

## Geographic Concentration and Regional Specialization of Manufacturing Industries in West Bengal

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### *Abstract*

*The paper presents an empirical study of the regional specialization and the geographic concentration of some selected manufacturing industries across the three administrative divisions of West Bengal viz. Jalpaiguri division, Burdwan Division and Presidency division. Four important and popular characteristics of the manufacturing economy viz. i) No. of factories, ii) Fixed Capital, iii) Gross Value Added (GVA) and iv) number of persons engaged (employment) have been used for measuring the concentration of the Industries and specializations of the regions. Traditional measures like Herfindahl Index and Krugman Dissimilarity Index are used to measure the divisional specialization and geographic concentration based on these characteristics.*

*The research explores a new data set provided by the "Annual Survey of Industry" publications of Bureau of Applied Economics and Statistics presently under Department of Statistics and Programme Implementation, Government of West Bengal. Due to limited availability of comparable regional data, the research is restricted to the latest available six year period 2004-05 to 2009-10. For each division Modified Lilien Index and Stoikov Index on Norm of absolute Values are also computed to measure the structural change in the demand for variance in the industry employment growth. For the purpose an additional data for the year 1997-98 is used. The analysis points out to the divergence in the level of specialization and concentration among the divisions and the industries considered irrespective of the characteristic used. It brings out the existence of high inequality among the divisions in terms of the development of the top industries in West Bengal. In the light of economic policies this analysis helps the State Government in adopting appropriate steps while pursuing policies for overall industrial development with a view to achieve growth with equity. It also provides useful information when decisions encouraging investments or formulation of employment policies are undertaken.*

### **1. Introduction**

1.1 The recent growth path of West Bengal Economy depicts the picture of increasing share of the secondary sector to the State GDP over the last decade, the rise mainly attributed to the increasing manufacturing activities. This puts tremendous responsibility

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on the State Government to boost industrial growth, private investments and employment generation with a view to achieve growth with equity for the three administrative divisions viz. Jalpaiguri division, Burdwan Division and Presidency division, as well. The top five manufacturing industries, ranked in terms of GVA along with two more industries having high employment are selected to have an insight on the existence of high in-equalities among the divisions. For balanced growth, the concentration of industrial activities must decline over time and industrially backward division must also attract good share in total output of the state thus in turn creating good employment opportunities. On the other hand, a division is said to be highly specialized if a small number of industries have a large combined share in the economy of that division.

## **2. Objective of the study**

2.1 The objective of the study is to investigate whether the economy of the manufacturing activities in West Bengal are more geographically dispersed or not with respect to the administrative divisions. The study also finds out whether the economic structure of the division is converging or is becoming more divergent, considering the four key characteristics viz. No. of factories, Fixed Capital, GVA and employment. It also presents a measure of the speed of changes in specialization of the divisions and reallocation of employment between the time periods 1997-98 and 2009-10.

## **3. Materials and Methods**

### **3.1 Literature Survey**

3.1.1 The theory of industrial location and the concept of agglomeration of industrial firms were first developed by Marshall (1920) and Weber (1929). More recently, the "New Economic Geography" has emerged to study the location, distribution and spatial organization of economic activities across the world. Developed by Paul Krugman, the new discipline has arisen as a compelling alternative paradigm for industrial location. The models and empirical studies focusing on regional specialization and industrial concentration had their origin in this new discipline. Though most of the regional economic literature considers the industrial specialization of regions/ countries and geographic concentration of industries as "two sides of the same coin", there are some empirical outcomes suggesting that they would rather be considered as interrelated and their direction and pace of movement may not be same (Dalum,et.al, 1998). The same was also established in 2004 both methodologically and in an empirical study by K. Aigner and S. W. Davis for the manufacturing in European Union since 1985.

3.1.2 A review of the literature shows that numerous studies on regional specialization and geographic concentration have been undertaken both in national and international context. To cite a few, in 1997 Glenn Ellison developed a model to show that localized industry-specific spillovers, natural advantages, and pure random chance all contribute to geographic concentration of manufacturing industries in United States. In 1998 M. Brulhart and J Torstensson showed that industrial specialization among European Union (EU) countries has increased in the 1980's and increasing returns industries tend to be highly localized, concentrated in Central EU countries and subject to relative low intra-

industry trade. In a more recent study A. Hildebrandt and J. Wörz applied regression analysis on individual industries to investigate the determinants of the patterns of regional concentration and specialization in Central and Eastern European Countries (CEECs) over the years 1993 to 2000. He reached the conclusion that a massive reallocation of production and labour force strongly affects the pattern of regional concentration of manufacturing firms and concentration both in terms of production and employment generally increased in the CEECs. In 2006 Canfei He, et al. concluded in a research study on Economic Transition and Industrial Concentration in China , that country's manufacturing employment has been increasingly concentrated since the early 1980's while industrial output experienced a decentralization in the 1980's followed by a centralization process in 1990's. Also Chinese provinces have also become less specialized with more diversified industrial structure. In another study on manufactures development of China, Kai Li, et al, in 2006, used Gini's coefficient and CR-4 ratios to conclude that concentration and agglomeration have different relation in different development stages and in different industries. A study some -what similar to the present one was undertaken by Z. Goschin, et al in 2009 ,where measures like Herfindahl Index , Krugman dissimilarity Index and Lilien index were used to explore the main characteristics and the interaction of the industries in Romania on the basis of GVA and employment figure where as the present study considers two more additional factors viz. no. of factories and Fixed Capital and uses Modified Lilien Index and Stoikov index instead of Lilien Index to analyze the industrial scenario of West Bengal. The main findings of the Romanian study were that during 1996-2005 the speed of structural changes within their regions was high and significant reallocation of employment took place in order to adapt to the changing economy and the regions becomes less specialized while the industries become slightly more concentrated. In 1999 F. Maurel, et. al studied the geographic concentration in French Manufacturing Industries to confirm the independence of firm's location choice. It also identifies three types of localized industries viz. extractive, traditional and high technology industries based on technological spill over. In 2006 C. Naude used Gini's coefficient and Herfindahl Index to conclude that the level of manufacturing industry concentration in South Africa is high.

