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Central Statistics Office
Industrial Statistics Wing
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EDITORIAL

Statistics, in the words of Professor P.C. Mahalanobis, should have a purpose and the purpose is to reveal the truth i.e. to portray the true situation or picture of the prevailing state of affairs in the concerned sphere or domain. However, implicit in this characterization of Statistics is its potential to project the future state of affairs as also to explain what happened in the past. In fact, data made available through statistical exercises—in terms of censuses and sample surveys, followed by processing and dissemination of data collected — provide the most important input into planning for the future.

Planning for expanding the coverage and scope to cope with emerging needs for knowledge—keeping in mind the chain viz. data duly processed yield information and information duly processed yield knowledge—should be an important activity for any agency—public or private—engaged in the conduct of such censuses and surveys. This is very much true for Industrial Statistics in India and the concerned agencies.

Given the context of a chaotic situation in global business and industry, projection of the performance of any Indian industry or of an industrial unit in terms of even a deep analysis of its past and present performance has become pretty difficult. Further, industrial performance has become inextricably linked up with Technology and Innovation, which cannot be captured just in terms of an economic analysis of technical efficiency. This performance these days depend on the increasing concern for consumption of non-renewable natural resources and the corresponding regulatory mechanisms. Sustainability of performance has been made quite enigmatic because of some global reporting and monitoring systems becoming more or less mandatory.

It is easy to suggest that data on such aspects as influence sustainability of an industry should be collected and that we should remember that the word 'data' means 'whatever is (are) given' to analyse or/and assess a situation or phenomenon and, therefore, non-numerical data are also to be considered, the problem data collection from a diverse respondent community has often been enormous.

While much has been said about Research and Development efforts for ensuring a sustainable health of our Industry in exhortations by political leaders and

bureaucrats and even in frank admissions by industrial executives, there are no credible figures on Investment in R and D in our industries, particularly in the private sector. Apart from the amount, the big question relates to the components of expenditure. A somewhat detailed analysis of R&D expenditure in Indian industries was once carried out by the National Institute for Science, Technology and Development Studies (a wing of the Department of Science & Technology, Government of India) and the revelations are quite discouraging. The study shows that expenses on routine testing and inspection for incoming materials as also in-process and finished products along with expenses on maintenance and calibration of the equipments used for these purposes have been shown under 'Research & Development Expenditure' .

What is badly needed before any exercise to collect data on any new item is initiated is a broad-based discussion to come up with consensus and defensible operational definitions of the items –compatible with definitions adopted in industrially developed countries. That should be followed by efforts to convince the industries about the need for and utility of such information for formulating and implementing policies and plans to assess the performance of any sector of Industry and to work out regulatory measures as well as promotional initiatives.

The Industrial Statistics Wing of the Central Statistics Office should take up the initiative and we look forward to the outcome.

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Elasticity of Substitution between Capital and Labour Inputs in Manufacturing Industries of the Indian Economy

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Abstract

Elasticity of substitution among factors of production is an important parameter of manufacturing industries. Differences in the elasticity of substitution across the manufacturing industries have significant implications for tax policy. Elasticity of substitution is an important determinant of sustainability of growth rate as well as movements in factor income shares over time. Despite the importance of this parameter, in the last twenty years, there have been very few studies on the elasticities of substitution in manufacturing industries in India. A set of estimates of elasticity of substitution for different manufacturing industries would provide useful parameters for building computable general equilibrium (CGE) models for the Indian economy.

In this paper, the elasticity of substitution between capital and labour inputs is estimated for 22 manufacturing industries (2-digit, NIC-2004) of the Indian economy. The estimation is done on the basis of a constant elasticity of substitution (CES) production function, using annual time-series data for the period 1980-81 to 2007-08 from the Annual Survey of Industries, Central Statistical Office. The SURE method has been applied for estimation of elasticity of substitution based on the SMAC functions. The ARDL model has also been applied. This provides estimates of long-term elasticity of substitution. The results indicate that the elasticity of substitution is commonly less than one, with some variation across manufacturing industries of the Indian economy. There are indications of significant labour-saving technical change in most manufacturing industries.

