for Electrical Machinery Industry

Regions	L.Q.	Regions	L.Q.
Punjab Northern	8.697	GUJ Eastern	0.246
Punjab Southern	0.426	GUJ Plains Northern	0.534
H.P.	0.413	GUJ Plains Southern	1.244
HR Eastern	0.899	MH Coastal	1.327
RAJ Western	0.061	MH Inland Western	2.424
RAJ North-Eastern	1.086	MH Inland Northern	1.320
RAJ South-Eastern	0.466	MH Inland Central	2.760
UP Western	0.879	MH Inland Eastern	0.596
UP Central	0.186	AP Coastal	0.000
UP Eastern	0.712	AP Inland Northern	0.275
UP Southern	4.540	AP South Western	0.493
BIHAR Northern	0.182	AP Inland Southern	0.226
BIHAR Central	0.256	KAR Inland Southern	2.300
WB Central Plains	1.571	KER Northern	0.048
WB Western Plains	3.349	KER Southern	0.742
ORI Coastal	1.380	TN Coastal	0.916
MP Chhattisgarh	0.174	TN Northern	0.143
MP Vindhya	1.938		
MP Central	6.350		
MP Malwa	1.549		

Source: Author's Calculation.

The industry has been upgrading the existing technology and is now capable of taking up turnkey contracts also for export markets. This industry has been de-licensed. The existing installed capacity in the industry is of the orders of 4500 MW of thermal, 1345 MW of Hydro and about 250 MW of gas based power generation equipment per annum. There also exists capability for manufacture of equipment for nuclear power plants in the country. The share of domestic equipment is about 66% in the country's power generation capacity. The domestic Heavy Electrical equipment manufacturers are making use of the developments in the global market with respect to product designs and upgrading of manufacturing & testing facilities. In the year 1999-00, this sub-sector provided employment to 167350 workers in the manufacturing sector which accounted for about 2.67 % of the total manufacturing employment. This sub-sector accounted for about 3.67 % of the value added generated in the manufacturing sector.

Table 3.9 shows the values of location quotients for this sub-sector in the different regions of the country. It can be seen from the above table that regional specialisation varies to a great extent in the manufacture of electrical machinery and equipment. The highly specialised northern region of Punjab shows a very high value of L.Q. which is highest among all the regions. Other regions in the northern states like H.P., Haryana have L.Q. which is less than one. Majority of regions in the states like Bihar, U.P., Rajasthan, Gujarat, Kerala, A.P., and T.N. have very low level of specialisation as indicated by the L.Q. values in these regions. This means that these regions are less specialised when compared to the level of specialisation for the country as a whole.

Table 3.10: No. of Regions specialising in the different sub-sectors.

Industry name	No. of regions specialising
Food and Beverages	24
Textiles	17
Paper and Paper Products	14
Publishing and Printing	9
Non-metallic Mineral Products	24
Basic Metals	22
Machinery and Equipment	17
Electrical Machinery Equipment	15

Source: Author's Calculation

The regions in states like W.B., Maharashtra, M.P. and Karnataka, exhibit relatively higher values of L.Q. greater than one indicating a fairly high level of specialisation in these regions. The following table shows the no. of regions in each sub-sector which are highly specialised.

The next section of this chapter examines the relationship between agglomeration economies and productivity, separately for each of the eight sub-sectors, i.e. the impact of localisation and urbanisation economies on productivity is studied empirically.

3.4 Agglomeration Economies in the Indian Manufacturing Sector: 1999-00

Results and Discussion

The linear regression equation no. 3 is estimated for the 15 states for the year 1999-2000 including the 56 regions (according to the 55th round of the NSS) examined under the study and the 8 industry sub-sectors. Whereas for the time period 2004-05, the no. of NSS regions included are 53 due to change in the classification in the 61st round of NSS (2004-05). Table 3.11 presents the results for the first three sub-sectors- namely Food and Beverages industry (15), Textiles industry (17) and Paper and paper products industry (21). A simple OLS approach was used to estimate the parameters of the regression equation. The results of the first three sub-sectors considered in Table 3.11 are examined separately.

First sub-sector which is discussed is the food and beverages industry. In this sub-sector, the log of capital-labour ratio, index of urbanisation, square of the urbanisation index representing diseconomies and costs associated with the urbanisation, and the average size of firms have a significant impact on the log of labour productivity. The only variable which turns out to be insignificant is the localisation index as measured by the location quotient. The value of R square is close to 49% for this sub-sector. Out of these four significant variables, the coefficients of log of capital-labour ratio and square of the urbanisation index are positive. The coefficient of log of capital-labour ratio is 0.3157 which is significant at 1 % level. This implies that increase in the capital intensity leads to an increase in the level of labour productivity.

The positive and significant coefficient of the square of urbanisation index is 9.318 implying that one percent increase in the urbanisation level results in 9.38% increase in the dependent variable which is the log of labour productivity. The other two significant variables which are the urbanisation index and the average size of firms have a negative coefficient. The coefficient of urbanisation index is -8.704 meaning a one percent increase in the urbanisation level leads to 8.7% increase in the log of labour productivity. This result is supported by what has been found by Lall et al (2003) where they find a negative impact of urbanisation economies on the plant output.

This means that an increase in the level of urban concentration as captured by the urbanisation economies have an adverse affect on the level of plant output. But they have used urban density as the proxy for measuring urbanisation economies. Aggarwalla (2011) and Mitra (2000) have also found a similar result for the manufacturing sector as a whole where they observe that there is a U-shaped relationship between the level of urbanisation and productivity (though their measure of productivity is the total factor productivity). Mitra (2000) has also found the existence of this relationship for some manufacturing sub-sectors like woollen textiles, jute textiles, machinery other than transport, and rubber, petroleum and coal products. The U-shaped relationship means that first an increase in the urbanisation level leads to a decline in the productivity level and then after a point, productivity tends to rise with the increase in the urbanisation level. Although there are negative externalities for manufacturing sector initially, after achieving a threshold level of urbanization equal to 37-38%, there are positive returns to urbanization, in terms of increasing level of labour productivity. At a lower level of urbanization, other supporting services do not develop much to help in cost reduction. Besides the local labour market is also not concentrated enough to provide the benefits of competition. This shows that manufacturing units benefit by locating in very large urban areas, and not in small cities.

With respect to the average size of firms, the value of the coefficient is negative and significant though very small in magnitude. The implication is that an increase in the average size of firms in this sector tends to have a marginally adverse effect on the level of labour productivity. The coefficient of localisation index is negative but

insignificant which means that the localisation economies are weak in the food and beverages sub-sector and do not have any impact on the level of labour productivity. Aggarwalla (2011) has also found that there is an adverse effect of localisation on the level of total factor productivity for the manufacturing sector as a whole. But she has analysed the relationship for the sector as a whole and not separately for the different sub-sectors.

The manufacture of textiles sub-sector is the second sub-sector in the discussion. This sub-sector is the largest contributor in terms of employment generation in the country. Table shows that for this sub-sector, the capital-labour ratio, the urbanisation index, and the localisation index have a significant impact on the level of labour productivity. Whereas the square of urbanisation index, and average size of firms are not significant in influencing the level of labour productivity. Among these three variables which affect the level of labour productivity significantly, only capital labour ratio has a positive effect on the labour productivity and indices of urbanisation and localisation have negative coefficients indicating the negative effect on the labour productivity. Positive capital labour ratio implies that an increase in the capital-intensity leads to increase in the productivity level. The coefficient of the urbanisation index is -7.645 which is significant at 10% level implying that one percent increase in the urbanisation level leads to 7.64% decline in the labour productivity. This result is supported by the finding of Mitra (2000) for the textiles sub-sector where he has found a negative and significant coefficient of the urbanisation index depicting that increase in the urbanisation level in the textiles sub-sector leads to a negative and adverse effect on the productivity. The urbanisation index square variable which represents diseconomies arising out of urbanisation (congestion, rising rents etc.) has a positive coefficient though it is not statistically significant.

The coefficient of localisation index also turns out to be negative for this sub-sector. The magnitude of the coefficient is -0.343 which is significant at 1% level meaning that an increase in own-industry concentration in this sub-sector leads to decline in the level of labour productivity. Negative localisation economies are also found by Aggarwalla (2011) for the whole of the manufacturing, services, trade and transport sectors and also by Mitra (2000) for some of the manufacturing sub-sectors. Several empirical studies have found localisation diseconomies, e.g. Glaeser et. al (1992).

According to Combes (2000), these manufacturing sub-sectors usually have a declining share in employment, and higher specialization reflects lower flexibility and adaptability of products, and regions with lower specialization are better able to reconvert their activities. The average size of firms and square of the urbanisation index do not have any significant impact on the dependent variable though the coefficient of both these variables is positive.

Next sub-sector is the manufacture of paper and paper products. In this sector, out of the five independent variables considered in the study, only log of capital-labour ratio turns to be significant. An increase in the capital intensity leads to an increase in the level of labour productivity. With respect to urbanisation economies and productivity, the pattern and behaviour of the urbanisation index and the square of urbanisation index is similar to the first two sectors. Increase in the urbanisation level initially seems to affect labour productivity adversely and after a point, labour productivity is positively affected. As opposed to the first two sectors considered, namely food and beverages sub-sector and manufacture of textiles, the index of localisation has a positive coefficient though it is not statistically significant. The average size of firms also does not have any significant impact on the level of labour productivity in this sub-sector. Also the value of R square turns out to be very low for this sub-sector.

Table 3.12 presents the results for the next three sub-sectors considered namely- publishing (22), printing and reproduction of electronic media, manufacture of non-metallic mineral products (26), and manufacture of basic metals (27). In the publishing, printing and reproduction of electronic media sub-sector, log of capital-labour ratio and average size of firms are the only variables which have a significant impact on the level of labour productivity. The other variables though insignificant display the same pattern as has been observed for the previous sub-sectors. That is, the urbanisation economies and labour productivity depicting a U-shaped relationship, initially urbanisation seems to be negatively affecting labour productivity and later on, after a particular point is reached, it seems to have a positive effect on the labour productivity. This pattern is observed by Mitra (2000) and Aggarwalla (2011) in the relationship between urbanisation economies and labour productivity.

The non-metallic mineral products sub-sector transforms mined or quarried non-metallic minerals such as sand, clay, into products for intermediate or final

consumption. Table 3.12 shows that the log of capital-labour ratio, urbanisation index, and the urban diseconomies term, square of urbanisation index are the only significant variables affecting the level of labour productivity. The other two variables which turn out to be insignificant are the localisation index and the average size of firms. Out of the three significant variables, log of capita-labour ratio and square of urbanisation index have a positive effect on the level of labour productivity, the former being significant at 1% level and the latter at 5% level.

The coefficient of urbanisation index is negative with a magnitude of 8.56. This means that 1% increase in the urbanisation level leads to about 8.5 % decline in the level of labour productivity. As observed before, this represents the U-shaped relationship between the urbanisation economies and productivity which is also supported by several other empirical studies. For the non-metallic mineral sector also, there is an increase in the productivity level after some critical point of urbanisation is reached. Initially, the productivity declines with increase in the urbanisation index (thereby giving negative coefficient to the urbanisation index) and then after a point, productivity increases with the increase in the urbanisation level (which is reflected in the positive coefficient of the urbanisation square variable.) The square of urbanisation index is included in the regression, to capture the non-linearity of the relationship. The coefficients of localisation index and average size of firms in this sub-sector are very small and also insignificant in influencing the level of labour productivity. Thus for this sub-sector, localisation economies are weak and almost non-existent.

Next, the results for the basic metals sector are discussed. In the case of basic metals sub-sector, none of the independent variables turn out to be significant in affecting the level of labour productivity. The coefficients show the similar behaviour as observed in most of the sub-sectors considered until now. Urbanisation economies and productivity in this sub-sector also depict a U-shaped relationship but the coefficients of both these variables are insignificant in affecting the level of labour productivity. Localisation economies and the capital-labour ratio have the positive coefficients but not statistically significant to make any meaningful statement.

Table 3.13 presents the results for the last two of the eight sub-sectors considered in the study, namely- machinery and equipment sub-sector and electrical machinery and

apparatus sub-sector. In the machinery and equipment sub-sector, the capital-labour ratio is the only significant variable and the rest four variables do have any significant impact on the level of labour productivity. However, the behaviour of urbanisation variables and productivity is in conformity with the behaviour in majority of the other sub-sectors. Localisation economies are also found to be weak in this sub-sector though the coefficient is positive but insignificant. This shows that own-industry concentration in this sub-sector does not have any favourable impact on the level of labour productivity. But urbanisation does contribute to an increase in the level of labour productivity although after a particular level of urbanisation is attained. As in almost all of the sub-sectors, average size of firms does not have any significant impact on the labour productivity level and the magnitude of coefficient is too small.

The manufacture of electrical machinery and apparatus is the last sub-sector in the discussion. In this sub-sector, the log of capital labour ratio, localisation index and average size of firms significantly affect the level of labour productivity. The other two variables representing urbanisation economies turn out to be insignificant in affecting the labour productivity. Out of the three significant variables, log of capital-labour ratio and localisation index have a positive coefficient whereas the size variable has a negative coefficient. This means that an increase in capital-intensity and an increase in own-industry concentration lead to a significant increase in the level of labour productivity. The average size variable shows a significant negative coefficient but it is very small in magnitude. The urbanisation economies as measured by the index of urbanisation are not significant enough. Localisation economies are stronger than the urbanisation economies in this sub-sector. The coefficient of localisation economies is 0.475 indicating that a one percent increase in own-industry concentration will lead to about 0.47 percent increase in the level of dependent variable. This is the only sub-sector out of the eight sub-sectors included in the study where urbanisation economies and productivity do not seem to show a U-shaped pattern. Only in this sub-sector, the coefficient of urbanisation index bears a positive sign and that of square of urbanisation index a negative sign. Localisation economies are found positively and significantly affecting the level of labour productivity in this sub-sector. In some other sub-sectors, where these economies turn out to be positively affecting the productivity, they were not found to be significant enough. The value of R square for this sub-sector is just over 52 per cent.

Table 3.11 Estimation Results (dependent variable: LPROD) 1999-00

	Manufacture of food products and beverages (15)	Manufacture of Textiles (17)	Manufacture of paper and paper products (21)
Constant	11.67 (7.35)*	9.588 (6.81)*	10.002 (2.42)**
Log K/L ratio	0.3157 (2.71)*	0.4584 (5.10)*	0.46 (1.88)***
Urb Index	-8.704 (-2.65)*	-7.645 (-1.77)***	-12.83 (-1.14)
Urban Square	9.318 (2.77)*	8.29 (1.39)	17.66 (1.19)
Loc Index	-0.167 (-0.56)	-0.343 (-2.55)*	0.2591 (0.45)
Size	-.0019 (-3.98)*	0.0013 (0.34)	-.0.012 (-1.21)
R square	0.4887	0.5106	0.266

Note: * and ** show significance at 1 % and 5 % level respectively. Figures in parenthesis are values of t-statistic.

Source: Author's Calculation using unit-level data, ASI 1999-00.