**3.1.3** In India Ghosh (1975) computed Gini's coefficient and Herfindahl Index to show that a declining trend exists in concentration of twenty-two industries over the period 1948 to 1968. P. G. Apte and R. Vaidyanathan (1979) computed 4-firm concentration ratio and H-index to establish the impact of concentration on profitability of twenty-nine manufacturing industries in India by using multivariate regression analysis. In 2006 S. Athraye, et al. studied the impact of economic liberalization on industrial concentration by using dynamic model based on time series data on twelve industries over the period 1970-99. In July, 2012 Dr. F. P. Singh used Annual Survey of Industries (ASI) data to compute industrial concentration levels for the states based on Gini's coefficient and Herfindahl index for each year between 1979-80 and 2006-07 to reach a conclusion that high value of these measures indicate high inter-state disparities exist, as far as industrial development is considered. In 2011 D. Saikia examined with the help of Gini's coefficient the spatial concentration of the unorganized manufacturing at the state level and revealed that there is a decline in industrial share of the leading states in post reform period.

**3.1.4** When most of the earlier works dealt either with the temporal analysis of the industrial concentration or examining the effect of government policies and liberalization

on the concentration or to establish the interstate disparities in terms of Industrial development in India, the present study focuses on the industrial scenario and unbalanced industrial growth in divisions of West Bengal. Unlike the earlier works done in India, the study measures also the specialization of a region (a division in this case) with respect to any industry in addition to measuring the geographical concentration of industries. It also captures the speed of the employment reallocation in the economy, as the main factor of differences in specialization.

### **3.2 Data**

3.2.1 The present study is based on the secondary information available from a yearly publication of industrial statistics. It explores a new data set provided by the "Annual Survey of Industry" publications of Bureau of Applied Economics and Statistics presently under Department of Statistics and Programme Implementation, Government of West Bengal. Due to limited availability of comparable regional data the research is restricted to the latest available six year long period ranging from 2004-05 to 2009-10. For the sake of construction of Modified Lilien Index to measure the structural change in the demand for variance in the industry employment growth an additional data set for the year 1997-98 is also used.

### **3.3 Scope and Coverage**

3.3.1 To shed some light in the pattern of concentration and industrial specialization in West Bengal economy, the four most popular characteristics are considered. They are i) No. of factories, ii) Fixed Capital, iii) the Gross Value Added (GVA) and iv) the number of persons engaged (employment).

3.3.2 The study is restricted to some selected industries in West Bengal based upon data from 2 digit manufacturing. It first considers the top five industries ranked in order of their GVA contribution. The rank is examined for the period under study i.e. from 2004-05 to 2009-10 and the industries coming in top five for the majority of the time is considered here. These are i) Manufactures of Basic Metal, ii) Manufacture of Chemical and Chemical Products, iii) Manufacture of textile, iv) Manufacture of Coke and Refined Petroleum Products and v) Manufacture of Food Products and Beverages. It is to be mentioned here that Manufacture of Food Products and Beverages are separated as two industries a) Manufacture of Food products and b) Manufacture of Beverages under the latest NIC (National Industrial Classification) code 2008, but for the sake of comparability this industry is considered as the old classification and the characteristic values are the total of the two industries for the years 2008-09 and 2009-10 where NIC 2008 structure was followed. In addition to these industries two more industries in view of their employment potentiality are also considered. They are Manufacture of Tobacco and Tobacco Products and Manufacture of Leather and related Products.

3.3.3 The most important industrial belt in West Bengal is a corridor extending for a number of miles north and south of Kolkata, along the Hugli River. Another significant industrial region is located along the Damodar River. There are steel plants at Durgapur and Burnpur. Haldia, the terminus of an oil pipeline from Assam and the site of a large oil

refinery, also has a petrochemical industry. A third significant contribution comes from the tea industries in the hilly districts mostly from the Darjeeling and Jalpaiguri. Again tobacco industries have a strong place in Murshidabad and Malda districts compared to the rest of the districts. All these point out to the apparent location-wise distribution of the industries among the three regions of West Bengal, likely to be marked as i) Burdwan and the adjoining districts, ii) Darjeeling and the adjoining districts and iii) Kolkata-Howrah and the adjoining districts, which coincides with the three administrative divisions of West Bengal viz. Jalpaiguri division, Burdwan Division and Presidency division. Hence instead of considering the individual districts the study focuses on these three administrative divisions of West Bengal. This consideration increases the chance of getting better figure (data) in terms of the industrial representation in a group of districts rather than individual district.

### **3.4 Divisions of West Bengal**

West Bengal is now divided in nineteen districts, almost equally grouped under three divisions, as tabulated below.

Burdwan division	Jalpaiguri Division	Presidency Division
Bankura District	Cooch Behar District	Howrah District
Bardhaman District (Burdwan)	Darjeeling District	Kolkata District
Birbhum District	Jalpaiguri District	Murshidabad District
East Medinipur Dist (Purba Medinipur)	Malda District	Nadia
Hooghly District	North Dinajpur District (Uttar Dinajpur)	North 24 Parganas (Uttar 24 Parganas)
Purulia District	South Dinajpur District (Dakshin Dinajpur)	South 24 Parganas (Dakshin 24 Parganas)
West Medinipur District (Paschim Medinipur)		

### **3.5 Regional Specialization Vs Geographical Concentration of Industries**

3.5.1 A bulk of the literature on regional specialization and geographical concentration considers these two phenomena as closely related. In fact Regional specialization is usually analyzed in connection with industrial concentration, the latter being focused on “the distribution in the geographic dimension” (Aigner, 2000). Even specialization and concentration were seen as the “two sides of the same coin”. For example, suppose that each country or a region becomes more specialized, concentrating more of its activity in those industries in which it is comparatively larger, and less in those in which it is comparatively smaller. Under the assumption that all countries or regions were of the same size, and likewise all industries, such increased specialization must mean that industries will also become more concentrated. Aigner put the same point statistically by describing specialization and concentration as two perspectives to be derived from a matrix with the columns referring to countries or the regions, and the rows to industries. Specialization is then observed by reading down each column, while concentration is observed by reading along each row thus suggesting that if inequalities tend to increase down the columns, so they should also increase along the rows.