1. Introduction

1.1 In developing countries, capital accumulation is often the prime source of economic growth. It not only affects the rate of output growth but also the labour productivity and thus determines the demand for labour. The relationship between capital and labour is a complex dynamic phenomenon. For simplicity of empirical purposes, in general, it is measured in terms of elasticity of substitution[2] between labour and capital. The capital-labor substitution elasticity is a key parameter in quantifying the welfare effects of policy shocks (Balistreri et al. 2003).

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[2] Elasticity of substitution measures the ease with which one factor can be substituted for another. The concept has relevance because various factors of production have alternative use (Arya, 1985)

1.2 The elasticity of substitution is relevant to a number of other problems as well, in both developed and developing countries (Morawetz, 1976). A higher elasticity of substitution between labor and capital may result in a higher level of labor productivity in the steady-state (Klump and de La Grandville, 2000). If the elasticity of substitution between factors of production is high, it implies that there prevails flexibility to adjust the factors of production in response to changes in factors' prices and/or growth in demand for products of the industry emanating from any external or internal reasons. The fast growing factor may be substituted for slow growing factor or the factor having higher productivity may be substituted for the factor having low productivity. Therefore, the estimate of factor substitution elasticity has wide applicability including their use in policy making, and a study of factor substitution elasticity is important.

1.3 In the CGE modeling, the value of elasticity of substitution is an important parameter. It may be applied for assessing the efficacy of policy changes that aims to use taxes, tariffs and price mechanism. To give an example, through a CGE study, Zuccollo (2011) has investigated the impact of tariffs reduction on economic growth by using elasticity of substitution between factors as parameters. An increase in the relative cost of labor makes the firm use relatively more capital than before, at any scale of production. Therefore, the elasticity of substitution between capital and labour may be applied to explain the capital accumulation as a growth driver for real unit labour costs (Lebrun and Perez, 2011).

1.4 There have been a number of studies on the elasticity of substitution since introduction of the concept by Hicks in 1932. The wide range of estimates found in the literature spanning several decades reveals a lack of consensus concerning the magnitude of the capital-labor substitution elasticity (Balistreri et al., 2003). The variation in the estimates of the capital-labour substitution mainly depends on the type of capital data used (i.e. aggregate, panel, etc), and the type of production function used (i.e. Constant Elasticity of Substitution (CES), Translog, etc). The estimates of elasticities of substitution may differ considerably across different countries and in the same country during different time periods (Morawetz, 1976). Therefore, the purpose and the nature of study on the elasticity becomes a very relevant issue.

1.5 There have been some multi-country or cross-country studies on the elasticity of substitution between capital and labour in which India is included. Mallick (2007), for instance, has estimated the elasticity of substitution at the aggregate economy level separately for different countries for the period 1950 to mid-1990s by employing a normalized CES production function. The estimates of elasticity of substitution obtained in Mallick's study for some major developing countries are as follows: 0.515 for India, 0.548 for China, 0.112 for Argentina, 0.126 for Brazil, 0.087 for Mexico, 0.197 for Thailand, 0.075 for Philippines, 1.139 for Indonesia and 1.522 for Malaysia. The estimates suggest that the elasticity of substitution between capital and labour at the aggregate economy level is generally low among developing countries.

1.6 Inter-industry variation in the elasticity of substitution has been less attended by researchers. In a survey five CGE studies, Chirinko (2002) observes that all have assumed one common elasticity of substitution for the entire economy. In a two-country model,

Roeger et al. (2002) considers same elasticity of substitution for both countries. However, there are studies in which differences across sectors have been considered. In a CGE study with 19 industries, Fullerton and Rogers (1993) has taken different elasticity of substitution for each industry.

1.7 For examining differences in elasticity of substitution across the US industry-level, Caballero et al. (1995) have estimated elasticity of substitutions for 2-digit SIC manufacturing industries using plant-level data from 1972 to 1988. The range of the estimated elasticity of substitutions is 0.01 to 2.00. Balisteri et al. (2003) have estimated elasticity of substitution for 28 US industries using data from 1947 to 1999. Their framework does not capture bias in technical change. Young (2013) has estimated the elasticity of substitution separately for 35 industries (2-digit SIC) from 1960 to 2005. He has observed considerable variation in the elasticity of substitution across industries but the values are uniformly less than unity.