Table 3.12 Estimation Results (dependent variable: LPROD)

	Publishing, printing & Reproduction of media (22)	Manufacture of non-metallic mineral products (26)	Manufacture of basic metals (27)
Constant	10.055 (3.98)*	8.539 (6.23)*	11.938 (4.64)*
Log K/L ratio	0.3176 (1.97)***	0.530 (5.08)*	0.2015 (1.10)
Urb Index	-2.548 (-0.35)	-8.56 (-2.34)**	-4.453 (-0.63)
Urban Square	6.313 (0.98)	8.441 (2.36)**	4.276 (0.62)
Loc Index	0.010 (0.03)	-0.06 (-0.44)	0.2337 (1.06)
Size	-0.009 (-2.27)**	-0.002 (-1.58)	-0.006 (-1.47)
R square	0.3689	0.4965	0.1408

Note: *, ** and *** show significance at 1 %, 5 % and 10% level respectively. Figures in parenthesis are values of t-statistic.

Source: Same as Table 3.11.

Table 3.13 Estimation Results (dependent variable: LPROD)

	Manufacture of Machinery & Equipment (29)	Manufacture of Electrical Machinery & Apparatus (31)
Constant	8.98 (3.53)*	8.548 (5.32)*
Log K/L ratio	0.448 (2.68)*	0.3035 (2.61)*
Urb Index	-4.571 (-0.92)	2.489 (0.51)
Urban Square	5.031 (1.05)	-0.079 (-0.02)
Loc Index	0.018 (0.05)	0.4753 (2.22)**
Size	-0.004 (-0.87)	-0.005 (-3.55)*
R square	0.3758	0.5262

Note: *, ** and *** show significance at 1 %, 5 % and 10% level respectively. Figures in parenthesis are values of t-statistic.

Source: Same as Table 3.11.

Chapter 4

Regional Specialization and Agglomeration Economies-Productivity Relationship in the Manufacturing Sector: 2004-05

4.1 Introduction:

Structural change in any economy involves the transformation of a traditional agriculture based economy into manufacturing and then to a service driven economy. It is often remarked that India has skipped the second stage and from agriculture, a transition to a service-oriented economy has taken place. Manufacturing sector forms an important element of the India economy, accounting for nearly 25 % share in the GDP. This sector comprises of the organised sector and the unorganised sector. The organized sector means the units registered under Section 2m of Factories Act, 1948, for which the data are collected regularly on annual basis through Annual Survey of Industries (ASI), conducted by the C.S.O and unorganized sector means the rest, for which the data are collected in a gap of normally 5 years through socio-economic survey of NSS. The present study focuses on the agglomeration economies and productivity relationship in the organised sector.

There has been considerable attention paid since independence on the industrial policies as it was recognised by the policy makers that the economic success of the country is highly correlated with the performance of the industrial sector. The industrial policies of the 1950s and 1960s focused on heavy and large industries influenced by the success of former U.S.S.R. These policies favoured licensing, import-substitution and absence of market mechanism. As a result of these polices, the growth in the industrial sector was adversely affected and growth in labour and total factor productivity was almost negligible. This led to a massive change in the industrial policies beginning from mid 1980s and with the introduction of New Industrial Policy (NIP) in 1991. The new policy emphasised export promotion, abolition of licensing and quotas, encouragement to private and foreign investors and innovative research and development etc. among other measures.

These new polices led to significant increases in labour and total factor productivity in the following decade. Unel (2003) finds that the growth in labour and total factor productivity in total manufacturing and most of the sub-sectors was remarkably higher in 1980s than in the 60s and 70s. His study finds that these growth rates accelerated after 1991 reforms. However, a study by Goldar[7] on growth of TFP in the post-reform period finds that there was a deceleration in the TFP growth. The

[7] See Goldar (2004), Productivity Trends in Indian Manufacturing in the Pre and Post Reform Periods.

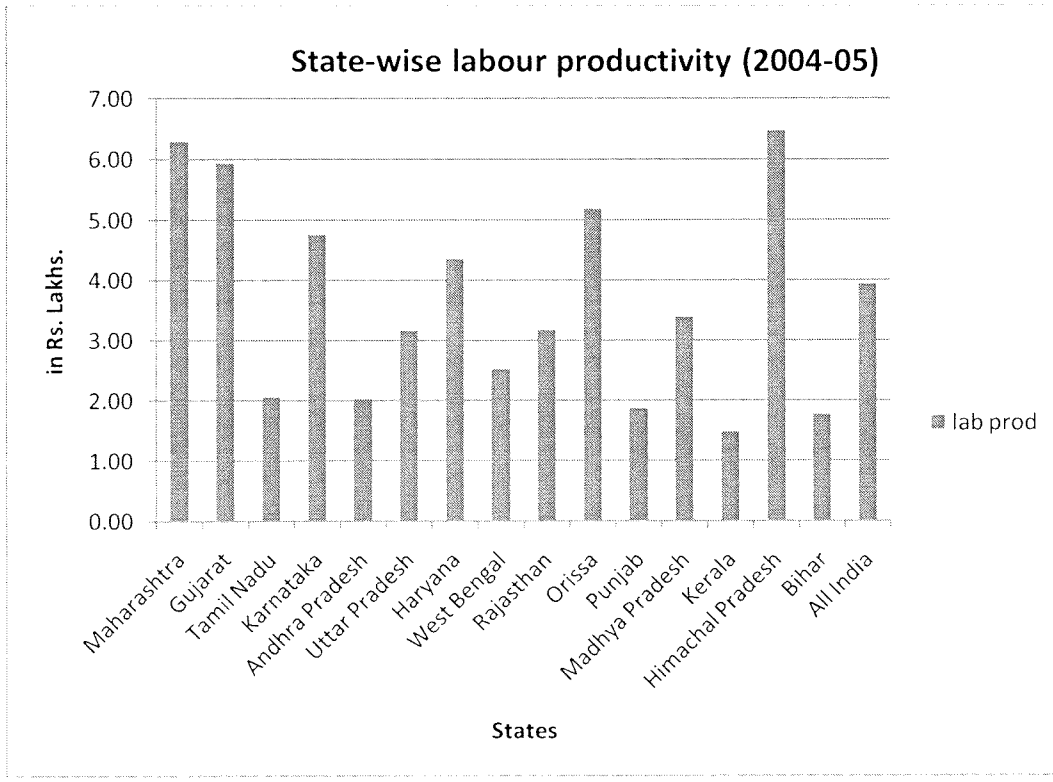
estimated average annual growth rate in TFP is 2.14 per cent for the period 1979-80 to 1990-91 and much lower at 1.00 per cent for the period 1991-92 to 1997-98.

In addition to the introduction given above, the rest of the chapter is organised into various sections. Section 4.2 gives an overview of the labour productivity in the overall manufacturing sector and also at the level of sub-sectors. Section 4.3 deals with analysis of localisation level in the eight sub-sectors in all the regions. The last section then discusses and empirically examines the agglomeration economies and labour productivity relationship for each of the sub-sector separately.

4.2 Labour Productivity in the Indian Manufacturing Sector (2004-05)

A recent study on the productivity in different countries has found that China and India top the growth in labour productivity in the year 2010. India witnessed a growth rate of 5.4 % in the labour productivity growth being the second highest in the world, only next to China (8.75).

Chart 4.1



Source: Calculated from Summary Results, ASI (2004-05)

Therefore, labour productivity in the overall manufacturing sector for different regions in the year 2004-05 is looked upon to get an idea of the low and high productivity regions in the country.

The above chart shows the level of labour productivity in the 15 major states considered in this study for the year 2004-05. The labour productivity in the eight different sub-sectors of industry is also calculated in all the 53 regions which will be presented in the subsequent section. The labour productivity is calculated by simply dividing the net value added by the no. of workers. This chart shows that, labour productivity overall in the manufacturing sector is higher in southern and western states like Maharashtra, Gujarat, Karnataka, and Orissa. The low labour productivity can be seen in states like Kerala, Bihar, Tamil Nadu and Punjab.

Table 4.1: Percentage Change in labour productivity in the Major States from 2001-02 to 2004-05.

States	% change in labour productivity
Maharashtra	75.0
Gujarat	83.3
Tamil Nadu	26.4
A.P.	246.0
Uttar Pradesh	-22.2
Karnataka	18.4
Haryana	39.1
West Bengal	74.6
M.P.	-15.8
Punjab	159.4
Rajasthan	-30.6
Kerala	157.1
Orissa	-32.0
H.P.	33.6
Bihar	44.3
All India	62.6

Source: Calculated using Summary Results, ASI.

Table 4.1 shows the percentage change in labour productivity in the 15 major states considered in the present study. During the five year period from 2001-02 to 2004-05, almost all states witnessed an improvement in the level of labour productivity. Except the three states (U.P., M.P. and Orissa) all other twelve states registered an increase in labour productivity. The highest percentage increase is in the case of A.P., Punjab and

Kerala showing an increase of more than 150 percent. The three states- Orissa, M.P. and U.P. - experienced a negative growth rate in the labour productivity. At the all India level, the labour productivity increased about 63% during the five years from 2001-02 to 2004-05.

Table 4.2 shows the level of labour productivity in the eight selected sub-sectors of manufacturing for the year 2004-05. These show the labour productivity at the all-India level calculated by dividing the net value added by the total no. of workers in that particular sub-sector. The labour productivity is seen to be highest in the sub-sector of Basic Metals whereas the level is quite low in the sub-sectors like Food and Beverages, and Textiles products.

Table 4.2 Labour Productivity in the eight sub-sectors for the year 2004-05

NIC	Industry	Labour productivity (Rs lakh)
15	Food and Beverages	1.710
17	Textiles Products	1.346
21	Paper and Paper Products	2.453
22	Publishing, printing	4.212
26	Non-metallic mineral products	2.819
27	Basic Metals	11.420
29	Machinery and Equipment	4.535
31	Electrical Machinery & Apparatus	4.649

Source: Author's calculation from ASI data, 2004-05.

It is important to understand the levels of labour productivity in these manufacturing sub-sectors in order to examine how the agglomeration economies have an impact on the labour productivity. The sub-sectors of Publishing, Printing; Machinery & Equipment and Electrical Machinery and Apparatus show similar levels of labour productivity.

4.3 Analysis of Localisation in the Different Manufacturing Sub-sectors:

About 18% of the total labour force is engaged in the organised manufacturing sector as per the 2004-05 ASI data. The importance and regional dominance of each of the eight manufacturing sub-sectors is analysed by looking at the location quotients (L.Q.). The eight subsectors are namely Food products and Beverages (NIC 15),

Textiles (NIC 17), Paper and paper products (NIC 21), Publishing, printing and reproduction of electronic media (NIC 22), Non-metallic mineral products (NIC 26), Basic metals (NIC 27), Machinery and equipment (NIC 29) and Electrical machinery and Apparatus (NIC 31.) These sub-sectors are discussed one by one in order to present a brief picture about their significance and contribution in the manufacturing sector as a whole. The location quotients (called localisation index) are calculated for each of the sub-sectors in all the 53 regions considered in the study.

4.3.1 Food and Beverages Industry:

The manufacture of food products and beverages is an important sub-sector in the Indian manufacturing sector. India is the world's second largest producer of food next to China, and has the potential of being the biggest with the food and agricultural sector. The total food production in India is likely to double in the next ten years and there is an opportunity for large investments in food and food processing technologies, skills and equipment, especially in areas of Canning, Dairy and Food Processing, Specialty Processing, Packaging, Frozen Food/Refrigeration and Thermo Processing.

Table 4.3 shows the localisation index for this sector calculated in all the regions included in the study. As stated earlier, if the value of L.Q. exceeds one it indicates that the region is more specialised in a given sector than on the average in the country, and, alternatively, if the value is below one the sector is less represented in the region than nationally. Table 4.3 shows that the regions in the southern states of Tamil Nadu, Kerala and A.P. have L.Q. greater than 1 implying that these regions are much more specialised as compared to the country as a whole. In the case of food and beverages industry, the regions in the states of Bihar and West Bengal are less specialised as compared to the entire country as shown by the value of L.Q. which is less than 1. Most of the regions in the states of M.P. and Karnataka have L.Q. which is less than 1 showing a lesser degree of specialisation in these regions. The states of U.P. and Himachal Pradesh (H.P.) comprise of regions which have a higher degree of specialisation in the manufacture of food products and beverages as compared to the nation as a whole. H.P. has a developed food processing and beverages industry which causes it to be more specialised.

Table 4.3: Localisation Index for Food and Beverages Industry (15) in all the regions.

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.520	GUJ Eastern	0.200
Punjab Southern	1.985	GUJ Plains Northern	0.577
H.P.	2.368	GUJ Plains Southern	2.820
HR Eastern	0.498	GUJ Dry Areas	0.000
HR Western	1.523	GUJ Saurashtra	0.799
RAJ Western	0.421	MH Coastal	0.437
RAJ North-eastern	0.635	MH Inland Western	1.277
RAJ Southern	0.021	MH Inland Northern	1.429
RAJ South-Eastern	1.994	MH Inland Central	1.496
UP Western	1.035	MH Inland Eastern	1.895
UP Central	1.780	MH Eastern	1.374
UP Eastern	1.214	AP Coastal	1.863
UP Southern	0.673	AP Inland Northern	0.350
BIHAR Northern	0.219	AP South Western	1.482
BIHAR Central	0.474	AP Inland Southern	2.136
WB Himalayan	2.207	KAR Coastal	2.758
WB Eastern Plains	0.658	KAR Inland Eastern	0.487
WB Central Plains	0.489	KAR Inland Southern	0.300
WB Western Plains	2.859	KAR Inland Northern	1.078
ORI Coastal	0.843	KER Northern	0.948
ORI Southern	3.116	KER Southern	1.922
ORI Northern	1.920	TN Coastal Northern	0.927
MP Vindhya	0.084	TN Coastal	0.940
MP Central	0.493	TN Southern	1.469
MP Malwa	0.959	TN Inland	0.952
MP South	0.872	MP South Western	1.964
MP Northern	2.691		

Source: Author's Calculation.

4.3.2 Textiles Industry:

The Textiles industry holds a very significant and unique position in the Indian manufacturing sector. It is the largest industry in terms of the generation if employment. At present, it contributes 14 % of the industrial output. So the study of this industry is crucial as it is a vital and essential component of the manufacturing sector in India. This industry supports many agro-based industries and thus provides significant employment. The textiles industry in India works on an independent basis

starting from the procurement of raw materials to the final stage of production. In the year 2004-05, this industry accounted for about 16.32 % of the total manufacturing employment.

Regional localisation of the textiles industry in different regions is clear from the above table 2. The textiles firms in regions in the state of Haryana and Rajasthan exhibit are highly localised as compared to the nation as a whole. Southern states like T.N., Kerala, Karnataka and A.P. have the presence of textile firms which are not as specialised indicated by a value of L.Q. which is less than 1.