3.5.2 However Dalum, et al in 1998 tried to establish empirically that specialization and geographic concentration are two independent processes and the two phenomena may exhibit different pace and direction of movement. In 2004 K. Aigner and S. W. Davis showed that the two phenomena cannot be considered as the two sides of a coin for the European Union. In fact greater specialization in the structures of individual countries does not necessarily mean that the industries will become more geographically concentrated.

3.5.3 The new economic geography models suggest that specialization patterns may be the result of the spatial agglomeration of economic activities (Krugman, P., 1991; Krugman and Venables, 1995, Venables, T., 1996). Krugman's analysis focused on a two sector-two region model similar to that of Krugman and Venables (1995). Unlike in the latter model, the two regions are identical in terms of initial factor endowments and the factor specific to manufacturing (industrial workers) is mobile across regions. He showed that relocation of firms and workers from one region to the other triggers agglomeration and the manufacturing sector in the 'donor' region would collapse and manufacturing would concentrate in the 'receiving' region.

3.5.4 Thus most of the existing literature defines regional specialization and geographical concentration of industries in relation to production structures. Regional specialization expresses the regional perspective and depicts the distribution of the industry's shares in its overall economy. A region is considered to be highly specialized if a small number of industries have a large combined share in the economy of that region. Geographic concentration of a specific industry reflects the distribution of its regional shares. A highly concentrated industry will have a very large part located in a small number of regions.

3.5.5 In absolute terms, a region  $j$  is 'specialized' in a specific industry  $i$  if this industry has a high share in the manufacturing activity of region  $j$ . The manufacturing structure of a region  $j$  is 'highly specialized', if a small number of industries have a large combined share in the total manufacturing of region  $j$ . In relative terms, regional specialization is defined as the distribution of the shares of an industry  $i$  in total manufacturing in a specific region  $j$  compared to a benchmark.

3.5.6 In absolute terms, a specific industry  $i$  is 'concentrated', if a large part of its production is carried out in a small number of regions. In relative terms, geographical concentration of industries is defined as the distribution of the shares of regions in a specific industry  $i$  compared to a benchmark.

### 3.6 Absolute Vs Relative measures

3.6.1 According to absolute measure a country or a region is specialized if a few industries together have a high share, and an industry is concentrated if a few countries or regions have a large share of production. Relative measure assesses the specialization of the country or a region relative to specialization of the larger region, or concentration of an industry, relative to concentration of overall economic activity.

3.6.2 Sometimes a very small region is successful in some high tech industries, though the overall share of this region remains small relative to the much larger benchmark region. Again some industries are highly concentrated in absolute terms, but do not score very high on relative concentration. This must imply that these industries have a bias towards localization in larger countries or regions. The industries which are important in a few, smaller countries or regions, are high up on the list in terms of relative concentration, but not in terms of absolute concentration.

3.6.3 In 2004 Aigner, K. and Davies, S.W. brought out a comparison between the absolute and relative measures in the line of thought of Haaland, et al. (1999). It appears that both the measures are needed to give a more complete picture of the pattern of concentration and specialization. It only depends on the question the measure addresses i.e. relative measures are important for some questions, absolute for others.

### **3.7 Measures of Specialization and Concentration**

3.7.1 Several absolute and relative measures of specialization and concentration are available in the existing literature, each having certain advantages as well as shortcomings. The first measure employed in the present analysis is the traditional Herfindahl Index for absolute measure, which is probably the most common measure of specialization/concentration. The Herfindahl index is increasing with the degree of concentration/specialization, reaching its upper limit of 1 when the industry  $i$  is concentrated in one region or the region  $j$  is specialized in only one industry. The lowest level of concentration is  $1/n$  i.e. all regions have equal shares in industry  $i$ , ( $i = 1(1)n$ ) ,while the lowest specialization is  $1/m$  i.e. all industries have equal shares in region  $j$ ,( $j = 1(1)m$ ).

3.7.2 The second indicator is for relative measure and is the well known Krugman Dissimilarity Index for concentration/specialization and is used to compare one industry or region with the over all economy. Its value ranges from 0 (identical structures) to 2 (totally different structures). Both of these indicators propose either a sectoral perspective ("concentration") or a geographical perspective ("specialisation").

3.7.3 To capture the speed of the sectoral employment reallocation in the economy, as the main factor of differences in specialization a simplest measure of structural change, the Norm of Absolute Values (NAV) is used. It is also called Michael Index (Michael, 1962) or Stoikov-Index (Stoikov, 1966). For its computation first the differences of the sector shares of employment between two points in time  $s$  and  $t$  are calculated. Then the absolute amounts of these differences are summed up and divided by two (since each change is counted twice). Absolute values guarantee negative and positive changes in industry shares do not annul each other when summed up across industries. The amount of structural change equals exactly the share of the movements of the sectors as a percentage of the whole economy. If the structure remains unchanged, the indicator is equal to zero and if all sectors change at its most, which means the whole economy has a total change, the index is equal to unity (Dietrich, 2009).