2. Earlier Estimates of Capital-Labour Substitution Elasticity in Indian Industries

2.1 Estimates of the elasticity of substitution between labour and capital in Indian industries are available in a number of studies (e.g., Benerjee, 1971, 1973; Narasimhan and Fabrycy, 1974; Bhasin and Seth,1980; Goldar, 1986; Dhananjayan & Muthulakshmi, 1989; Ahluwalia, 1991; Chadha, et al., 1996; Upender, 2009; Virmani and Hashim, 2009).

2.2 Banerjee (1971) observed that the elasticity of substitution between labour and capital in the manufacturing sector in the period 1946 -1964 was not significantly different from unity. The estimates thus indicated sufficient capital-labour substitution possibilities existing in Indian manufacturing during the above mentioned period. In another study on five selected Indian industries (viz. Cotton Textile, Jute Textile, Sugar, Paper and Bicycle), Banerjee (1973) has found that the elasticity of substitution between capital and labour in these industries is significantly different from one. Similarly, in a study on estimation of production functions for Indian manufacturing industries for the period 1950-1965, Bhasin and Seth (1980) observed that the CES production function is a more appropriate specification than the Cobb-Douglas production function in most of the industries[3] since the estimate of the elasticity of substitution is often less than one.

2.3 Dhananjayan and Muthulakshmi (1989) have shown for three-digit non-traditional products manufacturing industries for a period 1973-74 to 1979-80 that there exists a significant variation in the elasticity of substitution across the industries. The numerical value of the elasticities of substitution in majority of industries at disaggregate levels has been observed to be greater than zero but less than one. In a study of 28 manufacturing industries, Gujrati (1966) has observed that the elasticity of substitution between capital and labour at aggregate level is one for the year 1958. On the basis of a cross section data for 26 major Indian industries for the year 2004-05, Upender (2009) has observed a positive and more than unity elasticity of substitution between capital and labour.

[3] This observation is based on the explanatory power of the model reflected in the value of R^2.

2.4 For entire manufacturing sector, Narasimhan & Fabrycy (1974) have observed the elasticity of substitution to be 0.78 for the CES model. Diwan & Gujrati (1968) has also found that the substitution between labour and capital is close to one, based on CES production function for a period 1946-58. Sanker (1970) and Kazi (1976) have also obtained similar estimates.

2.5 Goldar (1986) found the elasticity of substitution in Indian manufacturing to be about 0.7, less than unity. The estimates of Ahluwalia (1991) are, however, closer to unity. The estimates are about 0.9. The estimate of elasticity of substitution in Indian manufacturing made by Virmani and Hashi (2009) is about 0.64. This estimate again indicates that the elasticity of substitution in Indian manufacturing is less than one. Indeed, a number of studies undertaken in the past suggest that the elasticity of substitution between capital and labour in Indian industries is less than one.

2.6 The studies on elasticities of substitution pertaining to Indian industries clearly indicate that there exists variation in the magnitude of the elasticity across the industries. The reasons of this variation may be many but it also points towards the dynamic structure of the relationship between factors of production in Indian industries. Therefore, it is pertinent to have fresh estimates for the elasticity of substitution between capital and labour in manufacturing industries of India.

3. Objective of the Study

3.1 The object of this study is to estimate the elasticity of substitution between capital and labour input for manufacturing industries of the Indian economy. The estimates of the elasticity of substitution estimation have been obtained by estimating a constant elasticity of substitution (CES) production function from annual time series data for the period 1980-81 to 2007-08. The estimation of the elasticity has been done for 22 manufacturing industries of the Indian Economy shown in Table 1.

4. Data and Methodology

4.0 As stated above, the estimates of the elasticity of substitution between capital and labour input in Indian manufacturing industries have been obtained by estimating the parameters of a CES production function from annual time series data for the period 1980-81 to 2007-08. Further details on data and methodology are provided below.