Table 4.4: Localisation Index for Textiles Industry (17)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	1.712	GUJ Eastern	2.987
Punjab Southern	0.470	GUJ Plains Northern	0.527
H.P.	0.087	GUJ Saurashtra	0.891
HR Eastern	1.084	MH Coastal	1.645
HR Western	1.771	MH Inland Western	0.686
RAJ Western	1.966	MH Inland Northern	0.833
RAJ North-eastern	1.022	MH Inland Eastern	0.246
RAJ Southern	0.238	AP Coastal	0.164
UP Western	0.446	AP Inland Northern	0.200
UP Central	0.547	AP South Western	0.312
UP Eastern	0.137	AP Inland Southern	0.192
BIHAR Central	0.059	KAR Inland Southern	0.819
WB Eastern Plains	0.149	KAR Inland Northern	0.276
WB Central Plains	0.499	KER Northern	0.513
ORI Coastal	0.537	KER Southern	0.252
ORI Northern	0.028	TN Coastal Northern	0.501
MP Central	0.193	TN Coastal	2.842
MP Malwa	1.746	TN Southern	1.923
MP South-western	2.534	TN Inland	3.582
MP Northern	0.090		

Source: Author's Calculation.

4.3.3 Paper and Paper Products Industry:

The paper and paper products industry is considered as one of the core sectors in India. Most of the paper mills are privately owned and a very few are owned by the government. This industry is one of the most vibrant and crucial export industries in

India. Paper industry requires only a low capital and can also be set up even in villages. It is a source of employment to a majority of rural people in the country. Since it forms an important sub-sector of the manufacturing sector, it is important to study the linkages between agglomeration economies and productivity in this industry. The consumption of paper products like cardboards, envelops, bags, notebooks etc. have increased manifold in the recent years. This industry is one of the most promising industries and has a great growth potential.

In the year 2004-05, this industry accounted for just over 2 % of the manufacturing employment. Table 4.5 shows the degree of regional localisation in different regions in case of paper and paper products industry. The regions in the states of Bihar, West Bengal, Maharashtra and Karnataka are more localised as compared to the country in the case of paper and paper products industry. Northern states like U.P., Punjab and Haryana comprise of regions which are less localised relative to the entire country. The higher values of L.Q. are observed in the regions of Karnataka state implying a higher degree of localisation. Very low values of the L.Q. are observed in few regions of U.P., H.P. and Haryana.

Table 4.5: Localisation Index for Paper and Paper Products Industry (21)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	2.867	GUJ Eastern	0.951
Punjab Southern	0.428	GUJ Plains Northern	0.509
H.P.	0.218	GUJ Dry Areas	2.205
HR Eastern	0.677	GUJ Saurashtra	2.525
HR Western	0.078	MH Coastal	0.794
RAJ North-eastern	0.150	MH Inland Western	1.826
UP Western	1.166	MH Inland Northern	1.987
UP Central	0.640	MH Inland Eastern	2.098
UP Eastern	0.020	AP Coastal	0.323
BIHAR Central	1.088	AP Inland Northern	1.152
WB Central Plains	1.209	KAR Inland Eastern	9.083
WB Western Plains	0.231	KAR Inland Southern	3.294
ORI Coastal	0.787	KER Northern	0.037
ORI Southern	1.058	KER Southern	0.502
ORI Northern	0.333	TN Coastal Northern	0.491
MP Central	2.018	TN Coastal	2.750
MP Malwa	0.372	TN Southern	0.859
MP Northern	1.612	TN Inland	0.689

Source: Author's Calculation

This brings out the fact that the firms in the northern most regions of the country are not high specialised as compared to the country as a whole. Tamil Nadu, being the only southern state the regions of which depict L.Q less than 1 implying less regional specialisation of paper and paper products industry in these regions.

4.3.4 Publishing, printing and reproduction of electronic media:

Printing is often carried out as a large-scale industrial process and is an essential part of publishing and transaction printing. Indian print media is one of the largest print media in the world. The history of it started in it 1780, with the publication of Bengal Gazette from Calcutta. The India media and printing industry stood at Rs 584 billion in 2008, a growth of 12.4 % over the previous year. Over the next five years, the industry is expected to grow at an annual growth rate of 12.5% to reach the size of Rs 1052 billion by 2013, according to a report by FICCI. The structure of the Indian print industry is highly fragmented with importance to regional dominance as will be highlighted in the next paragraph with the use of regional location quotients.

Table 4.6: Localisation Index for Publishing, Printing and Media Industry (22)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.314	MH Coastal	3.944
Punjab Southern	0.660	MH Inland Western	0.642
H.P.	0.079	MH Inland Central	0.539
HR Eastern	0.040	AP Coastal	0.707
RAJ North-Eastern	0.006	AP Inland Northern	3.535
UP Western	0.480	AP South Western	0.349
UP Central	3.390	KAR Coastal	0.053
UP Eastern	0.261	KAR Inland Southern	1.008
BIHAR Northern	0.942	KAR Inland Northern	0.142
BIHAR Central	0.393	KER Northern	1.266
WB Central Plains	1.642	KER Southern	0.804
ORI Coastal	0.532	TN Coastal Northern	2.174
MP Malwa	0.031	TN Coastal	1.680
MP South	7.981	TN Southern	2.765
MP Northern	2.736	TN Inland	0.302
GUJ Eastern	0.284		
GUJ Plains Northern	1.885		
GUJ Saurashtra	0.008		

Source: Author's Calculation.

The regionalism aspect is clearly visible in the newspaper sector and this sector has relatively high entry barriers due to the strong brand equity of existing players. Also existing players have strong control over the distribution network making it difficult for new players to enter.

This sector accounted for just over 1 % of the total manufacturing employment in the year 2004-05. However, the share of this sector in the net value added generated in the manufacturing sector was relatively higher. Table 4.6 shows the degree of regional localisation in different regions in case of printing and publishing industry. Due to the very nature of printing and publishing activities, some regions are more specialised than the others. The value of L.Q. in the region of Himachal Pradesh (H.P.) is close to zero (0.079) indicating virtually no prevalence of this industry in that region. Same holds true for some of the NSS regions in the states of M.P. and Karnataka.

A very high degree of localisation of this sub-sector is observed in the regions of states of Tamil Nadu, Kerala, and few regions of Maharashtra, A.P., and Gujarat. The table 4.6 shows that the regions in southern states are more specialised than those in the northern and western states. The spread of this sub-sector is not even with respect to all the states as shown by higher L.Q. in regions of southern states. A brief analysis about the regions which specialise with respect to location of the sub-sectors provides an important insight for the further analysis.

4.3.5 Non-metallic Mineral Products Industry:

This category is comprised of firms that manufacture goods made from plaster of Paris, sand lime, and other miscellaneous non-metallic mineral products. Examples of industry output include synthetic stones, clay and plaster plaques, architectural plaster work, plaster of Paris sculptures, miniature gypsum images, plaster of Paris flower boxes, and gypsum urns. Markets for miscellaneous non-metallic mineral products are extremely fragmented. The largest single industry product category is statuary and art goods, which accounts for nearly 20 percent of industry output. The largest consumer of this industry's offerings is the nonferrous wire-drawing industry, which uses tubing made from quartz to produce electrical wire. Other major consumers include fabricated rubber product manufacturers and motor and generator makers, who also use quartz tubing. About 10 percent of production is exported.

The industry is relatively low-tech and manufactures many commodity-like products. The employment in the non-metallic mineral products industry was about 6.4% of the total manufacturing employment in 2004-05. This industry has a significant importance in the Indian manufacturing sector because of its potential to generate considerable export earnings. This sub-sector had over 13000 units all over India in the same year.

Table 4.7: Localisation Index for Non-metallic mineral products industry (26)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.658	GUJ Eastern	0.878
Punjab Southern	0.768	GUJ Plains Northern	0.819
H.P.	0.039	GUJ Plains Southern	0.923
HR Eastern	1.113	GUJ Saurashtra	1.289
HR Western	1.125	MH Coastal	0.370
RAJ Western	3.074	MH Inland Western	0.724
RAJ North-eastern	2.181	MH Inland Northern	1.162
RAJ Southern	6.386	MH Inland Central	2.057
RAJ South-Eastern	2.263	MH Inland Eastern	0.482
UP Western	0.509	MH Eastern	3.833
UP Central	0.014	AP Coastal	1.646
UP Eastern	0.109	AP Inland Northern	1.597
UP Southern	1.576	AP South Western	3.203
BIHAR Northern	5.525	AP Inland Southern	1.904
BIHAR Central	3.558	KAR Coastal	0.604
WB Himalayan	1.944	KAR Inland Southern	1.426
WB Central Plains	0.025	KAR Inland Northern	2.023
WB Western Plains	0.465	KER Northern	0.604
ORI Coastal	2.478	KER Southern	1.180
ORI Northern	0.719	TN Coastal Northern	0.794
MP Vindhya	6.508	TN Coastal	0.413
MP Central	0.235	TN Southern	0.441
MP Malwa	0.056	TN Inland	0.078
MP South	2.565		

Source: Author's Calculation.

Table 4.7 shows that out of the total 53 regions considered in the study, 24 of them specialise in the manufacture of non-metallic mineral products with location quotients greater than one. The highest value of L.Q. is observed in the one of the region of M.P. with a value of 6.5 indicating a very high degree of specialisation. The lowest value of L.Q. is observed in the region of H.P. at 0.039 indicating almost no

specialisation in this region. The regions in the northern states of Haryana, and Rajasthan have a higher degree of specialisation as compared to the nation as a whole. Both the regions in the state of Punjab have a value of L.Q. less than 1 indicating that the lack of specialisation in these regions. Out of the four regions in the state of U.P. the three are not specialised; only the fourth region is specialised with L.Q. greater than one. All the regions in the states of Bihar and A.P. are specialised with L.Q. in these regions being greater than one. Except the one region in the state of Gujarat the rest three are no specialised in the manufacture of non-metallic mineral products. The southern state of Tamil Nadu does not include any region which is specialised in the manufacture of non-metallic mineral products. All the regions in T.N. have a value of L.Q. which is less than one. Kerala and Karnataka have almost all the regions specialising in this sub-sector.

4.3.6 Basic Metals Industry:

Metal industry in India forms a very crucial part of the manufacturing sector providing employment to over three million workers[8] and the importance of this sub-sector has been increasing over the years. India has huge deposits of natural resources in the form of minerals like copper, iron-ore, chromate and gold. Therefore, the metal industry in India is one of the booming industries. The basic metals industry in India is categorised in the two divisions- the iron-based and non iron-based metal industries. The iron-based segment includes the manufacturing of three different kinds of steel such as carbon steel, ferrochrome steel, and stainless steel. The non-iron based category included the production of copper, tin, brass, lead, zinc and aluminium. The main operations of the basic metal industries in India are mining of the ores, refining of the ores, alloying, sheet and rolling into foils. Indian basic metals industry witnessed significant changes in the 1990s with the onset of the new form and source of investments with the adoption of liberalisation and privatisation policies. With the new form and sources of investments, the infrastructure pertaining to the industries was altered. More and more efficient and technologically advanced methods have led to an improvement in the production processes and in turn output of the industry has increased along with the quality of products.Since this chapter of the study focuses on the year 2004-05, we analyse the regions which specialise in the manufacture of basic

[8] See the Report of International Metalworkers' Federation (2002)

metals with the help of L.Q. presented for all the regions in Table 4.8. This sub-sector accounted for 6.5% of the total manufacturing employment (summary results). The table excludes those regions for which data were not available as some industries do not exist in all the regions considered in the study.

Table 4.8 shows that 17 regions specialise in the manufacture of basic metals with L.Q. of greater than one. The highest value of L.Q. for the basic metals industry is observed in a region of Karnataka (at 5.38) implying a very high degree of specialisation. The lowest value of L.Q. is observed in the case of Orissa (at 0.007). The regions of Gujarat, Maharashtra and Karnataka have on average higher values of L.Q. than the other regions. For Punjab, out of the two regions one has a L.Q. greater than one and other having less than one. The basic metals industry is not as dominant in hilly areas as shown by a very low value for Himachal Pradesh (0.21). Only one region in the state of T.N. shows higher degree of specialisation whereas the other three shows lack of specialisation shown by L.Q. which is less than one.

Table 4.8: Localisation Index for Basic Metals Industry (27)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.583	MH Coastal	1.123
Punjab Southern	1.627	MH Inland Western	1.526
H.P.	0.216	MH Inland Northern	0.779
HR Eastern	0.681	MH Inland Central	0.769
HR Western	1.012	MH Inland Eastern	0.594
RAJ Western	0.532	MH Eastern	0.024
RAJ North Eastern	2.690	AP Coastal	0.361
RAJ South Eastern	0.632	AP Inland Northern	1.134
UP Western	1.151	AP South Western	0.083
UP Central	0.523	KAR Inland Eastern	5.381
UP Eastern	0.241	KAR Inland Southern	0.383
UP Southern	1.225	KAR Inland Northern	0.614
BIH Central	0.190	KER Southern	1.126
WB Himalayan	0.422	TN Coastal Northern	1.945
WB Central Plains	3.051	TN Coastal	0.038
ORI Coastal	0.007	TN Southern	0.193
ORI Northern	1.979	TN Inland	0.413
MP Malwa	1.578		
GUJ Eastern	0.308		
GUJ Plains Northern	2.082		
GUJ Saurashtra	1.159		

Source: Author's Calculation.

Apart from the region in the state of Karnataka which has the highest value of L.Q. in the manufacture of basic metals industry, the other two regions are not specialised as shown by the value of L.Q. which is less than 1. This shows that specialisation of any industry in a particular state varies from region to region.

4.3.7 Machinery and Equipment Industry:

Machinery and equipment industry in India is the core around which all the industrial manufacturing activity takes place. This industry has amply demonstrated its potential in meeting enormous demand of goods both in the domestic as well as in the international market. Machinery and equipment industry forms the backbone of the manufacturing sector by supplying all the necessary equipments and the machinery required for production. This industry includes establishments that produce pumps and compressors, rolling-mill and metalworking equipment, forestry equipment, mining equipment, farm machinery, and construction equipment.

Table 4.9: Localisation Index for Machinery and Equipment Industry (29)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	2.276	MH Coastal	1.844
Punjab Southern	0.205	MH Inland Western	1.063
H.P.	0.901	MH Inland Northern	0.731
HR Eastern	1.556	MH Inland Central	0.082
RAJ Western	0.452	MH Inland Eastern	0.402
RAJ North Eastern	0.614	AP Coastal	0.159
UP Western	0.912	AP Inland Northern	2.151
UP Central	0.011	KAR Coastal	0.470
UP Eastern	0.857	KAR Inland Southern	1.768
BIHAR Northern	0.052	KAR Inland Northern	1.854
BIHAR Central	0.162	KER Northern	0.266
WB Eastern Plains	0.572	KER Southern	0.225
WB Central Plains	1.704	TN Coastal Northern	1.438
WB Western Plains	0.369	TN Coastal	0.159
ORI Coastal	0.212	TN Southern	0.189
ORI Northern	0.283	TN Inland	0.335
MP Central	0.663		
MP Malwa	1.880		
GUJ Eastern	1.601		
GUJ Plains Northern	1.977		
GUJ Saurashtra	0.904		

Source: Author's Calculation.