3.7.4 An often mentioned disadvantage of the NAV is that huge movements of a few sectors have the same impact on the index value as fewer changes of many sectors and

therefore are underestimated. But because in this paper only seven selected industries are considered, this problem is only of minor importance. Hence, a second measure that fulfils all conditions shall be used for comparison. A very prominent measure of structural change in the research field of structural unemployment is the Lilien-index (Lilien (1982)). For each region (or geographical area) of the country, the index measures the structural change in the demand for variance in sectoral employment growth from period s to period t. In other words it measures relative standard deviation of sector employment growth relative to overall growth in the region. Stamer (1998) modified this index by augmenting it with the weighting by the shares of the sectors in both periods to develop Modified Lilien Index (MLI). Hence, the influence/relevance of sector  $i$  is growing in proportion to its size and also with respect to the value of its relative growth. The index has to be equal to zero if the sectoral composition is unchanged. The higher the value of this index, the faster the structural changes and the bigger the re-allocations of employment between industries. Also Structural change between two points in time must be independent of the direction and only the extent of change is regarded (symmetry).

3.7.5 In this paper two different indices NAV and MLI are calculated, following Dietrich (2009) to check the robustness of the analysis with respect to the structural change measure. He also found that economic growth has an impact on structural change and that growth accelerates structural change and structural change slows down growth.

3.7.6 Notations and definitions of these indices used in this paper are given in Boxes 1 to 3.

**Box 1. Indicators of regional specialization and geographical concentration of industries: *Herfindahl Index***

$X$  = No. of factories **OR** Fixed Capital **OR** Gross Value Added (GVA) **OR** number of persons engaged (employment)

$S$  = shares

$i$  = industry (also referred as sector)

$j$  = region

$X_{ij}$  = value of  $X$  in industry  $i$  in region  $j$

$X_i$  = total value of  $X$  in industry  $i$

$X_j$  = total value of  $X$  in region  $j$

$S_{ij}^S$  = the share of  $X$  in industry  $i$  in region  $j$  in the total  $X$  of region  $j$  =

$$\frac{X_{ij}}{X_j} = \frac{X_{ij}}{\sum_i X_{ij}}$$

**Box 1 (Cntd.) . Indicators of regional specialization and geographical concentration of industries: *Herfindahl Index***

$S_{ij}^C$  = the share of  $X$  in industry  $i$  in region  $j$  in the state total of  $X$  of industry  $i$

$$= \frac{X_{ij}}{X_i} = \frac{X_{ij}}{\sum_j X_{ij}}$$

$$S_i = \text{share of state value of } X \text{ in industry } i \text{ in total state value of } X = \frac{X_i}{X}$$

$$S_j = \text{share of total } X \text{ in region } j \text{ in total state value of } X = \frac{X_j}{X}$$

$$H_j^S = \text{the Herfindahl index for Specialization} = \sum_{i=1}^m (S_{ij}^S)^2$$

$$H_i^C = \text{the Herfindahl index for Concentration} = \sum_{j=1}^n (S_{ij}^C)^2$$

**Box 2. Relative Measure of regional specialization and geographical concentration of Industries: *Krugman Dissimilarity Index***

Using notations in Box 1,

$$K_j^S = \text{Krugman Dissimilarity Index for Specialization} = \sum_{i=1}^m |S_{ij}^S - S_i|$$

$$K_i^C = \text{Krugman Dissimilarity Index for Specialization} = \sum_{j=1}^n |S_{ij}^C - S_j|$$

**Box 3. Relative Measure of sectoral employment growth:  
Modified Lilien Index (MLI) and Michaely-Index or Stoikov Index**

For each region  $j$  (or geographical area of the country) the Modified Lilien index as defined over two time periods  $t$  and  $s$  is

$$\text{MLI}_j = \sqrt{\sum_{i=1}^m W_{jt} \left[ \ln\left(\frac{e_{ijt}}{e_{ijs}}\right) - \ln\left(\frac{E_{jt}}{E_{js}}\right) \right]^2}, \text{ Where } E \text{ and } e \text{'s are } > 0$$

$W_{jt}$  = weight factor

= average share of the industry  $i$  in total regional employment over two time periods  $s$  and  $t$  for the region  $j$

$e_{ijt}$  = employment in industry  $i$  in region  $j$  at time point  $t$

$e_{ijs}$  = employment in industry  $i$  in region  $j$  at time point  $s$

$E_{jt}$  = employment in the entire region  $j$  at time point  $t$

$E_{js}$  = employment in the entire region  $j$  at time point  $s$

$\ln(e_{ijt}/e_{ijs})$  = employment growth in industry  $i$  in region  $j$  in period  $t$  over  $s$

$\ln(E_{jt}/E_{js})$  = employment growth in the entire region  $j$  in period  $t$  over  $s$

**Michaely-Index or Stoikov Index or the Norm of Absolute values (NAV) for the region  $j$**

$$\text{NAV}_j = 0.5 \sum_{i=1}^n |S_{it}^e - S_{is}^e|$$

$S_{ijt}^e$  = sector share of employment at time point  $t$  for the region  $j$

Similarly for  $S_{ijs}^e$ .

#### 4. Results and discussion

##### 4.1 Analysis on Regional Specialization

4.1.1 Empirical findings are presented in tabular forms (Table 1 to 3).

4.1.2 The Herfindahl index points out that Jalpaiguri Division is the most specialized division (manufacturing of food products, e.g. tea industry) among the other divisions, irrespective of the characteristic chosen, its maximum reaching for the characteristic Fixed Capital. It clearly points out that there is a need for developing other industries in the division to have a growth with equity in the industry of the state. Developed regions tend to have a lower level of specialization. A deeper look into the specialization indices indicates that apparently the process of balanced growth seems to have started in Jalpaiguri Division at a lower pace, as the Herfindahl index shows slight decline in the recent years 2007 to 2009 when the characteristic Number of Factories, Employment and GVA are considered.

4.1.3 Presidency division is the least specialized division pointing towards the diversified industrial structure of the division. Burdwan Division also has a low specialization index suggesting that the division is also in a favourable position as far as the dispersion of the potential industries is considered. In fact for both the divisions the Index shows that the level of specialization is more or less same over the last 6 years in all the characteristics except for a slight decline observed in the index based on Employment data.