4.1 Data and variables

4.1.1 The main source of data for the study is the *Annual Survey of Industries* brought out by the Central Statistical Office (CSO), Government of India. Number of employees is taken as the measure of labour input (L). Net fixed capital stock at constant prices is taken as the measure of capital input (K). Deflated gross value added has been taken as the measure of output (Y).[4] Trend growth rates in output, labour and capital in the 22 industries covered in the study are shown in Table 2.

[4] Some details of output and capital measurement are provided in Goldar (2012).

4.2 Production Function Specification: CES Production Function

4.2.1 The specification of production function plays a significant role in the empirical studies aimed to understand the growth processes and contribution of factors of production. If constant-returns-to-scale is assumed, an increase in wages may result in an appropriate adjustment of labour relative to capital. The extent of adjustment depends upon the elasticity of substitution between the labour and capital.

4.2.2 There are a range of possible forms of the production function, with each form possessing different mathematical properties and implications. The Cobb-Douglas production function assumes that the elasticity of substitution between capital and labour inputs is one, which implies that a unit increase in the ratio of wages to rental prices is followed by a unit increase in the capital-to-labour ratio. In the Leontief production function, it is assumed that there is no substitution possibility between factors of production. These two production functions are the specific cases of the constant elasticity of substitution production functions in which the elasticity of substitution is constant and varies between zero and infinity.

4.2.3 The assumption of unit elasticity of substitution underlying the Cobb-Douglas production function has been widely rejected by researchers (Chirinko, 2008, p. 683). Researchers have tried to find out whether the elasticity of substitution between capital and labour is greater or less than one. The variation in the value of the elasticity of substitution between capital and labour from unity may have important policy implications. A high elasticity of substitution between capital and labour may give rise to potential gains from tax reforms (Chirinko, 2002). If the elasticity of substitution between capital and labour differs significantly across industries then certain tax policy may lead to distorted inter-industry patterns of capital accumulation (Young, 2013).

4.2.4 In the initial phase of studies on production function, the Cobb-Douglas production was widely applied but subsequently the Constant Elasticity of Substitution production function has found preference among researchers due to its flexibility. Empirically, it has been observed that elasticity of substitution may not be one in the real world. Raval (2011) has observed no supporting evidence for the Cobb- Douglas production function in US manufacturing firms. Chirinko et al. (2004) have estimated the elasticity to be 0.4 rather than unity. Barnes et al. (2008) have also observed that, in the UK, the estimated elasticity is approximately 0.4 using firm-level data. Lebrun and Perez (2011) have found that the elasticity is approximately 0.7. Upender (2009) has shown the strong evidence in favour of the CES formulation in a study of Indian industries.

4.2.5 Therefore, in the present study CES production function has been used. The mathematical expression of CES production function is

$$Y = Ae^{\lambda t}[\delta K^{-\rho} + (1-\delta)L^{-\rho}]^{\frac{-\nu}{\rho}} \quad \ldots (1)$$

where Y, K, L and t represent output, capital, labour and time respectively and A, λ, δ, ρ and ν are parameters. The return to scale parameter is ν and the elasticity of substitution parameter σ is related to ρ by the equation: $\sigma = [1/(1+\rho)]$.

4.2.6 Under the assumption of constant return to scale and perfect competition, one can derive the following two equations which are based on the marginal productivity conditions.

$$\log\left(\frac{Y}{L}\right) = \sigma \log[A^{\rho}(1-\delta)^{-1}v^{-1}] + \sigma log W + (\sigma\rho\lambda)t \qquad \ldots (2)$$

$$\log\left(\frac{Y}{K}\right) = \sigma \log[A^{\rho}(\delta)^{-1}v^{-1}] + \sigma log R + (\sigma\rho\lambda)t \qquad \ldots (3)$$

In these equations, W and R represent Real Product Wage Rate and Real Product Rental Rate respectively. These equations will hereafter be called the SMAC functions. The two equations can be estimated jointly by using the SURE method.