Machinery and equipment are made in foundries, machine and welding shops and assembly plants. This industry is a labour and technology-intensive industry, employing large number of engineers and skilled tradesmen. In 2004-05, this sector accounted for about 4.5 % of the total manufacturing employment. The total no. of workers in this sub-sector in 2004-05 stood at 2, 98,174 increasing from 2, 65931 in 2001-02. This accounted for about an increase of 12% in a period of five years.

Table 4.9 shows that 12 regions specialise in the machinery and equipment industry with a L.Q. of greater than one. The highest value of the L.Q. is observed in one of the regions of the state of Punjab with a value of 2.276 and the lowest L.Q. is observed in one of the regions of U.P. (0.011). Kerala and Tamil Nadu (with an exception of one region in T.N.) do not have regions which specialise in the manufacture of machinery and equipment industry. The regions of Himachal Pradesh and Haryana exhibit a high degree of specialisation as most of the industries are located in these regions. Bihar includes both the regions which have a L.Q. of less than one indicating lack of specialisation. Gujarat is highly specialised in the manufacture of machinery and equipment as most of the regions in the state have a high value of L.Q.

4.3.8 Electrical Machinery and Equipment:

The Electrical Machinery and Equipment industry consists of companies engaged in the manufacturing of large-scale electrical equipment, such as elevators, escalators, industrial conveyor belt systems and electrical machinery. The industry also includes hydraulic, steam, gas and wind turbines, large generators and power grid equipment, such as transformers. The Electrical Equipment industry excludes large permanently installed machinery and engineering services, classified in Engineering & Construction; and small generators, classified in Electrical Components & Equipment. The electrical machinery and equipment sector in India primarily caters to the power sector and is poised for growth in view of the Government's thrust on the power and construction industries. The increasing thrust on power sector reforms is helping improve investor confidence in the sector and a parallel increase in the inflow of investments. India produces the full range of electric power generation and transmission machinery. The electrical machinery industry consists of four key product categories, based on their use. The first is the generation machinery which

includes products like generators, boilers and turbines. The second is the transmission industry which includes different types of transformers and transmission towers. The third is the distribution machinery and this includes circuit breakers, switch gears, and control gears. The fourth key product category is the miscellaneous category which includes electric motors, wires and cables.

This sector accounted for about 2.5 % of the total manufacturing employment. The total no. of workers in 2004-05 in this sub-sector stood at 168646 increasing from 151647 in 2001-02. This accounted for 11.2 % increase in the employment in the machinery and electrical equipment sub-sector over a period of five years. Table 4.10 shows the localisation index for the regions in electrical and machinery equipment industry for the year 2004-05. Only 13 regions specialise in the manufacture of electrical and machinery equipment shown by L.Q. of greater than one. The regions in the states of Punjab and H.P. exhibit very low L.Q. indicating that these regions are not specialised. The neighbouring state of Haryana includes a region with the highest value of L.Q., (4.036).

Table 4.10: Localisation Index for Electrical Machinery and Equipment Industry (31)

Regions	L.Q.	Regions	L.Q.
Punjab Northern	0.010	GUJ Eastern	0.745
Punjab Southern	0.064	GUJ Plains Northern	0.458
H.P.	0.142	GUJ Saurashtra	1.557
HR Eastern	4.036	MH Coastal	1.094
RAJ Western	0.014	MH Inland Western	0.266
RAJ North Eastern	0.240	MH Inland Northern	0.139
UP Western	4.383	MH Inland Central	2.285
UP Central	3.220	MH Inland Eastern	1.775
UP Eastern	0.012	AP Coastal	0.084
BIHAR Central	0.153	AP Inland Northern	1.317
WB Central Plains	2.229	AP South Western	0.000
ORI Coastal	1.381	KAR Inland Southern	2.325
ORI Northern	0.073	KER Southern	0.194
MP Central	2.678	TN Coastal Northern	1.450
MP Malwa	0.377	TN Southern	0.023
		TN Inland	0.157

Source: Author's Calculation.

The lowest value of L.Q. is observed in one of the region of the state of Punjab (0.010) indicating virtually zero specialisation. The states of Rajasthan, Bihar and Gujarat contain the regions with very low level of specialisation. All the regions in these states exhibit a level of L.Q. which is less than one.

This sub-sector has witnessed a continuous growth in the exports over the five year period from 2001-05. This sector exported about 830 million dollars worth of goods on 2004-05 as opposed to about 203 million in the year 2001-02 showing a growth rate of about 42%.[9] This sector acts as a main driver for exports has been increasing outsourcing of manufacturing goods from India, in addition to other factors like low labour costs and improvements in capability and technology of domestic players. It will be important to look at the aspect of agglomeration economies and productivity relationship in this sub-sector since it forms a crucial component of the manufacturing sector in India.

Table 4.11 shows the no. of regions which specialise in different industries. The highest no. of regions specialise in the manufacture of food products and beverages industry, followed closely by non-metallic mineral products industry. These two sub-sectors are more evenly spread across all the regions and large gains can be reaped by focusing on them.

Table 4.11: No. of Regions specialising in the different sub-sectors.

Industry name	No. of regions specialising
Food and Beverages	26
Textiles	12
Paper and Paper Products	16
Publishing and Printing	12
Non-metallic Mineral Products	24
Basic Metals	16
Machinery and Equipment	12
Electrical Machinery Equipment	13

Source: Author's Calculation

The other six sub-sectors more or less stand at the same position with the no. of regions that specialise ranging from 12 to 16. Whether this kind of specialisation has any favourable impact on the labour productivity will be seen in the next section

[9] IBEF report on Electrical Machinery Sector

where the impact of agglomeration economies is analysed on the labour productivity of the firms.

4.4 Agglomeration Economies in the Indian Manufacturing Sector:

4.4.1 Results and Discussion

The linear regression equation no. 3 is estimated for the 15 states- including the 53 regions examined under the study in the eight industry sub-sectors. Table 4.1 presents the results for the first three sub-sectors- namely Food and Beverages industry (15), Textiles industry (17) and Paper and paper products industry (21).

A simple OLS approach was used to estimate the parameters of the regression equation. The estimates reported in Table 4.12 suggest that there is considerable heterogeneity in the sources and magnitudes of agglomeration economies between industry sub-sectors. Also to capture the diseconomies from urbanisation, the square of urbanisation is included in the regression model. As mentioned before, the square term tries to capture the non-linear relationship between the urbanisation economies and labour productivity. The results of the first three sub-sectors considered in Table 4.12 are examined separately.

For the Food and Beverages industry (15), the variables which significantly affect the dependent variable are log of capital-labour ratio, urbanisation index, and average size of firms. The other two independent variables, namely localisation index and the square of urbanisation index turn out to be insignificant. The capital-labour ratio and the urbanisation economies have positive coefficients implying that an increase in capital-labour ratio and urban concentration lead to an increase in the level of labour productivity. The coefficient of the urbanisation index is 6.354 meaning that a 1% increase in the urbanisation level will lead to about 6.3 % increase in the level of labour productivity.

The average size of firms displays a negative and significant coefficient meaning that an increase in the average firm size will lead to decline in the level of labour productivity. However, the magnitude of this coefficient is very small. The localisation index variable displays a negative coefficient though it is significant. This

result is in parlance with what is observed for the previous time period i.e. 1999-2000 and also supported by results obtained by Aggarwalla (2011), who has found negative localisation economies for the manufacturing sector as a whole. Hence, for the food and beverages sub-sector, the economies of urbanisation dominate and are very important in affecting the labour productivity, whereas the localisation economies are found to be weak.

Certain studies have used the interaction variables by multiplying the size variable with the indices of localisation and urbanisation to understand whether the regions where average size of firms is large or small profit more localisation or urbanisation economies, (Mukkala, 2003). But inclusion of such kind of interaction variables creates a serious problem of multicollinearity. Therefore, the use of such interaction variables is not made to avoid that serious problem of correlated independent variables. As compared to the year 1999-2000, the behaviour of localisation economies is found to be the same, though the U-shaped relationship between urbanisation economies and labour productivity which is observed for the year 1999-00 does not hold good for this time period.

The value of R square is close to 49% for this sub-sector. The manufacture of textiles sub-sector is a very crucial and significant component of the manufacturing sector in India. It contributes around 3% to the total GDP of the country and also it is the largest contributor in terms of employment generation in the country. Table 4.12 shows that the only variables which significantly affect the labour productivity in this sub-sector are log of capital-labour and the average size of firms. The remaining independent variables turn out to be insignificant. Capital-labour ratio positively affects the labour-productivity in this sub-sector whereas the average size of firms seems to be negatively affecting it. The coefficient of average firm size variable is significant but it is very small in magnitude (-0.012). The urbanisation and localisation economies are very weak in this sub-sector so as to have any significant impact on the labour productivity. In this sub-sector too, as compared to the previous time period i.e. 1999-00, the U-shaped relationship between urbanisation economies and productivity it not observed. In this sub-sector, the coefficient of urbanisation index is positive and the coefficient of square of urbanisation index is negative.

However, this behaviour does not need to be stressed upon as these variables are insignificant. The value of R square for this sub-sector is about 46 per cent.

The results for the manufacture of paper and paper products industry do not yield any meaningful results as most of the coefficients turn out to be statistically insignificant. Only the coefficient of log of capital-labour ratio is significant and positive. The coefficient of urbanisation index is negative and the coefficient of square of urbanisation index is positive highlighting the U-shaped relationship between urbanisation economies and labour productivity. The localisation economies are weak and do not have any significant impact on the level of labour productivity. These results match with what have been observed for the previous time period i.e. 1999-2000. Also the value of R square turns out to be very low for this sub-sector.

Table 4.13 presents the results for the next three sub-sectors considered namely-publishing (22), printing and reproduction of electronic media, manufacture of non-metallic mineral products (26), and manufacture of basic metals (27). In the publishing, printing and reproduction of electronic media sub-sector, none of the five independent variables turn out to be significant in affecting the labour productivity. Though the coefficient of both localisation and urbanisation indices are positive but there cannot be any meaningful conclusion drawn since they turn out to be statistically insignificant. Even the log of labour productivity turns out to an insignificant variable. The square of urbanisation term has a negative coefficient which represents the diseconomies from an increase in the urbanisation level. These results are similar to those of the previous time period i.e. 1999-2000 where the localisation and urbanisation economies were found to be weak and insignificant in affecting the labour productivity. The R square value for this sub-sector turns to be very low.

The non-metallic mineral products sub-sector transforms mined or quarried non-metallic minerals such as sand, clay, into products for intermediate or final consumption. Table 4.2 shows that log of capital-labour ratio, the urbanisation index, localisation index and average size are the variables which have a significant impact on the level of labour productivity. The square of urbanisation index is the only variable which turns out to be statistically insignificant in affecting the labour productivity. Out of the four significant independent variables, only log of capital-

labour ratio has a positive coefficient implying that an increase in the capital-intensity leads to an increase in the labour productivity. The indices of urbanisation and localisation have negative coefficients in this sub-sector.

This means that an increase in the urban concentration and an increase in the own-industry concentration lead to a decline in the labour productivity. But this supports a similar finding by Lall et al (2001), where they have found a negative and significant coefficient of localisation index. The benefits of urban concentration do not offset associated costs. Higher wages, rents, and congestion in dense urban areas counteract benefits such as inter industry transfers and access to productive services.

The square of the urbanisation index has a positive coefficient but it is insignificant. This could be due to the U-shaped relationship between the urbanisation economies and productivity as also observed by Aggarwalla (2011) and Mitra (2000). The average size of firms has a negative coefficient which is significant meaning that an increase in the average size leads to decline in the labour productivity. But the magnitude of this coefficient is very small to have any important affect. These results for the year 2004-05 are similar to those found for the year 1999-2000.

Next, the results for the basic metals sector are discussed. For the basic metals industry, the log of capital-labour ratio, urbanisation index and localisation index turn out to be significant variables in affecting the labour productivity. The square of the urbanisation index and the average firm size do not seem to have any significant impact on the level of labour productivity. The coefficient of log of capital-labour ratio is positive implying that increase in the capital intensity leads to an increase in the labour productivity. The coefficients of urbanisation and localisation economies are negative indicating that an increase in the urbanisation level as well as increase in the own-industry concentration leads to a decline in the labour productivity. Both these coefficients are significant at 10% level of significance. The value of the coefficient of localisation index is -0.427 indicating that 1% increase in own-industry concentration (localisation) leads to 0.42% decline in the labour productivity level. Negative and significant localisation economies are observed for four of the total eight industry sub-sectors. The U-shaped relationship between the urbanisation economies and labour productivity is observed for this sub-sector too.

Table 4.14 presents the results for the last two of the eight sub-sectors considered in the study, namely- machinery and equipment sub-sector and electrical machinery and apparatus sub-sector. For the machinery and equipment sub-sector, the capital-labour ratio, average firm size and localisation index turn out to be the only significant variables in influencing the labour productivity. The remaining two independent variables namely, urbanisation index and the square of urbanisation index do not have any significant impact on labour productivity. Log of K/L ratio is the variable which affects labour productivity positively. The coefficient of localisation index is negative and its value is -0.20. This means that a doubling of own industry concentration would reduce the labour productivity in this sector by about 20 %. There are no gains from specialisation and localisation in this sub-sector. Rather own-industry concentration negatively affects labour productivity. The urbanisation index has and the size variables have a negative coefficient but it is not significant. Diseconomies from urbanisation, the term shown by square of urbanisation, show a positive coefficient but it does not have any significant impact on the level of labour productivity.

The manufacture of electrical machinery and apparatus is the final sub-sector in the analysis.. This is the only sub-sector where capital intensity has been found to be insignificant in influencing the labour productivity. None of the independent variables have any significant affect on the level of labour productivity in this sub-sector. However, the behaviour of the variables conforms to what has been observed for most of the manufacturing sub-sectors. The coefficient of urbanisation index is found to be negative and the coefficient of square of the urbanisation index is positive indicating the U-shaped relationship between the urbanisation economies and the labour productivity. The coefficient of urbanisation index is found to be -2.17 implying that a 1 percent increase in labour productivity diminishes labour productivity by about 2.17 percent. So there are no gains to firms of locating in diversified environment. The coefficient of localisation index is -0.37 indicating that a doubling of own-industry concentration would lead to 37 percent decline in labour productivity. The localisation and urbanisation economies in this sub-sector do not seem to be contributing to labour productivity rather they seem to have a negative impact on it. The size variable has a negligible coefficient and also which is insignificant. The value of R square for this sub-sector is just over 37 percent.