4.1.4 Another striking picture observed is that the Herfindahl Index based on Fixed Capital is bit on the higher side compared to the rest and remains there more or less stable in the last 6 years in each division. This draws the attention of the policy makers to the fact that fixed capital development for different industries is needed for a sustainable balanced growth. This is especially important for the Jalpaiguri Division.

4.1.5 An amplified value of Krugman Dissimilarity index for the Jalpaiguri Division proves an increasing divergence among the industrial structures of the region with respect to the potential industries. The index reaches its maximum values for the two divisions Jalpaiguri and Presidency, when computed out of the Fixed Capital Data.

4.1.6 Both Presidency and Burdwan Divisions exhibit similar Dissimilarity index value for most of the years and characteristics showing that the two Divisions are almost on equal footing with respect to their divergent industrial structure as compared to the state scenario. However, Burdwan has the lowest value when computed from employment data. In 2006, the dissimilarity index based on employment data increases sharply from 2004 and 2005 for the Presidency division indicating an increase in divergent nature of employment generation among the industries of the region as relative to the state.

4.1.7 Thus the indices, Herfindahl and Krugman Dissimilarity measures of specialization showed significantly higher values for the Jalpaiguri division, both reaching their highest when computed out of the Fixed Capital Data. However the two indices have more or less a similar time trend.

4.1.8 The close proximity of the two indicator values for both the years and for all the three division supports empirically the robustness of the findings. Leather Industry is omitted from this index computation as the employment figure for this industry in each division does not satisfy ' $>0$ ' condition. In Jalpaiguri the index value is close to zero for both the years 1997-2004 and 2005-2010 to show that composition of employment allocation among industries is unchanged. Since structural change in employment is associated with economic growth, the picture is not favourable for industrial development in Jalpaiguri. A surprising fact is that Presidency division only shows a high value of the index and exhibits a rise in the index value in 2005-2010 compared to 1997-2004. It points out to faster structural changes and bigger re-allocations of employment between industries in the division. However Burdwan division also has a low index value implying that structural transformation seems to have impeded certain industries from re-employing workers they had previously shed. Combined with the analysis of the Herfindahl index for the division, it can be concluded that majority of the working population of the Division is allocated in small number of industries, e.g. Industry of Basic Metal or Tobacco. Since structural change in employment is associated with economic growth, the picture is favourable for industrial development in Presidency division where as attention of policy makers is sought for the other two divisions and specially for Jalpaiguri division. The analysis so far indicates that if structural change is measured in terms of employment changes between the main industries of an economy then aggregate industrial growth does cause structural change.

## 4.2 Analysis on Geographical Concentration

4.2.1 The Herfindahl index for concentration shows high value for Leather Industries followed by Textile industry when computed for number of factories. It means that these two industries have large share in smaller locations and does not have good regional share. It supports the flourishing structure of Leather Industries in Presidency division and zero or nearly zero figure for the other divisions. Also textile industry seems to have more impetus in Burdwan division as compared to the rest. The Krugman Dissimilarity index is in concordance with the result of Herfindahl index again pointing towards regional imbalance. As expected the industry of manufacturing food products has low value for both the index showing that industry has good share in all the divisions (Vide Table 6).

4.2.2 A striking picture arises for Herfindahl index on Fixed Capital data that quite a good number of these potential industries show medium to high value of the index. It is expected for Leather or Textile industries which are also concentrated in terms of number of factories. Among the rest Tobacco industry shows high index value in the initial years 2004 to 2006 then declines for the remaining years with the corresponding reflection in the Krugman Dissimilarity Index as well. High value of this index for the two industries Coke and Petroleum Products and Chemicals and Chemical Products show that there is imbalance in Capital reallocation for Fixed Assets among these respective industries in different divisions. An instance may be cited for the Haldia Petrochemical falling under the Burdwan division which attracts a majority of the investment for their development. However, for the two manufacturing industries viz. food and basic metal, the concentration ratio along with the corresponding Krugman Dissimilarity index show low value indicating a balanced capital distribution for fixed asset among these industries (Vide Table 7).

4.2.3 Another interesting finding is that both the concentration index on employment data shows a medium to slight declining value for most of the industries over the years. This shows a strong concordance between the results of specialization and concentration index based on employment data. The index is high for leather industry followed by Chemicals and Chemical Products. For the latter case the index declines over the year (Vide Table 8).

4.2.4 In the year 2004 Leather Industry attained the maximum value of the Herfindahl index of concentration i.e. '1' when the index was calculated on the data of Gross Value Added. It supports the fact that only a single leather industry was set up in the year under the factory act in the entire Jalpaiguri division yielding a negligible figure for GVA. The index remained more or less stagnant showing that majority of the share of this industry's GVA comes from small number of regions (Presidency division). same was strongly supported by the corresponding Dissimilarity index. Two more industries viz. Coke and Petroleum Products and Chemical and Chemical Products show high concentration values. In the former case the value increases over the years while the latter had a lack of clear tendency in the results. Though most of the years recorded an average index value for Basic Metal, but there were few years marking a bit more than average index values.

4.2.5 Another surprising finding is that tobacco industry also showed quite high values till 2006, then sharply declining to an average value indicating that though there were a quite good number of tobacco factories in different divisions, but majority of the share of GVA used to come from few such factories located in particular division (Murshidabad district under Presidency division) till 2006 and then decentralization has started in a slow pace (Vide Table9).

## 5. Scope of further work

5.1 The present study uses a rather broad classification of industries (2 digits NIC level) due to lack of representative data. This however leaves a scope for the researcher to study the regional industrial scenario of West Bengal at a more disaggregated level. Though the present study tries to explore the specialization and geographical concentration of manufacturing industries based on some selected key characteristics, but a precise diagnosis of the importance of agglomeration forces in specific industries or regions remains to be done. Thus further research is needed in order to explore more driving forces of specialization and concentration in West Bengal industry both in absolute and relative term.