4.2.7 The discussion on methodology above has not considered two issues. There are (a) non-neutral technical change, and (b) non-stationarity of time series. To address the first issue, a factor augmentation form of the CES production function is considered. This gives rise to equations similar to (2) and (3) above except that the coefficients of time in the two equation are not equal. Under the assumption of constant returns to scale, the equations to be estimated are obtained as:

$$\log\left(\frac{Y}{L}\right) = \sigma \log[A^{\rho}(1-\delta)^{-1}v^{-1}] + \sigma log W + (\sigma\rho\lambda_L)t \qquad \ldots (4)$$

$$\log\left(\frac{Y}{K}\right) = \sigma \log[A^{\rho}(\delta)^{-1}v^{-1}] + \sigma log R + (\sigma\rho\lambda_K)t \qquad \ldots (5)$$

4.2.8 In these equations, λ_L and λ_K are the rates of labour augmenting and capital augmenting technical change. Thus, an alternate set of estimates of the elasticity of substitution has been obtained by estimating equations (4) and (5) by the SURE method, imposing the constraint that the coefficient of log (W) in equation (4) is equal to the coefficient of log (R) in equation (5), but not imposing any restriction on the coefficients of the time variable. Given the estimate of the estimated coefficients of equations (4) and (5), the rates of labour augmenting and capital augmenting technical change can be obtained.

4.2.9 As regards the issue of non-stationarity, Dickey-Fuller test and Augmented Dickey-Fuller test have been done to ascertain the order of integration of the time series on log(Y/L), log(W), log(Y/K) and log(R). Then, equations (4) and (5) have been estimated separately by applying the Auto-regressive distributed lag (ARDL) model. The estimated models give an estimate of the long run coefficients. Also, this approach makes it possible to test for co-integration.

4.2.10 The Dickey-Fuller and Augmented Dickey-Fuller test results for each of the 22 industries are presented in the Annex. The results are not discussed in detail in the paper. Suffice it to note that, in general, the test results indicate that the four series, log(Y/L), log(W), log(Y/K) and log(R), are integrate of order one, i.e. the series are I(1). Accordingly, one would be justified in applying the ARDL model to equations (4) and (5) for estimation of parameters.

5. Results: Estimates of Elasticity of Substitution

5.1 Estimates of elasticity of substitution between capital and labour input in various two-digit manufacturing industries are presented in Table 3. These estimates are based on the SMAC functions. The standard errors of the estimates are also shown in the table. The coefficients of *t* in the equations (4) and (5) may be restricted to be the same in the regression by SURE method.

5.2 Two alternate estimates of the elasticity of substitution have been shown in Table 3. Column (3) represents the estimate of the elasticity of substitution based on the regression which restricts the variation the coefficients of *t* while column (4) represents the estimate of the elasticity of substitution based on the regression which allows variation in the coefficients of *t*. Both types of estimates of elasticity of substitution are positive and mostly in the range of 0.5 to one. These findings are broadly consistent with findings in earlier studies (e.g. Bhasin and Seth, 1980; Narasimhan & Fabrycy, 1974; Diwan & Gujrati, 1968). The values in column (3) are higher than that of column (4) except for tobacco products and other transport equipment. The elasticity of substitution for 'other transport equipment' industry has been observed negative (i.e. -0.05) by the SURE method which restricts the variation in the coefficients of *t*.

5.3 The finding that there are significant variation in the elasticity of substitution between capital and labour across industries is similar to findings of Banerjee (1973), Bhasin & Seth (1980) and Dhananjayan and Muthulakshmi (1989). Drawing on the results of column (4) which is based on a more general model, the range of the value of elasticity of substitution between capital and labour is 0.54 to 0.97. Less than unitary elasticity of substitution estimates indicate that there is relatively low possibility of substitution labour and capital in Indian manufacturing industries. Lowest substitution possibilities has been observed in the industries of leather and basic metals (0.54 and 0.56 respectively) while highest substitution possibilities has been found in industries of wood, food and printing (0.97, 0.94, and 0.93 respectively).

5.4 Table 4 shows the trend of labour augmenting and capital augmenting technical change in the different manufacturing industries. It clearly indicates that in all manufacturing industries the labour augmenting technical change rate is positive while capital augmenting technical change rate is negative except in certain cases. It implies that manufacturing industries in India are adopting, in general, labour saving technological change. A similar result has been observed by Virmani and Hashim (2009) in their study on manufacturing industries in India during 1973-74 to 2000-01.