Table 4.12 Estimation Results (dependent variable: LPROD) 2004-05

	Manufacture of food products and beverages (15)	Manufacture of Textiles (17)	Manufacture of paper and paper products (21)
Constant	11.97 (7.50)*	9.472 (5.25)*	13.917 (7.98)*
Log K/L ratio	0.2128 (2.30)**	0.402 (3.52)*	.0.212 (1.84)***
Urb Index	6.354 (1.79)***	5.643 (0.89)	-6.381 (-0.84)
Urban Square	-8.191 (-1.59)	-5.419 (-0.63)	6.192 (0.64)
Loc Index	-0.08 (-0.45)	0.06 (0.24)	0.059 (0.14)
Size	-0.012 (-2.46)**	-0.0120 (-2.70)*	-0.005 (-0.98)
R square	0.4873	0.4588	0.2951

Note: * and ** show significance at 1 % and 5 % level respectively. Figures in parenthesis are values of t-statistic

Source: Author's Calculation using ASI unit-level data, 2004-05.

Table 4.13 Estimation Results (dependent variable: LPROD)

	Publishing, printing & Reproduction of media (22)	Manufacture of non-metallic mineral products (26)	Manufacture of basic metals (27)
Constant	13.449 (6.87)*	15.196 (11.92)*	13.01 (6.65)*
Log K/L ratio	0.1334 (1.82)***	0.185 (2.11)**	0.345 (2.98)*
Urb Index	6.337 (0.71)	-4.40 (-1.76)***	-8.87 (-1.79)***
Urban Square	-11.49 (-0.94)	0.759 (0.13)	8.66 (1.14)
Loc Index	0.307 (0.84)	-0.128 (-1.82)***	-0.427 (-1.75)***
Size	-0.025 (-1.58)	-0.023 (-3.23)*	-.004 (-0.44)
R square	0.2461	0.4157	0.5542

Note: *, ** and *** show significance at 1 %, 5 % and 10% level respectively. Figures in parenthesis are values of t-statistic.

Source: Same as Table 4.12

Table 4.14 Estimation Results (dependent variable: LPROD)

	Manufacture of Machinery & Equipment (29)	Manufacture of Electrical Machinery & Apparatus (31)
Constant	12.71 (7.40)*	15.70 (4.93)*
Log K/L ratio	0.254 (2.15)**	0.06 (0.26)
Urb Index	-1.164 (-0.22)	-2.176 (-0.26)
Urban Square	3.178 (0.46)	3.255 (0.31)
Loc Index	-0.20 (-1.76)***	-0.377 (-0.48)
Size	-0.011 (-2.09)**	-0.01 (-0.61)
R square	0.3891	0.3739

Note: *, ** and *** show significance at 1 %, 5 % and 10% level respectively. Figures in parenthesis are values of t-statistic.

Source: Same as Table 4.12.

Chapter 5

Conclusion and Policy Implications

5.1 Introduction

This study has tried to establish the existence and sources of agglomeration economies across eight different sub-sectors in the organised manufacturing sector using the ASI data for the years 1999-2000 and 2004-05. This study has tried to establish the linkage between agglomeration economies and labour productivity for the different sub-sectors. These sub-sectors have been examined at 2 digit level of NIC. The study has made use of location quotients to measure localization, urbanisation index (percentage of urban population in the total population) to capture the extent of urban concentration. These two variables, taken together have been represented to indicate agglomeration economies.

An attempt has been made to examine this relationship in the manufacturing sector by analysing the eight important sub-sectors which provides an important insight into the relationship between these economies and productivity within the manufacturing sector. The estimation analysis is based on a general production function model, using data for 15 states containing 56 NSS regions (for 1999-2000) and 53 NSS regions (for 2004-05) across eight sub-sectors. This study has tried to understand the relationship between agglomeration economies and productivity at the level of NSS region which is a narrower unit than state. In the Indian context, Mitra(2000) and Aggarwalla (2011) have analysed this relationship between agglomeration economies and productivity. But their study is based on state level data which is too broad a unit for investigating the agglomeration economies and productivity relationship. However, agglomeration economies and productivity relationship has been analysed at the district level in the India context for the year 1994-95, (Lall et. al, 2001).

5.2 Conclusion and Policy Implications

In this section, the results for both the time periods are analysed and compared for each sub-sector one by one. Then a broad summary of the findings is presented which helps us to draw some important policy implications. The last section of this chapter points out some of the limitations of this study.

For the year 1999-2000, in the case of Food and Beverages industry, labour productivity and urbanisation economies exhibit a U-shaped relationship. The impact

of urbanisation economies on productivity is negative and significant but after a certain level of urbanisation is attained; these economies seem to positively affect the labour productivity. The localisation economies are weak and insignificant in this sub-sector and have no affect on the level of labour productivity. A similar pattern is observed for the second time period i.e. 2004-05. Localisation economies continue to be weak and insignificant for this time period. The U-shaped relationship between labour productivity and urbanisation economies also holds for this year but the relationship does not appear to be as strong as was observed for the first time period. In the case of Textiles industry, a similar U-shaped relationship between urbanisation economies and productivity is observed for the year 1999-00. The localisation economies for this sub-sector are significant and adversely affect the labour productivity. However, for 2004-05, urbanisation and localisation economies turn out to insignificant in affecting the labour productivity for this sub-sector. The results for the Paper and Paper Products and Publishing, Printing and Reproduction of Electronic Media sub-sectors are similar for both the time periods. Both urbanisation and localisation economies turn out to weak and insignificant to have any meaningful impact on the labour productivity. Capital intensity is the only variable which positively and significantly affects the productivity.

In the case of Non-metallic Mineral Products sub-sector, there exists a U-shaped relationship between urbanisation economies and productivity for the year 1999-00. The localisation economies are weak and do not have any significant impact on the productivity level. A similar U-shaped relationship between the urbanisation economies and labour productivity holds in the year 2004-05 but in this time period, localisation economies are much stronger. Negative and significant localisation economies are observed for the Non-metallic Mineral Products sector. For the Basic Metals sub-sector, both the localisation and urbanisation economies are weak and insignificant in affecting the labour productivity in the year 1999-00. However, this is not the case in the year 2004-05, where negative and significant localisation economies are observed for this sub-sector. Also, the urbanisation economies are stronger and significant in affecting the productivity level.

Positive and significant localisation economies are found to exist only for the sub-sector of electrical machinery and apparatus in the year 1999-2000. Urbanisation

economies are weak and insignificant in affecting the labour productivity for this sub-sector. In the second time period, i.e. 2004-05, both the localisation and urbanisation economies are insignificant in affecting the labour productivity. None of the sub-sectors exhibit positive localisation economies. Capital-intensity is the only variable which has a positive and significant impact on the productivity for all the sub-sectors in both the time periods. The average size of firms does not seem to have any significant impact on the productivity for any of the sub-sectors in both the time periods.

In the nutshell, it can be concluded that there is not any significant change in the relationship between agglomeration economies and labour productivity over the two time periods. There appear to be some differences for few sub-sectors but the broad trends which emerge do not show any drastic change. For the year 1999-2000, the majority of the sub-sectors studied in the analysis seem to benefit from urbanisation economies more than from the localisation ones. But there appears to be a U-shaped relationship between the urbanisation economies and productivity for most of the sub-sectors. This result is supported by the findings of Aggarwalla (2011) and Mitra (2000) who have also found the existence of the U-shaped relationship. This means that initially, an increase in the urbanisation level leads to a decline in the labour productivity but after a critical level of urbanisation is reached, an increase in the urban concentration leads to an increase in the productivity. Mitra (2000) has found the existence of such a relationship for sub-sectors such as woollen textiles, machinery other than transport etc.

It is clear that localisation economies are weaker and negative for most of the manufacturing sub-sectors like textiles, food and beverages, and non-metallic mineral products for the first time period, i.e. 1999-00. For the second time period, i.e. 2004-05, negative localisation economies are even more prevalent and are found in the sub-sectors like non-metallic mineral products, basic metals and electrical machinery and equipment. These results are similar to those found by Lall et. al (2001) who find negative localisation economies for the non-metallic mineral sector and insignificant localisation economies for the five sub-sectors. Aggarwalla (2011) has found the existence of negative localisation economies for the overall manufacturing sector and for the trade, transport and other services sector. Combes (2000) has explained that

the reason for the negative localisation economies in the manufacturing sub-sectors is these sectors usually have a declining share in employment, and higher specialization reflects lower flexibility and adaptability of products, and regions with lower specialization are better able to reconvert their activities. Therefore, it is clear that in the Indian case industries in the manufacturing sector do not seem to gain from labour pooling, sharing of knowledge and idea which arise when there is specialisation of certain regions.

The results of this study are likely to have some important policy implications. This study provides new and useful information about the role of geographical concentration and agglomeration economies in regional development. The analysis performed here on specialisation and diversity economies enable us to evaluate whether a policy favouring only a few large growth centres (diversity economies dominate) is more desirable than the policy supporting many small-scale specialised regions. It emerges from the results of the study that for the organised manufacturing sector of India, diversified industrial policies are likely to have a more favourable and positive impact on the productivity level. This is evident from the U-shaped relationship observed for most of the sub-sectors. The results of this study do not lend much support to the localisation and specialisation of industrial activities. There is the presence of negative localisation economies for majority of the sub-sectors studied for both the time periods. Thus, it can be said that industrial policies favouring the growth of few large growth centres (diversified industrial policies) are likely to have a more favourable impact on productivity than those favouring the growth of many small specialised regions (specialised industrial policies).

5.3 Limitations of the Study:

The main drawback of this study is that it is difficult to expect any major change taking place between the agglomeration economies and productivity relationship between the selected time periods. The first time period which is studied is 1999-2000 and with a gap of about five years, this relationship is analysed for the second time period i.e. 2004-05. A better temporal change can be captured with a more broad time gap. Another limitation of this study is that it has solely focused on the agglomeration economies-productivity relationship in the organised manufacturing sector. Since services sector is growing in importance and has a large share in the total GDP of the

country, it will be useful to look at this relationship in the services sector. Though the eight sub-sectors studied account for about 55-60% of the manufacturing employment and about 50% of the NVA originating from the manufacturing sector, the inclusion of certain other sub-sectors would have provided a more complete picture of the whole of the organised manufacturing sector. Despite these limitations, this study has highlighted certain important issues and has looked upon the agglomeration economies and productivity relationship at a disaggregated level.

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APPENDIX

Definitions and Tables

Note 1 Annual Survey of Industries (ASI):

The ASI is the principal source of industrial statistics in India. It provides statistical information to assess and evaluate, objectively and realistically, the changes in the growth, composition and structure of organised manufacturing sector comprising activities related to manufacturing processes, repair services, gas and water supply and cold storage.

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 Sections 2m(i) and 2m(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. The survey also covers bidi and cigar manufacturing establishments registered under the Bidi & Cigar Workers (Conditions of Employment) Act, 1966 with coverage as above. All electricity undertakings engaged in generation, transmission and distribution of electricity registered with the Central Electricity Authority (CEA) were covered under ASI irrespective of their employment size. Certain servicing units and activities like water supply, cold storage, repairing of motor vehicles and other consumer durables like watches etc. are covered under the Survey. Though servicing industries like motion picture production, personal services like laundry services, job dyeing, etc. are covered under the Survey but data are not tabulated, as these industries do not fall under the scope of industrial sector defined by the United Nations. Defence establishments, oil storage and distribution depots, restaurants, hotels, café and computer services and the technical training institutes, etc. are excluded from the purview of the Survey.

. The NIC-1970 was followed to classify economic activities of the factories from ASI 1973-74 to ASI 1988-89. NIC- 1987 had then been introduced and followed till ASI 1997-98. NIC-1998 was then followed from ASI 1998-99 to ASI 2003-04. From ASI 2004-05, the new series of classification, i.e., NIC-2004 has been introduced and the same has been used till ASI 2007-08.

Table A.1: Firm Level Variables used in the study

Variable	Definition
Factory/No. of units	Those registered under sections 2m (i) and 2m (ii) of the Factory Act, 1948 The sections 2m (i) and 2m (ii) refer to any premises including the precincts thereof (a) whereon ten or more workers are working, or were working on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power, or is ordinarily so carried on or (b) whereon twenty or more workers are working or were working on any day of the preceding twelve months and in any part of which a manufacturing process is being carried on without the aid of power , or is ordinarily so carried on.
Output	Factory value of products and by-products manufactured during the accounting year – includes the receipt for non-industrial services rendered to others, the receipt for work done for others on materials supplied by them, value of electricity sold and net balance of goods sold in the same condition as purchased.
Capital	The measure of capital taken is fixed capital. It includes the sum of the book values of capital assets and capitalized rentals. It includes the total original (un-depreciated) value of installed plant and machinery at the end of the accounting year for each firm.
Workers	Include all persons employed directly or through any agency whether for wages or not and engaged in any manufacturing process or in cleaning any part of the machinery or premises used for manufacturing process or in any other kind of work incidental to or connected with the manufacturing process or the subject of the manufacturing process.
Labour	Labour is taken to mean total employees, include all workers and persons receiving wages and holding supervisory or managerial positions engaged in administrative office, store keeping section and welfare section, sales department as also those engaged in purchase of raw materials etc. or purchase of fixed assets for the factory and watch and ward staff.

Table A.2: List of NSS Regions, 55th round (1999-00).

States	State codes	Regions
Himachal Pradesh	9	Himachal Pradesh
Punjab	20	Northern
		Southern
Haryana	8	Eastern
		Western
Rajasthan	21	Western
		North-eastern
		Southern
		South-eastern
U.P	25	Himalayan
		Western
		Central
		Eastern
		Southern
Bihar	5	Southern
		Northern
		Central
W.B	26	Himalayan
		Eastern Plains
		Central Plains
		Western Plains
Orissa	19	Coastal
		Southern
		Northern
M.P.	13	Chhattisgarh
		Vindhya
		Central
		Malwa
		South
		South Western
		Northern
Gujarat	7	South Eastern
		Plains Northern
		Plains Southern
		Dry Areas
		Saurashtra

continued...

continued...

States	State codes	Regions
Maharashtra	14	Coastal
		Inland Western
		Inland Northern
		Inland Central
		Inland Eastern
		Eastern
A.P.	2	Coastal
		Inland Northern
		South western
		Inland Southern
Karnataka	11	Coastal n Ghats
		Inland Eastern
		Inland Southern
		Inland Northern
Kerala	12	Northern
		Southern
T.N.	23	Coastal Northern
		Coastal
		Southern
		Inland

Source: Compiled from NSS 55th Round, Appendix 2.

Table A.3: List of NSS Regions, 61st round (2004-05).

States	State codes	Regions
Himachal Pradesh	2	Himachal Pradesh
Punjab	3	Northern
		Southern
Haryana	6	Eastern
		Western
Rajasthan	8	Western
		North-eastern
		Southern
		South-eastern
U.P	9	Western
		Central
		Eastern
		Southern
Bihar	10	Northern

continued...

continued...

		Central
W.B	19	Himalayan
		Eastern Plains
		Central Plains
		Western Plains
Orissa	21	Coastal
		Southern
		Northern
M.P.	23	Vindhya
		Central
		Malwa
		South
		South Western
		Northern
Gujarat	24	South Eastern
		Plains Northern
		Plains Sourthern
		Dry Areas
		Saurashtra
Maharashtra	27	Coastal
		Inland Western
		Inland Northern
		Inland Central
		Inland Eastern
		Eastern
A.P.	28	Coastal
		Inland Northern
		South western
		Inland Southern
Karnataka	29	Coastal n Ghats
		Inland Eastern
		Inland Southern
		Inland Northern
Kerala	32	Northern
		Southern
T.N.	33	Coastal Northern
		Coastal
		Southern

Source: Compiled from NSS 61st Round, Appendix 2.