## 6. Conclusion

6.1 The present study explores a new data set provided by the "Annual Survey of Industry" publications of Bureau of Applied Economics and Statistics presently under Department of Statistics and Programme Implementation, Government of West Bengal. It uses some key characteristic values to shed light on the interaction between regional specialization and the geographic concentration of some selected manufacturing industries across the three administrative divisions of West Bengal viz. Jalpaiguri division, Burdwan Division and Presidency division. Several indices like Herfindahl index Krueman

Dissimilarity Index, both for specialization and concentration along with specific measures of structural changes in employment like Modified Lilien Index, Soikov Index are employed to highlight the different aspects of the phenomena.

6.2 The major findings of the study are that Jalpaiguri division with districts Darjeeling, Jalpaiguri, Cooch Behar and the two Dinajpurs is the most specialized division (Food Industry, e.g. tea) and Leather industry is the most concentrated industry (Presidency division). Among the other highly concentrated industries are Coke and Petroleum Products (Haldia Petro-chemicals) and Chemicals and Chemical Products. Also it shows that both the specialization and concentration indices are high when computed with the Fixed Capital, both in absolute and relative term, showing that capital investment for fixed asset is accumulating in smaller number of industries. Also it appears that this difference in fixed capital may be a cause for negligible change in the yield of GVA, even when the process of de-centralization of certain industries has started. An analysis of the measures of structural changes shows that for Jalpaiguri subdivision the composition of employment allocation among industries is unchanged over the years 1997-2004 and 2004-2010, where as a faster structural changes and a bigger re-allocation of employment among industries happen in Presidency Division with Kolkata, Howrah, N. 24 Parganas, S. 24 Parganas, Murshidabad, Nadia districts falling under the division. Another interesting finding is that Burdwan division comprising of the districts Bankura, Purulia, Birbhum, Burdwan, two Medinipur and Hooghly seems to have a similar footing with the Presidency division as far as low specialization and concentration index value suggests. But when it comes to the measure of structural changes in employment Burdwan division results in a poor index value suggesting that majority of working population in the division is allocated in small number of industries, say in Industry of Basic Metal or Tobacco and the pattern of the engagement seems to remain unchanged over the years. However, when viewed from the angle of structural change, this does not give favourable sign for industries in this division as well as in Jalpaiguri Division as usually structural change in employment is associated with economic growth.

6.3 In the light of economic policies these analysis helps the State Government in adopting appropriate steps while pursuing policies for overall industrial development with a view to achieve growth with equity. It also draws attention of the policy makers towards fixed capital generation for a healthy development of the industries. It also provides useful information when decisions encouraging investments or formulation of employment policies are undertaken.

## References

- Aigner, K. (2000), "Specialisation of European Manufacturing", *Austrian Economic Quarterly*, 2/2000, WIFO, Pp. 81-92. [http://karl.aigner.wifo.ac.at/fileadmin/files\\_aigner/publications/2000/specialisation.pdf](http://karl.aigner.wifo.ac.at/fileadmin/files_aigner/publications/2000/specialisation.pdf).
- Aigner, K., and Davies, S.W. (2004), "Industrial specialization and geographical concentration: Two sides of the same coin? Not for the European Union", *Journal of Applied Economics*, Nov. 2004, 7(2): 231-248.
- Aigner, K., and Paffermayr, M. (2004), "The Single Market and Geographical Concentration in Europe", *Review of International Economics*, 12(1): 1-11.
- Ansari, R. M., Mussida, C., and Pastore, F. (2013), "Note on Lilien and Modified Lilien Index", February 2013, IZA Discussion Paper No. 7198.
- Apte, P.G., and Vaidyanathan, R. (1979), "Concentration Controls and Performance in Twenty-Nine Manufacturing Industries in India", *Indian Economic Review*, 17(2-4): 241-262.
- Athraye, S., and Kapur, S. (2006), "Industrial Concentration in a Liberalising Economy: A study of Indian Manufacturing" *Journal of Development Studies*, Taylor & Francis Journals, 42(6): 981-999.
- Brulhart, M. (2000), "Evolving Geographical Concentration of European Manufacturing Industries", University of Lausanne, Weltwirtschaftliches Archiv, 2001, Vol. 137(2), Pp. 215-243.
- Brulhart, M., and Torstensson, J (1998), "Regional Integration, Scale Economies and Industry Location in the European Union", School of Economic Studies, University of Manchester, research paper under the Stimulation Plan for Economic Sciences in the European Union (SPES-CT91-0058) and by the Swedish Council for Research in the Humanities and Social Sciences (HSFR).
- Canfei He, Yehua Dennis Wei, and Xiuzhen Xie (2008), "Globalization, Institutional Change and Industrial Location: Economic Transition and Industrial Concentration in China", *Regional Studies*, Vol. 427, August, 2008, Pp. 923-945; <http://www.regional-studies-assoc.ac.uk>.
- Ceapraz, L. I. (2008), "The Concepts of Specialization and Spatial Concentration and the process of Economic Integration: Theoretical Relevance and Statistical Measures. The Case of Romania's Region", summer 2008, *Romanian Journal of Regional Science*, 2(1): 68-93.
- Dalum, B., Laursen, and K., Villumsen G. (1998), "Structural change in OECD Export Specialization Patterns: De-specialization and "Stickiness""", *International Review of Applied Economics*, 12(3): 423-442.
- Dietrich, A. (2009), "Does Growth Cause Structural Change, or Is it the Other Way Round? A Dynamic Panel Data Analysis for Seven OECD Countries" Jena Economic Research