5.5 Table 5 presents the short run and long run estimates of elasticity of substitution between capital and labour in manufacturing industries in India. The long-run elasticity estimates are based on the ARDL model. In the cases where long run estimates of the elasticity of substitution between capital and labour could be obtained, it is observed that though the long run and short run elasticity estimates differ from industry to industry, the short and long run elastsicities are close to one another in many cases.

5.6 Considering the estimates presented in Tables 3 and 5, it is observed that the estimates of elasticity of substitution between capital and labour in manufacturing industries in India are often not equal to one. In many cases, the estimated elasticity is less than one. Therefore, the findings indicate that the production structure in Indian manufacturing industries follow the CES production function rather than the Cobb-Douglas production function. Virmani and Hashim (2009) have also come up with similar finding for Indian manufacturing industries.

6. Conclusion

6.1 The estimation of elasticity of substitution between input factors in an industry has many applications for policy analysis and research. In the present endeavour, the elasticity of substitution between capital and labour input for 22 manufacturing industries has been estimated on the basis of constant elasticity of substitution production function (i.e. SMAC function) by SURE and ARDL regression methods. In a majority of Indian manufacturing industries, the elasticity of substitution between capital and labour is less than one which implies that the possibility of substitution is relatively low in these industries. There is variation in the elasticity of substation between capital and labour across different manufacturing industries. It indicates that different tax policies may be applied for different manufacturing industries. In general, manufacturing industries has been found to adopt labour saving technological change. The long run and short run estimates are different for different industries but the both are close to one another is many cases.

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Table 1: Description of Industries covered in the study

Sl. No.	Industry Code (2-digit, NIC -2004)	Description of Industries
1	15	Manufacture of food products and beverages
2	16	Manufacture of tobacco products
3	17	Manufacture of textiles
4	18	Manufacture of wearing apparel; dressing and dyeing of fur
5	19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
6	20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plating materials
7	21	Manufacture of paper and paper products
8	22	Publishing, printing and reproduction of recorded media
9	23	Manufacture of coke, refined petroleum products and nuclear fuel
10	24	Manufacture of chemicals and chemical products
11	25	Manufacture of rubber and plastics products
12	26	Manufacture of other non-metallic mineral products
13	27	Manufacture of basic metals
14	28	Manufacture of fabricated metal products, except machinery and equipment
15	29	Manufacture of machinery and equipment n.e.c.
16	30	Manufacture of office, accounting and computing machinery
17	31	Manufacture of electrical machinery and apparatus n.e.c.
18	32	Manufacture of radio, television and communication equipment and apparatus
19	33	Manufacture of medical, precision and optical instruments, watches and clocks
20	34	Manufacture of motor vehicles, trailers and semi-trailers
21	35	Manufacture of other transport equipment
22	36	Manufacture of furniture; manufacturing n.e.c.

Table 2: Trend growth rates in output, capital stock and labour input, Manufacturing Industries of the Indian economy, 1980-81 to 2007-08

Industry Code (2-digit, NIC -2004)	Trend growth rate (% p.a.)			Industry Code (2-digit, NIC -2004)	Trend growth rate (% p.a.)		
	Output	Labour Input	Capital Stock		Output	Labour Input	Capital Stock
15	6.63	0.86	6.32	26	7.89	1.41	7.54
16	5.71	1.26	6.47	27	6.87	0.17	5.28
17	5.75	-0.11	6.24	28	7.61	2.6	6.35
18	13.6	10.03	14.84	29	5.08	0.26	4.59
19	6.79	3.65	7.26	30	11.81	-1.39	8.48
20	0.11	-1.23	4.52	31	7.81	1.48	4.99
21	5.47	1.78	5.1	32	14.89	1.78	9.9
22	1.73	-1.05	5.68	33	9.71	2.37	6.05
23	9.99	2.4	9.93	34	9.26	3.01	8.78
24	8.18	2.32	6.04	35	6.33	-2.25	2.76
25	9.8	4.13	8.96	36	12.53	5.9	9.04