Table A.4 List of State Codes, 1999-00 and 2004-05

Serial No.	States	1999-00	2004-05
1	Andhra Pradesh	2	28
2	Bihar	5	10
3	Gujarat	7	24
4	Haryana	8	6
5	Himachal Pradesh	9	2
6	Karnataka	11	29
7	Kerala	12	32
8	Madhya Pradesh	13	23
9	Maharashtra	14	27
10	Orissa	19	21
11	Punjab	20	3
12	Rajasthan	21	8
13	Tamil Nadu	23	33
14	Uttar Pradesh	25	9
15	West Bengal	26	19

Source: ASI Information Schedule, 1999-00 and 2004-05.

Table A.5 Share in Total Employment and NVA of the Sub-sectors (1999-00)

NIC Code	Industry	Net value added	No. of workers	Emp.	NVA
15	Food and Beverages	1679182	1041353	16.58	10.84
17	Textiles Products	1131398	1084375	17.27	7.3
21	Paper and Paper Products	203307	137358	2.19	1.31
22	Publishing, printing	239584	75558	1.2	1.55
26	Non-metallic mineral products	725793	359946	5.73	4.68
27	Basic Metals	1844069	4795677	7.64	11.9
29	Machinery and Equipment	986749	298495	4.75	6.37
31	Electrical Machinery Apparatus	568010	167350	2.66	3.67

Source: Calculated using Summary Results, ASI, 1999-00.

Table A.6 Share in Total Employment and NVA (2004-05)

NIC Code	Industry	Net value added	No. of workers	Employment	NVA
15	Food and Beverages	1805955	1056053	16	6.95
17	Textiles Products	1448674	1076480	21.95	5.57
21	Paper and Paper Products	338770	138094	1.3	1.3
22	Publishing, printing	297231	70560	1.07	1.14
26	Non-metallic mineral products	1191251	422612	6.4	4.58
27	Basic Metals	4925070	431259	6.53	18.95
29	Machinery and Equipment	1352361	298174	4.52	5.2
31	Electrical Machinery Apparatus	783993	168646	2.56	3.02

Source: Author's Calculated using Summary Results, ASI, 2004-05

Table A.7 RURAL, URBAN POPULATION AND URBANISATION INDICES (U.I.) 55th Round: 1999-00

States	State-Regions	Rural Population	Urban Population	Total Population	U.I.
1	Himachal Pradesh	5037227	500493	5537720	0.09
Punjab					
2	Northern	7836561	4624033	12460594	0.371
3	Southern	6654804	2279065	8933869	0.255
Haryana					
4	Eastern	9038601	3983597	13022198	0.306
5	Western	4658336	1384043	6042379	0.229
Rajasthan					
6	Western	11359574	3833594	15193168	0.252
7	North-eastern	14602787	4444597	19047384	0.233
8	Southern	4795848	741324	5537172	0.134
9	South-eastern	4587630	994105	5581735	0.178
U.P.					
10	Western	4607014	1713508	6320522	0.271
11	Central	42226162	14665221	56891383	0.258
12	Eastern	21809458	9502986	31312444	0.303
13	Southern	54189199	5615653	59804852	0.094
14		5510655	1351950	6862605	0.197
Bihar					
14	Southern		4312888	4312888	1
15	Northern	37348349	2969501	40317850	0.074
16	Central	24685580	4845619	29531199	0.164
W.B.					
16	Himalayan	4986949	855890	5842839	0.146
17	Eastern Plains	21051315	1910019	22961334	0.083
18	Central Plains	18807154	11837704	30644858	0.386

19	Western Plains	13097730	991886	14089616	0.07
Orissa					
20	Coastal	13008545	2826744	15835289	0.179
21	Southern	5760667	732176	6492843	0.113
22	Northern	10153038	2120083	12273121	0.173
M.P.					
23	Chhattisgarh	16858248	3003396	19861644	0.151
24	Vindhya	8911700	2087667	10999367	0.19
25	Central	5085439	2666785	7752224	0.344
26	Malwa	9678734	3893766	13572500	0.287
27	South	7259487	1632030	8891517	0.184
28	South Western	5255761	1794948	7050709	0.255
29	Northern	5880759	2143253	8024012	0.267
Gujarat					
29	South Eastern	6225956	559136	6785092	0.082
30	Plains Northern	8015382	5444500	13459882	0.404
31	Dry Areas	5522226	2944701	8466927	0.348
32	Kacch	4178137	1107262	5285399	0.209
33	Saurashtra	6187745	4169863	10357608	0.403
Maharashtra					
34	Coastal	6440440	16671570	23112010	0.721
35	Inland Western	15465239	6333855	21799094	0.291
36	Inland Northern	7785061	2510835	10295896	0.244
37	Inland Central	11241761	3211325	14453086	0.222
38	Inland Eastern	9276509	4938416	14214925	0.347
39	Eastern	4319959	790541	5110500	0.155
A.P.					
40	Coastal	22709097	8127822	30836919	0.264
41	Inland Northern	19304256	9742916	29047172	0.335
42	South western	5006274	1903069	6909343	0.275
43	Inland Southern	4586035	1759185	6345220	0.277
Karnataka					
44	Coastal n Ghats	2865136	879062	3744198	0.235
45	Inland Eastern	4351750	858846	5210596	0.165
46	Inland Southern	10108185	6914903	17023088	0.406
47	Inland Northern	17857138	4580389	22437527	0.204
Kerala					
48	Northern	8820450	2765263	11585713	0.239
49	Southern	11345939	4332012	15677951	0.276
T.N.					
50	Coastal Northern	11218911	9573542	20792453	0.46
51	Coastal	7668059	2675737	10343796	0.259
52	Southern	9183533	4224928	13408461	0.315
53	Inland	9013169	4168634	13181803	0.316

Source: NSS unit-level data, 55th round (1999-00).

Table A.8 RURAL, URBAN POPULATION AND URBANISATION INDICES (U.I.) 61st Round: 2004-05.

States	State-Region (SR)	Rural Population	Urban Population	Total Population	U.I.
1	Himachal Pradesh	5494939	566862	6061801	0.094
Punjab					
2	Northern	8685461	5094995	13780456	0.37
3	Southern	7329849	2380841	9710690	0.245
Haryana					
4	Eastern	9707662	4246810	13954472	0.304
5	Western	6004783	1535747	7540530	0.204
Rajasthan					
6	Western	14678049	3919693	18597742	0.211
7	North-eastern	17641805	7246851	24888656	0.291
8	Southern	5570678	916270	6486948	0.141
9	South-eastern	4452480	1003298	5455778	0.184
U.P.					
10	Western	45329606	16979718	62309324	0.273
11	Central	23631245	7175236	30806481	0.233
12	Eastern	56226845	6694393	62921238	0.106
13	Southern	6157900	1688949	7846849	0.215
Bihar					
14	Northern	39087263	1901593	40988856	0.046
15	Central	25499439	4581559	30080998	0.152
W.B.					
16	Himalayan	5911426	754654	6666080	0.113
17	Eastern Plains	18498839	2850464	21349303	0.134
18	Central Plains	20774992	14934863	35709855	0.418
19	Western Plains	14030168	1328816	15358984	0.087
Orissa					
20	Coastal	14659382	2274363	16933745	0.134
21	Southern	6004353	551692	6556045	0.084
22	Northern	10993077	2137818	13130895	0.163
M.P.					
23	Vindhya	9622104	1645415	11267519	0.146
24	Central	5545208	2461862	8007070	0.307
25	Malwa	10467018	4205330	14672348	0.287
26	South	8278336	1819477	10097813	0.18
27	South Western	5936539	1665606	7602145	0.219
28	Northern	6229429	2133767	8363196	0.255
Gujarat					
29	South Eastern	8279953	1339105	9619058	0.139
30	Plains Northern	6490521	5615087	12105608	0.464
31	Dry Areas	5312401	4730242	10042643	0.471
32	Kacch	5137792	688346	5826138	0.118
33	Saurashtra	6411903	3381221	9793124	0.345

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States	State-Region (SR)	Rural Population	Urban Population	Total Population	U.I.
Maharashtra					
34	Coastal	6156088	15983413	22139501	0.722
35	Inland Western	15282576	7484780	22767356	0.329
36	Inland Northern	7665850	3211403	10877253	0.295
37	Inland Central	12099984	3631417	15731401	0.231
38	Inland Eastern	9351380	5435038	14786418	0.368
39	Eastern	4226854	1055714	5282568	0.2
A.P.					
40	Coastal	23642265	8584094	32226359	0.266
41	Inland Northern	19819972	6880341	26700313	0.258
42	South western	5185718	1781607	6967325	0.256
43	Inland Southern	4650224	1350002	6000226	0.225
Karnataka					
44	Coastal n Ghats	3292524	934558	4227082	0.221
45	Inland Eastern	3642864	832776	4475640	0.186
46	Inland Southern	9966896	7571575	17538471	0.432
47	Inland Northern	16506253	5727254	22233507	0.258
Kerala					
48	Northern	9860269	2588543	12448812	0.208
49	Southern	13396450	4620887	18017337	0.256
T.N.					
50	Coastal Northern	10362954	8991378	19354332	0.465
51	Coastal	7562739	2560581	10123320	0.253
52	Southern	8074944	4921024	12995968	0.379
53	Inland	8124710	5125587	13250297	0.387

Source: NSS unit-level data, 61st round (2004-05)

Table A.9: Basic Data used: Food and Beverages Industry (1999-00)

State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
Punjab Northern	52953	1041	50.87	12.852
Punjab Southern	64611	861	75.04	12.027
H.P.	1781	93	19.15	11.678
HR Eastern	42247	573	73.73	11.695
HR Western	8720	185	47.14	12.338
RAJ Western	8519	158	53.92	14.158
RAJ North-eastern	6863	278	24.69	12.488
RAJ Southern	2816	42	67.05	8.774
RAJ South-Eastern	6198	65	95.35	9.123

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State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
UP Himalayan	11282	63	179.08	12.216
UP Western	256392	1623	157.97	11.855
UP Central	49126	648	75.81	12.363
UP Eastern	25337	313	80.95	12.598
UP Southern	5173	73	70.86	13.184
BIHAR Southern	1128	139	8.12	14.76
BIHAR Northern	6031	153	39.42	11.606
BIHAR Central	11445	164	69.79	14.978
WB Himalayan	22525	347	64.91	10.823
WB Eastern Plains	6056	106	57.13	10.686
WB Central Plains	58064	846	68.63	14.848
WB Western Plains	3360	214	15.7	13.706
ORI Coastal	13485	245	55.04	12.138
ORI Southern	4704	187	25.16	14.855
ORI Northern	51224	142	360.73	9.517
MP Chattisgarh	123991	884	140.26	12.186
MP Central	6492	59	110.03	11.894
MP Northern	21521	346	62.2	14.956
MP Malwa	8566	70	122.37	11.875
MP South	299280	100	2992.8	11.41
MP South Western	2958	51	58	10.345
GUJ Eastern	22273	285	78.15	11.99
GUJ Plains Northern	31664	667	47.47	12.66
GUJ Plains Southern	4202	93	45.18	14.129
GUJ Dry Areas	771	33	23.36	*
GUJ Saurashtra	47133	574	82.11	12.125
MH Coastal	44213	628	70.4	12.268
MH Inland Western	75728	644	117.59	13.17
MH Inland Northern	34620	449	77.1	13.037
MH Inland Central	21752	279	77.96	11.864
MH Inland Eastern	52175	660	79.05	12.901
MH Eastern	271	21	12.9	*
AP Coastal	453905	3070	147.85	12.879
AP Inland Northern	447838	2517	177.93	13.395
AP South Western	89232	516	172.93	12.455
AP Inland Southern	25530	512	49.86	16.065
KAR Coastal Ghats	26258	254	103.38	12.027
KAR Inland Northern	*	861	*	13.177
KER Northern	2330	178	13.09	13.754
KER Southern	31936	808	39.52	13.618
TN Coastal Northern	69482	566	122.76	11.843
TN Coastal	59736	387	154.36	7.887
TN Southern	184841	1217	151.88	10.152
TN Inland	72362	1883	38.43	13.752

Source: Author's Calculation from Unit record data, ASI (1999-00).

Table A.10: Basic Data used: Textiles Industry (1999-00)

State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
Punjab Northern	24893	1185	21.01	13.71
Punjab Southern	1699	41	41.44	10.013
H.P.	1638	52	31.5	11.37
HR Eastern	21444	408	52.56	12.511
HR Western	3206	100	32.06	13.847
RAJ Western	34111	670	50.91	14.345
RAJ North-eastern	16567	640	25.89	16.969
RAJ Southern	221	19	11.63	12.793
UP Western	28499	352	80.96	12.539
UP Central	12821	92	139.36	12.909
UP Eastern	5674	103	55.09	13.098
UP Southern	11928	93	128.26	*
BIHAR Southern	1613	13	124.08	*
BIHAR Central	3620	30	120.67	13.81
WB Eastern Plains	167	3	55.67	15.352
WB Central Plains	88589	381	232.52	13.956
WB Western Plains	1336	10	133.6	11.766
ORI Coastal	4046	65	62.25	13.539
ORI Southern	487	17	28.65	14.063
ORI Northern	823	9	91.44	11.007
MP Central	554	6	92.33	10.296
MP Northern	19863	193	102.92	11.081
MP South	4000	75	53.33	12.334
GUJ Eastern	130435	1435	90.9	13.928
GUJ Plains Northern	35576	763	46.63	13.83
GUJ Plains Southern	13	46	0.28	21.054
GUJ Dry Areas	645	34	18.97	10.933
GUJ Saurashtra	1642	61	26.92	14.126
MH Coastal	89511	1260	71.04	12.758
MH Inland Western	47854	427	112.07	11.29
MH Inland Northern	3823	118	32.4	11.131
MH Inland Eastern	4315	98	44.03	11.713
AP Coastal	17015	189	90.03	10.906
AP Inland Northern	5479	210	26.09	15.361
AP South Western	376	56	6.71	11.415
AP Inland Southern	2718	76	35.76	12.722
KAR Inland Southern	5174	285	18.15	15.57
KAR Inland Northern	10229	164	62.37	14.364
KER Northern	1631	216	7.55	14.975
KER Southern	6458	208	31.05	13.655
TN Coastal Northern	32193	227	141.82	9.705
TN Coastal	17045	286	59.6	13.859
TN Southern	119720	1057	113.26	10.95
TN Inland	157483	3402	46.29	12.785

Source: Same as Table A.7

Table A.11: Basic Data used: Paper and Paper Products Industry (1999-00)