- Papers, Friedrich-Schiller-University Jena, Max-Planck-Institute of Economics, working paper No. 2009-034 <http://econpapers.repec.org/paper/jrpjrpwprp/2009-034.htm>.
- Ellison, G. and Glaeser, E. L. (1997), "Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach", *Journal of Political Economy*, 105(5): 889-997 by The University of Chicago.
- Ghosh, A. (1975). "Concentration and Growth of Indian Industries 1948-68", *Journal of Industrial Economics*, 23(3): 203-222.
- Goschin, Z., Constantin, D. L., Roman, M., and Ileanu, B. (2009), "Regional Specialization and Geographic Concentration of Industries in Romania", *South-Eastern Europe Journal of Economics*, Vol 1, Pp. 99-113.
- Hildebrandt, A. and Wörz, J., (2004), "Determinants of Industrial Location Patterns in CEECs, Working Papers No. 32, The Vienna Institute for International Economic Studies.
- Haaland, J. I., Kind, J.H. Torstensson, J. et al. (1999), "What determines the Economic Geography of Europe", February 1999, Discussion Paper No. 2072, Centre for Economic Policy Research, London.
- Kai Li, and Tao Xiang (2006), "The relations between Concentration and agglomeration in Manufactures development of China", School of Business Administration, North eastern University, China.
- Krugman, P (1991), "Increasing Returns and Economic Geography", *Journal of Political Economy*, 99(3): 483-499 by The University of Chicago.
- Krugman and Venables (1995), "Globalization and the Inequality of Nations", *Quarterly Journal of Economics*, Vol. 110, Pp. 857-880.
- Lilien, D.M. (1982), "Sectoral Shifts ad Cyclical Unemployment", *Journal of Political Economy*, Vol. 90, Pp. 777-793.
- Marshall,(1920), "Principles of Economics" Book IV. "The Agents of Production. Land, Labour, Capital and Organization", Ch X "Industrial Organization, Continued. The Concentration of Specialized Industries in Particular Localities".
- Maurel, F., and Sedillot, B. (1999), "A measure of the Geographic Concentration in French manufacturing Industries", *Regional Science and Urban Economics*, Vol. 29, Pp. 575-604.
- Michaely, M. (1962), "Concentration in International Trade", Contributions to Economic Analysis, Amsterdam, North Holland Publishing Company.
- Naude, C. (2006), "Measures of Manufacturing Industry Concentration- Implications for South Africa", October, 2006, Conference Paper, Development Policy Research Unit, South Africa.
- Saikia, D. (2011), "Unorganized manufacturing industries in India: A regional perspective", *African Journal of Marketing Management*, 3(8): 195-206.

- Singh, F.P. (2012), "Economic Reforms and Industrial Concentration in Indian Manufacturing Sector- An Inter-Temporal Analysis", *International Journal of Marketing, Financial Services & Management Research*, 1(7): 36-53.
- Stamer, M. (1998), "Interrelation between Subsidies, Structural Change and Economic Growth in Germany, A Vector Autoregressive Analysis", *Konjunkturpolitik*, 44(3): 231-253.
- Stoikov, V. (1966), "Some Determinants of the Level of Frictional Unemployment: A Comparative Study", *International Labour Review*, Vol. 93, Pp. 530-549.
- Venables, T (1996) Equilibrium locations of vertically linked industries. *International Economic Review*, 37(2): 341-360.
- Weber, Alfred (1929), "Theory of the location of industries", University of Chicago Press.

**Table 1: Measure of specialization based on Number of Factories data**

Index/ Region	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Jalpaiguri Division	0.717	0.709	0.712	0.638	0.615	0.613	0.975	0.944	0.931	0.895	0.877	0.896
Burdwan Division	0.384	0.401	0.386	0.403	0.4	0.416	0.497	0.501	0.449	0.568	0.417	0.487
Presidency Division	0.173	0.169	0.173	0.177	0.178	0.177	0.451	0.474	0.47	0.433	0.467	0.459

Source: Author's calculation

**Table 2: Measure of specialization based on Fixed Capital data**

Index/ Region	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Jalpaiguri Division	0.736	0.757	0.776	0.731	0.729	0.739	1.546	1.674	1.589	1.584	1.621	1.628
Burdwan Division	0.332	0.326	0.333	0.331	0.338	0.319	0.231	0.055	0.212	0.218	0.228	0.178
Presidency Division	0.211	0.216	0.225	0.225	0.233	0.222	0.638	0.64	0.508	0.69	0.946	0.901

Source: Author's calculation

**Table 3: Measure of specialization based on Employment data**

Index/ Region	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Jalpaiguri Division	0.617	0.614	0.603	0.623	0.480	0.485	1.321	1.35	1.379	1.377	1.101	1.326
Burdwan Division	0.314	0.312	0.316	0.313	0.286	0.284	0.268	0.282	0.377	0.41	0.275	0.462
Presidency Division	0.286	0.292	0.391	0.41	0.375	0.356	0.072	0.079	0.465	0.464	0.471	0.438

Source: Author's calculation

**Table 4: Measure of specialization based on Gross Value Added data**

Index/ Region	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Jalpaiguri Division	0.578	0.581	0.562	0.429	0.474	0.433	1.599	1.515	1.405	1.237	1.397	1.295
Burdwan Division	0.296	0.281	0.304	0.284	0.317	0.41	0.357	0.221	0.37	0.215	0.327	0.418
Presidency Division	0.286	0.283	0.274	0.269	0.252	0.214	0.698	0.659	0.522	0.598	0.475	0.66

Source: Author's calculation

**Table 5: Measure of speed of changes in specialization based on Employment data**

Index/ Region	Modified Lilien Index		Norm of Absolute Values	
	1997-2004	2005-2010	1997-2004	2005-2010
Jalpaiguri Division	0.059	0.056	0.060939	0.048
Burdwan Division	0.274	0.139	0.219342	0.124
Presidency Division	0.652	0.616	0.769977	0.737