Source: Authors' computations

Table 3: Estimation of Elasticity of Substitution by SMAC Function

Industry Code (2-digit)	Description of Industries	Elasticity of Substitution (Std. Err.; P>|t|)	
		Variation in coefficients of t restricted	Variation in coefficients of t allowed
(1)	(2)	(3)	(4)
15	Manufacture of food products and beverages	1.09 (0.04; 0.00)	0.94 (0.01; 0.00)
16	Manufacture of tobacco products	0.63 (0.14; 0.00)	0.64 (0.04; 0.00)
17	Manufacture of textiles	1.02 (0.07; 0.00)	0.64 (0.06; 0.00)
18	Manufacture of wearing apparel; dressing and dyeing of fur	0.77 (0.02; 0.00)	0.66 (0.02; 0.00)
19	Tanning and dressing of leather; manufacture of luggage, handbags, addler, harness and footwear	0.94 (0.06; 0.00)	0.56 (0.07; 0.00)
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plating materials	1.02 (0.01; 0.00)	0.97 (0.02; 0.00)
21	Manufacture of paper and paper products	1.00 (0.06; 0.00)	0.73 (0.03; 0.00)
22	Publishing, printing and reproduction of recorded media	1.02 (0.06; 0.00)	0.93 (0.04; 0.00)
23	Manufacture of coke, refined petroleum products and nuclear fuel	1.05 (0.07; 0.00)	0.84 (0.02; 0.00)
24	Manufacture of chemicals and chemical products	1.10 (0.07; 0.00)	0.88 (0.03; 0.00)
25	Manufacture of rubber and plastics products	1.15 (0.03; 0.00)	0.80 (0.03; 0.00)
26	Manufacture of other non-metallic mineral products	1.33 (0.05; 0.00)	0.81 (0.04; 0.00)
27	Manufacture of basic metals	0.91 (0.16; 0.00)	0.54 (0.05; 0.00)
28	Manufacture of fabricated metal products, except machinery and equipment	1.09 (0.03; 0.00)	0.81 (0.05; 0.00)
29	Manufacture of machinery and equipment n.e.c.	1.13 (0.03; 0.00)	0.87 (0.03; 0.00)
30	Manufacture of office, accounting and computing machinery	1.25 (0.07; 0.00)	0.73 (0.05; 0.00)
31	Manufacture of electrical machinery and apparatus n.e.c.	1.04 (0.08; 0.00)	0.73 (0.03; 0.00)
32	Manufacture of radio, television and communication equipment and apparatus	0.99 (0.04; 0.00)	0.82 (0.05; 0.00)
33	Manufacture of medical, precision and optical instruments, watches and clocks	0.79 (0.02; 0.00)	0.74 (0.02; 0.00)
34	Manufacture of motor vehicles, trailers and semi-trailers	1.19 (0.03; 0.00)	0.86 (0.02; 0.00)
35	Manufacture of other transport equipment	-0.05 (0.16; 0.75)	0.71 (0.06; 0.00)
36	Manufacture of furniture; manufacturing n.e.c.	0.96 (0.03; 0.00)	0.87 (0.01; 0.00)

Source: Authors' computations

Note: For estimation, the SURE technique has been applied to equations (4) and (5)

Table 4: Rate of Technical Change

Industry Code (2-digit)	Description of Industries	Rate of Technical Change	
		Labour Augmenting (λ_L)	Capital Augmenting (λ_K)
(1)	(2)	(3)	(4)
15	Manufacture of food products and beverages	0.30	-0.11
16	Manufacture of tobacco products	0.13	-0.04
17	Manufacture of textiles	0.10	-0.04
18	Manufacture of wearing apparel; dressing and dyeing of fur	0.03	-0.01
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.04	-0.02
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plating materials	0.30	-0.22
21	Manufacture of paper and paper products	0.08	-0.02
22	Publishing, printing and reproduction of recorded media	0.37	-0.31
23	Manufacture of coke, refined petroleum products and nuclear fuel	0.33	-0.03
24	Manufacture of chemicals and chemical products	0.26	-0.04
25	Manufacture of rubber and plastics products	0.10	-0.01
26	Manufacture of other non-metallic mineral products	0.19	-0.04
27	Manufacture of basic metals	0.11	0.00
28	Manufacture of fabricated metal products, except machinery and equipment	0.11	-0.02
29	Manufacture of machinery and equipment n.e.c	0.13	-0.04
30	Manufacture of office, accounting and computing machinery	0.23	-0.01
31	Manufacture of electrical machinery and apparatus n.e.c.	0.12	0.00
32	Manufacture of radio, television and communication equipment and apparatus	0.24	-0.01
33	Manufacture of medical, precision and optical instruments, watches and clocks	0.06	0.04
34	Manufacture of motor vehicles, trailers and semi-trailers	0.21	-0.06
35	Manufacture of other transport equipment	0.20	-0.06
36	Manufacture of furniture; manufacturing n.e.c.	0.18	-0.03