State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
Punjab Northern	4455	115	38.74	8.604205
Punjab Southern	2840	47	60.43	*
H.P.	288	28	10.29	12.41523
HR Eastern	6194	89	69.6	12.01173
HR Western	511	31	16.48	13.21035
RAJ North-eastern	679	55	12.35	13.70999
UP Western	28001	260	107.7	11.08211
UP Central	2440	55	44.36	13.59134
UP Eastern	4264	41	104	13.03825
UP Southern	684	101	6.77	14.77192
BIHAR Central	4994	51	97.92	14.14458
WB Eastern Plains	2486	9	276.22	16.61597
WB Central Plains	14124	171	82.6	11.89034
ORI Coastal	832	23	36.17	14.81036
MP Northern	6627	99	66.94	12.50657
GUJ Eastern	34172	257	132.96	12.16662
GUJ Plains Northern	3407	138	24.69	14.22283
GUJ Plains Southern	210	61	3.44	15.76142
GUJ Dry Areas	60	49	1.22	16.10973
GUJ Saurashtra	475	20	23.75	13.13283
MH Coastal	21111	322	65.56	10.18053
MH Inland Western	31203	192	162.52	11.32665
MH Inland Northern	8907	123	72.41	7.270363
MH Inland Central	3030	51	59.41	*
MH Inland Eastern	2280	92	24.78	*
AP Coastal	28467	155	183.66	13.70544
AP Inland Northern	22532	179	125.88	13.00316
KAR Coastal Ghats	1173	16	73.31	14.16877
KAR Inland Eastern	17728	9	1969.78	*
KAR Inland Southern	19693	179	110.02	15.32388
KAR Inland Northern	125	21	5.95	*
KER Northern	473	28	16.89	13.41216
KER Southern	1050	61	17.21	13.52846
TN Coastal Northern	19512	177	110.24	12.37488
TN Southern	30576	179	170.82	9.078527
TN Inland	7076	194	36.47	12.34738

Source: Same as Table A.7

*Note: * Industry does not exist in region*

Table A.12: Basic Data used Publishing and Printing Industry: (1999-00)

State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
Punjab Northern	6286	77	81.64	12.151
H.P.	64	11	5.82	*
HR Eastern	2	26	0.08	17.859
RAJ North-eastern	1812	35	51.77	9.289
UP Himalayan	64	23	2.78	13.259
UP Western	1328	66	20.12	15.1
UP Central	1720	78	22.05	13.413
UP Eastern	1700	35	48.57	13.804
UP Southern	2290	131	17.48	12.463
BIHAR Southern	2771	35	79.17	9.412
BIHAR Central	2422	55	44.04	11.537
WB Central Plains	32221	317	101.64	11.458
ORI Coastal	1592	15	106.13	13.857
MP Central	292	7	41.71	12.848
MP Northern	4892	40	122.3	14.031
MP Malwa	303	21	14.43	11.092
GUJ Eastern	1359	45	30.2	*
GUJ Plains Northern	9973	220	45.33	13.18
GUJ Saurashtra	554	18	30.78	12.171
MH Coastal	118175	768	153.87	11.414
MH Inland Western	28157	187	150.57	12.758
MH Inland Eastern	2650	82	32.32	10.652
AP Coastal	1222	79	15.47	13.172
AP Inland Northern	61240	173	353.99	13.834
AP South Western	4448	18	247.11	11.824
KAR Inland Southern	7846	142	55.25	11.954
KAR Inland Northern	222	38	5.84	11.942
KER Northern	870	33	26.36	16.397
KER Southern	1274	110	11.58	15.018
TN Coastal Northern	41291	297	139.03	11.187
TN Coastal	1904	48	39.67	7.985
TN Southern	74790	450	166.2	12.002

Source: Same as Table A.7

*Note: * Industry does not exist in region*

Table A.13: Basic Data used Non-metallic Mineral Products Industry: (1999-00)

State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
Punjab Northern	2748	101	27.21	13.02778
Punjab Southern	415	23	18.04	12.67003
H.P.	1990	49	40.61	9.029023
HR Eastern	23238	501	46.38	12.80033
HR Western	470	66	7.12	14.60009
RAJ Western	11269	450	25.04	14.54191
RAJ North-eastern	22930	515	44.52	13.08096
RAJ Southern	13169	366	35.98	8.904601
RAJ South-Eastern	13885	112	123.97	7.742682
UP Himalayan	10047	68	147.75	12.49031
UP Western	87548	755	115.96	13.78126
UP Central	1476	49	30.12	*
UP Eastern	23528	95	247.66	12.11593
UP Southern	5336	114	46.81	13.34701
BIHAR Southern	37106	597	62.15	13.85757
BIHAR Northern	31918	458	69.69	12.3619
BIHAR Central	37184	380	97.85	12.83869
WB Central Plains	21758	300	72.53	*
WB Western Plains	1113	8	139.13	*
ORI Coastal	16781	166	101.09	10.31996
ORI Northern	7188	138	52.09	10.89118
MP Chattisgarh	626	107	5.85	13.03215
MP Vindhya	11928	93	128.26	11.41358
MP Central	9120	64	142.5	13.12892
MP Northern	22086	259	85.27	12.37879
MP Malwa	43989	200	219.95	11.3125
GUJ Eastern	14822	251	59.05	12.34904
GUJ Plains Northern	16092	584	27.55	13.40743
GUJ Plains Southern	63569	463	137.3	12.37143
GUJ Dry Areas	2997	297	10.09	15.55111
GUJ Saurashtra	22525	727	30.98	13.97425
MH Coastal	66986	477	140.43	11.79932
MH Inland Western	54726	368	148.71	12.3389
MH Inland	4100	153	26.8	10.1696
MH Inland Eastern	32718	220	148.72	13.47174
MH Eastern	4290	103	41.65	15.33984
AP Coastal	238750	1085	220.05	11.50134
AP Inland Northern	639411	751	851.41	11.41713

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State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
AP South Western	49843	630	79.12	13.22445
AP Inland Southern	22041	189	116.62	11.43064
KAR Coastal Ghats	25941	136	190.74	10.6819
KAR Inland Southern	16683	293	56.94	12.59036
KAR Inland Northern	14342	170	84.36	12.82003
KER Northern	3874	143	27.09	12.3254
KER Southern	24042	862	27.89	13.63144
TN Coastal Northern	25952	389	66.71	11.82056
TN Coastal	3569	82	43.52	7.938055
TN Southern	64767	284	228.05	9.385944
TN Inland	17058	248	68.78	11.37093

Source: Same as Table A.7

*Note: * Industry does not exist in region*

Table A.14: Basic Data used: Basic Metals Industry (1999-00)

State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
Punjab Northern	21123	365	57.87	11.641
Punjab Southern	8350	214	39.02	12.522
H.P.	15735	58	271.29	11.164
HR Eastern	7709	305	25.28	13.329
HR Western	871	60	14.52	12.571
RAJ Western	1392	101	13.78	14.203
RAJ North-eastern	20062	252	79.61	12.394
RAJ Southern	1056	33	32	13.481
UP Himalayan	7576	49	154.61	14.415
UP Western	36152	410	88.18	13.129
UP Central	9664	114	84.77	13.55
UP Southern	11128	106	104.98	14.245
BIHAR Southern	18463	206	89.63	13.697
BIHAR Central	11536	69	167.19	14.266
WB Himalayan	5152	24	214.67	14.251
WB Central Plains	98910	876	112.91	15.448
ORI Coastal	5670	76	74.61	15.723
ORI Northern	1536	110	13.96	16.004
MP Chattisgarh	13420	201	66.77	14.937
MP Northern	7358	161	45.7	14.942
MP Malwa	3416	24	142.33	9.644

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State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
MP South Western	6568	65	101.05	14.867
GUJ Eastern	1332	195	6.83	17.711
GUJ Plains Northern	37056	725	51.11	15.047
GUJ Plains Southern	2380	145	16.41	15.536
GUJ Saurashtra	20016	295	67.85	14.441
MH Coastal	56406	598	94.32	13.86
MH Inland Western	178621	363	492.07	13.157
MH Inland Northern	1125	73	15.41	16.678
MH Inland Central	3820	131	29.16	13.642
MH Inland Eastern	21761	129	168.69	12.062
AP Coastal	8258	134	61.63	11.301
AP Inland Northern	36290	296	122.6	12.613
AP South Western	1056	34	31.06	14.199
AP Inland Southern	8	3	2.67	21.17
KAR Inland Eastern	3162	22	143.73	7.293
KAR Inland Southern	3555	164	21.68	11.848
KAR Inland Northern	2086	142	14.69	14.008
KER Northern	369	46	8.02	11.944
KER Southern	850	61	13.93	10.651
TN Coastal Northern	39223	300	130.74	11.976
TN Coastal	135	49	2.76	13.985
TN Southern	11110	75	148.13	9.405
TN Inland	6837	351	19.48	13.666

Source: Same as Table A.7

*Note: * Industry does not exist in region*

Table A.15: Basic Data used: Machinery and Equipment Industry (1999-00)

State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
Punjab Northern	59186	1088	54.4	13.439
H.P.	380	53	7.17	16.539
HR Eastern	16651	429	38.81	12.443
RAJ Western	426	68	6.26	14.188
RAJ North-eastern	11029	161	68.5	11.654
RAJ Southern	28	26	1.08	12.013
UP Western	28120	444	63.33	12.849

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State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
UP Central	19284	153	126.04	13.263
UP Eastern	12944	61	212.2	10.952
UP Southern	15384	187	82.27	13.624
BIHAR Southern	4066	62	65.58	12.029
BIHAR Northern	656	21	31.24	10.724
BIHAR Central	2172	51	42.59	12.205
WB Eastern Plains	684	17	40.24	*
WB Central Plains	57755	867	66.61	13.25
ORI Coastal	2445	31	78.87	12.049
ORI Northern	636	47	13.53	16.6
MP Chattisgarh	6231	38	163.97	13.152
MP Vindhya	459	9	51	17.89
MP Central	1790	24	74.58	9.776
MP Northern	6130	111	55.23	10.207
GUJ Eastern	25702	429	59.91	11.402
GUJ Plains Northern	9189	1096	8.38	14.401
GUJ Plains Southern	5290	311	17.01	16.186
GUJ Dry Areas	180	80	2.25	15.895
GUJ Saurashtra	18832	372	50.62	11.792
MH Coastal	139521	1271	109.77	12.241
MH Inland Western	57994	733	79.12	12.662
MH Inland Northern	10346	146	70.86	11.508
MH Inland Central	33	47	0.7	16.647
MH Inland Eastern	24890	81	307.28	8.185
AP Coastal	30573	118	259.09	9.893
AP Inland Northern	51955	564	92.12	13.5
KAR Coastal Ghats	1434	24	59.75	*
KAR Inland Eastern	1323	9	147	*
KAR Inland Southern	44554	659	67.61	12.444
KAR Inland Northern	23893	166	143.93	11.279
KER Northern	939	44	21.34	13.087
KER Southern	3277	59	55.54	11.931
TN Coastal Northern	44299	532	83.27	13.577
TN Coastal	1758	75	23.44	10.521
TN Inland	24112	659	36.59	13.293

Source: Same as Table A.7

*Note: * Industry does not exist in region*

Table A.16: Basic Data used: Electrical Machinery and Apparatus Industry (1999-00)

State-Regions(SR)	No. of employees	No. of firms	Avg. Size	log K/L
Punjab Northern	140851	99	1422.74	7.824
Punjab Southern	1761	15	117.4	11.186
H.P.	478	37	12.92	9.733
HR Eastern	5741	208	27.6	11.34
RAJ Western	177	32	5.53	*
RAJ North-eastern	4767	82	58.13	10.446
RAJ South-Eastern	497	3	165.67	7.872
UP Western	22250	248	89.72	12.946
UP Central	942	71	13.27	*
UP Eastern	2816	33	85.33	11.528
UP Southern	15976	173	92.35	12.801
BIHAR Southern	620	12	51.67	13.486
BIHAR Central	988	20	49.4	11.347
WB Central Plains	32932	381	86.44	13.862
WB Western Plains	1220	5	244	*
ORI Coastal	3454	64	53.97	11.47
MP Chattisgarh	1348	10	134.8	*
MP Vindhya	1383	39	35.46	12.418
MP Central	8952	61	146.75	8.995
MP Northern	7724	124	62.29	11.454
GUJ Eastern	2976	94	31.66	12.294
GUJ Plains Northern	4070	187	21.76	14.596
GUJ Plains Southern	5227	220	23.76	10.251
MH Coastal	39572	509	77.74	10.369
MH Inland Western	68137	207	329.16	12.385
MH Inland Northern	4620	98	47.14	12.416
MH Inland Central	4780	59	81.02	10.147
MH Inland Eastern	4490	48	93.54	12.236
AP Coastal	10	33	0.3	20.743
AP Inland Northern	18303	217	84.35	14.215
AP South Western	3801	49	77.57	9.673
AP Inland Southern	596	11	54.18	
KAR Inland Southern	18157	462	39.3	12.862
KER Northern	26	14	1.86	15.386
KER Southern	2755	91	30.27	14.1
TN Coastal Northern	13557	279	48.59	9.995
TN Inland	2132	129	16.53	14.154

Source: Same as Table A.7

*Note: * Industry does not exist in region*

Table A.17: Basic Data used: Food and Beverages Industry (2004-05)

State Region	No. of employees	no. of firms	Avg. Size	Log K/L
Punjab Northern	29091	678	42.907	12.171
Punjab Southern	49257	1283	38.392	12.842
H.P.	8850	104	85.096	7.954
HR Eastern	20162	567	35.559	12.952
HR Western	6135	121	50.702	12.069
RAJ Western	8278	221	37.457	14.118
RAJ North-eastern	23248	272	85.471	10.679
RAJ Southern	40	34	1.176	18.194
RAJ South-Eastern	939	75	12.52	12.118
UP Western	73675	1155	63.788	10.794
UP Central	30758	461	66.72	11.514
UP Eastern	18525	359	51.602	13.303
UP Southern	2950	20	147.5	
BIHAR Northern	2192	61	35.934	13.978
BIHAR Central	5701	148	38.52	14.302
WB Himalayan	15385	373	41.247	14.313
WB Eastern Plains	3921	158	24.816	15.474
WB Central Plains	30192	597	50.573	12.367
WB Western Plains	11240	111	101.261	13.206
ORI Coastal	5453	214	25.481	13.211
ORI Southern	12970	197	65.838	13.048
ORI Northern	22760	190	119.789	8.833
MP Vindhya	132	29	4.552	14.894
MP Central	3091	40	77.275	6.731
MP Northern	26497	388	68.291	11.932
MP Malwa	4712	48	98.167	8.48
MP South	12854	75	171.387	8.448
MP South Western	11949	81	147.519	9.874
GUJ Eastern	8985	346	25.968	13.29
GUJ Plains Northern	31531	794	39.712	12.849
GUJ Plains Southern	10697	98	109.153	10.609
GUJ Saurashtra	39267	420	93.493	14.629
MH Coastal	24428	583	41.901	13.516
MH Inland Western	86148	745	115.635	12.325
MH Inland Northern	8295	453	18.311	13.354
MH Inland Central	7668	130	58.985	13.068
MH Inland Eastern	10370	600	17.283	13.625

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State Region	No. of employees	no. of firms	Avg. Size	Log K/L
MH Eastern	5745	103	55.777	12.975
AP Coastal	169245	4199	40.306	12.765
AP Inland Northern	11767	2708	4.345	14.183
AP South Western	19875	501	39.671	12.552
AP Inland Southern	32821	547	60.002	12.065
KAR Coastal Ghats	36172	338	107.018	11.751
KAR Inland Eastern	619	64	9.672	15.495
KAR Inland Southern	12952	479	27.04	13.493
KAR Inland Northern	14812	734	20.18	13.248
KER Northern	20783	213	97.573	13.435
KER Southern	34748	920	37.77	13.201
TN Coastal Northern	48243	785	61.456	11.892
TN Coastal	12734	390	32.651	12.227
TN Southern	39503	1338	29.524	12.799

Source: ASI, 2004-05 unit-level data.