**Table 6: Measure of concentration based on Number of Factories data**

Index/ Manufacturing Industry	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Food Products	0.359	0.37	0.363	0.366	0.366	0.365	0.247	0.249	0.201	0.258	0.262	0.264
Tobacco Products	0.583	0.589	0.556	0.501	0.555	0.511	0.291	0.342	0.305	0.464	0.355	0.352
Textile	0.705	0.701	0.692	0.745	0.627	0.706	1.469	1.497	1.509	1.515	1.459	1.556
Leather Products	0.989	0.991	0.98	0.983	0.987	0.995	1.807	1.844	1.855	1.791	1.912	1.898
Coke and Petroleum Products	0.457	0.482	0.453	0.515	0.501	0.488	0.272	0.215	0.368	0.244	0.41	0.375
Chemicals & Chemical Products	0.68	0.632	0.676	0.587	0.583	0.581	0.431	0.388	0.483	0.287	0.362	0.343
Basic Metal	0.675	0.638	0.598	0.561	0.552	0.539	0.415	0.389	0.331	0.242	0.279	0.263

Source: Author's calculation

**Table 7: Measure of concentration based on Fixed Capital data**

Index/ Manufacturing Industry	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Food Products	0.336	0.335	0.34	0.339	0.244	0.283	0.227	0.203	0.277	0.236	0.247	0.233
Tobacco Products	0.811	0.866	0.812	0.599	0.587	0.518	1.425	1.592	1.456	0.939	0.935	0.964
Textile	0.52	0.654	0.541	0.515	0.585	0.606	0.85	0.814	0.944	0.99	1.014	1.067
Leather Products	0.998	0.998	0.996	0.997	0.998	0.999	1.592	0.646	1.598	1.668	1.708	1.749
Coke and Petroleum Products	0.843	0.857	0.878	0.932	0.964	0.987	1.302	1.032	1.347	1.336	1.317	1.286
Chemicals & Chemical Products	0.852	0.762	0.778	0.871	0.932	0.865	1.311	1.028	1.223	1.269	1.283	1.154
Basic Metal	0.48	0.47	0.405	0.356	0.418	0.441	0.072	0.03	0.117	0.123	0.151	0.125

Source: Author's calculation

**Table 8: Measure of concentration based on Employment data**

Index/ Manufacturing Industry	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Food Products	0.531	0.527	0.373	0.345	0.359	0.357	0.283	0.269	0.266	0.286	0.156	0.166
Tobacco Products	0.562	0.582	0.46	0.401	0.415	0.428	0.195	0.282	0.261	0.152	0.126	0.118
Textile	0.686	0.702	0.557	0.56	0.568	0.573	0.101	0.11	0.184	0.198	0.138	0.101
Leather Products	0.999	0.999	0.996	0.997	0.987	0.999	0.98	0.971	1.025	1.027	0.816	0.989
Coke and Petroleum Products	0.574	0.481	0.461	0.613	0.752	0.762	1.169	1.217	0.907	0.762	1.25	0.965
Chemicals & Chemical Products	0.723	0.712	0.631	0.561	0.476	0.49	1.154	1.129	1.552	1.411	1.454	1.185
Basic Metal	0.593	0.589	0.575	0.569	0.545	0.583	0.897	0.808	0.852	0.862	0.845	0.848

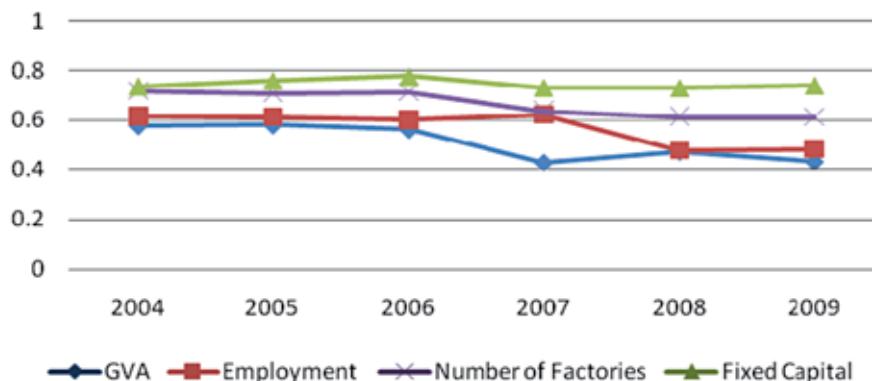
Source: Author's calculation

**Table 9: Measure of concentration based on Gross Value Added data**

Index/ Manufacturing Industry	Herfindahl Index						Krugman Dissimilarity Index					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
Food Products	0.366	0.37	0.336	0.386	0.343	0.352	0.251	0.161	0.152	0.254	0.222	0.168
Tobacco Products	0.786	0.897	0.862	0.501	0.435	0.439	1.3	1.509	1.184	1.385	1.102	1.073
Textile	0.515	0.567	0.529	0.534	0.555	0.552	0.59	0.529	0.544	0.819	0.734	0.737
Leather Products	1.000	0.998	0.999	0.997	0.999	0.999	1.794	1.545	1.282	1.513	1.371	1.386
Coke and Petroleum Products	0.756	0.764	0.789	0.879	0.883	0.912	0.404	1.129	1.485	1.411	0.556	1.699
Chemicals & Chemical Products	0.761	0.572	0.614	0.723	0.757	0.56	0.377	0.087	0.268	0.21	0.448	0.755
Basic Metal	0.713	0.584	0.634	0.682	0.585	0.706	1.304	0.64	0.903	0.944	0.855	1.441

Source: Author's calculation

**Fig 1: Showing Movement of Herfindahl Index of Specialization over the years 2004 to 2009 based on the selected characteristics in Jalpaiguri Division**



**Fig 2: showing the structure of Herfindahl Index of concentration based on GVA data for each of the selected industries over the years 2004 to 2009**