Table A.18: Basic Data used: Textiles Industry (2004-05)

State Region	No. of employees	no. of firms	Avg. Size	Log K/L
Punjab Northern	49460	1198	41.285	3.721
Punjab Southern	6025	67	89.925	4.499
H.P.	168	46	3.652	1.295
HR Eastern	22662	543	41.735	3.731
HR Western	3681	52	70.788	4.26
RAJ Western	19976	658	30.359	3.413
RAJ North-eastern	19323	688	28.086	3.335
RAJ Southern	234	17	13.765	2.622
UP Western	16410	498	32.952	3.495
UP Central	4878	108	45.167	3.81
BIHAR Central	364	18	20.222	3.007
WB Eastern Plains	460	17	27.059	3.298
WB Central Plains	15887	330	48.142	3.874
ORI Coastal	1794	36	49.833	3.909
ORI Northern	174	7	24.857	3.213
MP Central	625	10	62.5	4.135
MP Northern	24897	104	239.394	5.478

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State Region	No. of employees	no. of firms	Avg. Size	Log K/L
MP South	8559	65	131.677	4.88
MP South Western	206	2	103	*
GUJ Eastern	69219	1724	40.15	3.693
GUJ Plains Northern	14874	622	23.913	3.174
GUJ Saurashtra	22605	85	265.941	5.583
MH Coastal	47458	1134	41.85	3.734
MH Inland Western	23893	479	49.881	3.91
MH Inland Northern	2495	76	32.829	3.491
MH Inland Eastern	696	72	9.667	2.269
AP Coastal	7688	281	27.359	3.309
AP Inland Northern	3465	157	22.07	3.094
AP South Western	2158	75	28.773	3.359
AP Inland Southern	1523	52	29.288	3.377
KAR Inland Southern	18252	320	57.038	4.044
KAR Inland Northern	1956	79	24.759	3.209
KER Northern	5810	216	26.898	3.292
KER Southern	2354	217	10.848	2.384
TN Coastal Northern	13463	252	53.425	3.978
TN Coastal	19885	490	40.582	3.703
TN Southern	26698	943	28.312	3.343
TN Inland	137771	5156	26.721	3.285

Source: Same as Table A.17

*Note: * Industry does not exist in region*

Table A.19: Basic Data used: Paper and Paper Products Industry (2004-05)

State Region	No. of employees	no. of firms	Avg. Size	Log K/L
Punjab Northern	23638	159	148.667	8.05035
Punjab Southern	1566	47	33.319	17.41989
H.P.	120	34	3.529	10.66353
HR Eastern	4040	85	47.529	13.05977
HR Western	46	28	1.643	14.8385
RAJ North-eastern	809	67	12.075	17.09134
UP Western	12232	292	41.89	12.29228
UP Central	1630	64	25.469	10.81552
UP Eastern	45	56	0.804	13.18047
BIHAR Central	1930	18	107.222	10.1257

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State Region	No. of employees	no. of firms	Avg. Size	Log K/L
WB Central Plains	11000	133	82.707	11.71487
WB Western Plains	134	8	16.75	*
ORI Coastal	750	21	35.714	6.295556
ORI Northern	582	8	72.75	12.25138
MP Northern	1515	44	34.432	8.963031
MP South Western	1055	22	47.955	14.24154
GUJ Eastern	6290	274	22.956	13.62373
GUJ Plains Northern	4095	201	20.373	14.1975
GUJ Saurashtra	18295	61	299.918	7.94594
MH Coastal	6535	387	16.886	14.95939
MH Inland Western	18155	202	89.876	9.319866
MH Inland Northern	1700	106	16.038	11.46978
MH Inland Eastern	1692	96	17.625	10.47619
AP Coastal	4318	245	17.624	11.15301
AP Inland Northern	5710	267	21.386	13.63548
KAR Inland Southern	20949	232	90.297	11.41392
KER Southern	1337	77	17.364	12.16909
TN Coastal Northern	3761	213	17.657	14.22769
TN Coastal	5493	43	127.744	13.97193
TN Southern	3406	214	15.916	17.04313
TN Inland	7565	201	37.637	12.7776

Source: Same as Table A.17

*Note: * Industry does not exist in region*

Table A.20: Basic Data used: Publishing and Printing Industry (2004-05)

State Region	No. of employees	no. of firms	Avg. Size	Log K/L
Punjab Northern	1910	51	37.451	13.079
Punjab Southern	1780	18	98.889	12.133
H.P.	32	11	2.909	9.369
HR Eastern	176	19	9.263	14.971
RAJ North-eastern	23	35	0.657	19.247
UP Western	3717	140	26.55	11.264
UP Central	6365	82	77.622	12.921
UP Eastern	432	40	10.8	16.705
BIHAR Central	514	37	13.892	15.066

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State Region	No. of employees	no. of firms	Avg. Size	Log K/L
MP Northern	94	18	5.222	14.773
MP Malwa	4687	24	195.292	10.77
GUJ Eastern	1384	90	15.378	15.368
GUJ Plains Northern	11191	149	75.107	13.881
GUJ Saurashtra	44	14	3.143	14.648
MH Coastal	23945	580	41.284	12.602
MH Inland Western	4705	170	27.676	14.115
AP Coastal	6975	101	69.059	9.762
AP Inland Northern	12918	204	63.324	10.955
KAR Coastal Ghats	75	38	1.974	17.053
KAR Inland Southern	4725	182	25.962	12.493
KAR Inland Northern	212	26	8.154	14.229
KER Northern	3015	43	70.116	12.924
KER Southern	1579	90	17.544	14.206
TN Coastal Northern	12291	310	39.648	13.176
TN Coastal	2474	51	48.51	8.945
TN Southern	8079	363	22.256	13.773
TN Inland	2442	90	27.133	12.078

Source: Same as Table A1.7

*Note: * Industry does not exist in region*

Table A.21: Basic Data used: Non-metallic Mineral Products Industry (2004-05)

State Region	No. of employees	no. of firms	Avg. Size	Log K/L
Punjab Northern	18028	498	36.201	11.379
Punjab Southern	9340	265	35.245	13.648
H.P.	71	38	1.868	11.217
HR Eastern	22077	443	49.835	13.565
HR Western	2220	46	48.261	14.874
RAJ Western	29633	548	54.075	12.023
RAJ North-eastern	39118	703	55.644	12.459
RAJ Southern	5955	366	16.27	14.501
RAJ South-Eastern	522	173	3.017	15.139
UP Western	17739	536	33.095	13.278
UP Central	120	37	3.243	18.526
UP Eastern	818	54	15.148	11.435
UP Southern	3385	46	73.587	6.429

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State Region	No. of employees	no. of firms	Avg. Size	Log K/L
BIHAR Central	20974	482	43.515	14.259
WB Central Plains	757	161	4.702	14.707
WB Western Plains	896	26	34.462	8.831
ORI Coastal	7854	206	38.126	12.303
ORI Northern	4178	160	26.113	12.956
MP Vindhya	4989	66	75.591	11.922
MP Central	721	22	32.773	9.678
MP Northern	760	45	16.889	10.842
MP Malwa	6791	146	46.514	12.725
GUJ Eastern	19305	542	35.618	12.808
GUJ Plains Northern	21935	560	39.17	12.094
GUJ Plains Southern	1715	47	36.489	12.469
GUJ Saurashtra	31050	764	40.641	15.548
MH Coastal	10127	291	34.801	13.5
MH Inland Western	23931	305	78.462	12.488
MH Inland Northern	3304	117	28.239	8.183
MH Inland Central	5164	57	90.596	9.343
MH Inland Eastern	1293	157	8.236	14.657
MH Eastern	7853	56	140.232	9.832
AP Coastal	73264	1302	56.27	12.923
AP Inland Northern	26309	965	27.263	12.978
AP South Western	21035	719	29.256	13.138
AP Inland Southern	14325	239	59.937	11.995
KAR Coastal Ghats	3882	76	51.079	12.04
KAR Inland Southern	30138	346	87.104	12.16
KAR Inland Northern	13615	141	96.56	11.627
KER Northern	6484	176	36.841	14.663
KER Southern	10448	770	13.569	15.214
TN Coastal Northern	20236	458	44.183	14.843
TN Coastal	2742	111	24.703	12.838
TN Southern	5816	347	16.761	13.593
TN Inland	2839	192	14.786	17.46

Source: Same as Table A.17

*Note: * Industry does not exist in region*

Table A.22: Basic Data used: Basic Metals Industry (2004-05)

State Region	No. of employees	no. of firms	Avg. Size	Log K/L
Punjab Northern	8766	374	23.439	11.46691
Punjab Southern	10855	309	35.129	14.8278
H.P.	217	33	6.576	12.63916
HR Eastern	7410	313	23.674	13.58065
HR Western	1096	62	17.677	16.39711
RAJ Western	2816	120	23.467	14.13391
RAJ North-eastern	26471	291	90.966	10.78792
UP Western	22025	390	56.474	12.31204
UP Central	2430	128	18.984	12.24721
UP Southern	1444	27	53.481	14.8844
BIHAR Central	616	57	10.807	14.36576
WB Central Plains	50631	592	85.525	13.17916
ORI Coastal	12	59	0.203	18.50662
ORI Northern	6306	134	47.06	11.94276
MP Northern	11717	147	79.707	11.80995
GUJ Eastern	3717	264	14.08	13.69884
GUJ Plains Northern	30579	733	41.718	13.67379
GUJ Saurashtra	15323	255	60.09	13.36801
MH Coastal	16863	425	39.678	13.13196
MH Inland Western	27680	396	69.899	12.34668
MH Inland Northern	1216	94	12.936	13.70589
MH Inland Central	1060	77	13.766	12.87869
MH Inland Eastern	874	108	8.093	14.42179
MH Eastern	27	11	2.455	13.26134
AP Coastal	8813	225	39.169	12.00996
AP Inland Northern	10249	371	27.625	12.69614
AP South Western	298	21	14.19	12.94878
KAR Inland Eastern	1837	22	83.5	12.12403
KAR Inland Southern	4438	169	26.26	11.60881
KAR Inland Northern	2268	143	15.86	13.65054
KER Southern	5472	39	140.308	8.1512
TN Coastal Northern	27195	300	90.65	15.82984
TN Coastal	139	56	2.482	17.96587
TN Southern	1396	70	19.943	12.22077
TN Inland	8263	326	25.347	15.19478

Source: Same as Table A.17

*Note: * Industry does not exist in region*

Table A.23: Basic Data used: Machinery and Equipment Industry (2004-05)

State Region	No. of employees	no. of firms	Avg. Size	Log K/L
Punjab Northern	52102	926	56.266	12.305
Punjab Southern	2085	100	20.85	10.477
H.P.	1377	76	18.118	14.143
HR Eastern	25768	496	51.952	13.44
RAJ Western	3638	43	84.605	12.748
RAJ North-eastern	9189	174	52.81	11.074
UP Western	26550	507	52.367	12.884
UP Central	80	94	0.851	17.108
UP Eastern	5350	52	102.885	10.882
BIHAR Central	799	42	19.024	13.784
WB Central Plains	43023	498	86.392	12.369
WB Western Plains	594	3	198	*
ORI Coastal	560	30	18.667	11.488
ORI Northern	1372	21	65.333	10.261
MP Central	1700	36	47.222	8.075
MP Northern	21238	93	228.366	12.583
GUJ Eastern	29406	646	45.52	12.42
GUJ Plains Northern	44197	1035	42.702	13.085
GUJ Saurashtra	18177	400	45.443	13.865
MH Coastal	42150	1110	37.973	12.721
MH Inland Western	29339	747	39.276	12.33
MH Inland Northern	1737	96	18.094	16.363
MH Inland Central	171	35	4.886	11.472
MH Inland Eastern	900	61	14.754	12.628
AP Coastal	5922	177	33.458	11.825
AP Inland Northern	29591	564	52.466	12.133
KAR Coastal Ghats	2520	21	120	12.312
KAR Inland Southern	31217	615	50.759	11.605
KAR Inland Northern	10419	165	63.145	11.951
KER Northern	2389	22	108.591	10.37
KER Southern	1665	80	20.813	11.817
TN Coastal Northern	30606	633	48.351	13.434
TN Coastal	881	36	24.472	12.519
TN Southern	2079	91	22.846	13.777
TN Inland	10222	591	17.296	14.042

Source: Same as Table A.17

*Note: * Industry does not exist in region*

Table A.24: Basic Data used: Electrical Machinery and Apparatus Industry (2004-05)

State Region	No. of employees	no. of firms	Avg. Size	Log K/L
Punjab Northern	99	85	1.165	16.815
Punjab Southern	294	35	8.4	15.308
H.P.	98	43	2.279	11.343
HR Eastern	30210	175	172.629	9.488
RAJ North-eastern	1627	146	11.144	15.455
UP Western	57684	294	196.204	11.468
UP Central	10286	62	165.903	12.364
UP Eastern	35	35	1	12.678
BIHAR Central	340	10	34	12.936
WB Central Plains	25433	282	90.188	12.644
ORI Coastal	1652	41	40.293	12.944
ORI Northern	161	13	12.385	12.776
MP Central	3104	57	54.456	10.366
MP Northern	1926	87	22.138	14.736
GUJ Eastern	6183	280	22.082	12.661
GUJ Plains Northern	4623	185	24.989	11.801
GUJ Saurashtra	14150	57	248.246	*
MH Coastal	11294	519	21.761	15.803
MH Inland Western	3318	295	11.247	14.865
MH Inland Northern	149	102	1.461	17.609
MH Inland Central	2165	31	69.839	10.667
MH Inland Eastern	1795	39	46.026	13.083
AP Coastal	1405	93	15.108	13.025
AP Inland Northern	8185	211	38.791	12.759
KAR Inland Southern	18543	372	49.847	11.11
KER Southern	650	82	7.927	13.297
TN Coastal Northern	13946	197	70.792	12.679
TN Southern	112	27	4.148	14.826
TN Inland	2162	161	13.429	14.365

Source: Same as Table A.17

*Note: * Industry does not exist in region*