Source: Authors' computations

Note: The estimates of λ_L and λ_K have been derived from estimates of equations (4) and (5).

Table 5: Estimates of Elasticity of Substitution, Alternate set of estimates

Industry	SMAC Functions allowing for non-neutral technical change	Eq. (4) by ARDL model		Eq(5) by ARDL model	
	Elasticity of Substitution (Std. Err.)	Elasticity of Substitution (Std. Err.)	Max. lag taken in the Model [F-stat for existence of long-run relationship]	Elasticity of Substitution (Std. Err.)	Max. lag taken in the Model [F-stat for existence of long-run relationship]
15	0.94 (0.01)	0.86(0.38)	2[10.08]@$	0.78(0.03)	1[10.11]@$
16	0.64 (0.04)	0.90(0.18)	3[38.18]@$	0.84(0.05)	3[231.22]@$
17	0.64 (0.06)	0.51(0.20)	1*	—	—
18	0.66 (0.02)	1.32(2.69)	1[1.28]##$$	0.61(0.08)	1[1.66]##$$
19	0.56 (0.07)	—	—	—	—
20	0.97 (0.02)	0.97(0.12)	1*	0.88(0.10)	1[2.26]##$$
21	0.73 (0.03)	0.83(0.44)	1[8.37]@$	0.78(0.11)	1[2.74]##$
22	0.93 (0.04)	0.62(0.16)	1*	0.84(0.09)	3[6.95]#$
23	0.84 (0.02)	0.07(0.66)	2[3.57]##$	0.93(0.02)	1[11.25]@$
24	0.88 (0.03)	0.67(0.70)	1[2.82]##$	0.62(0.07)	4[9.20]@$
25	0.80 (0.03)	1.66(0.45)	2[8.07]#$	0.89(0.11)	1[6.97]@@#
26	0.81 (0.04)	0.40(0.26)	1*	0.85(0.10)	1[2.33]##$
27	0.54 (0.05)	0.10(0.30)	1[7.13]@@$	0.69(0.14)	1[2.89]##$
28	0.81 (0.05)	0.39(0.25)	1[3.82]##$	0.83(0.23)	1[0.99]##$$
29	0.87 (0.03)	0.55(0.31)	2[4.85]##$	1.34(0.35)	4[9.09]@$$
30	0.73 (0.05)	0.00(0.30)	1*	0.77(0.18)	1[1.64]##$$
31	0.73 (0.03)	0.06(0.27)	2[7.39]@@$	0.57(0.08)	4[6.68]#$
32	0.82 (0.05)	0.59(0.09)	1*	1.04(0.36)	1[0.89]##$$
33	0.74 (0.02)	0.19(1.38)	4[1.07]##$$	0.80(0.04)	3[7.25]@@$
34	0.86 (0.02)	0.63(0.52)	3[9.88]@$	0.85(0.04)	2[3.87]##$
35	0.71 (0.06)	2.47(0.73)	4[4.38]##$	0.61(0.18)	4[5.79]##$
36	0.87 (0.01)	1.40(0.25)	1*	0.76(0.02)	1*

Source: Authors' computations

Note: SMAC function: Equations (4) and (5) jointly estimated by SURE method. Variation in coefficients of t is allowed.

@ F-statistics exceeds upper bound at 95% level of confidence.

@@ F-statistics exceeds upper bound at 90% level of confidence.

F-statistics between upper and lower bound at 90% level of confidence.

F-statistics is below lower bound at 90% level of confidence.

$ ECM term in the error correction model is negative and statistically significant.

$$ ECM term in the error correction model is negative but not statistically significant.

— Results unsatisfactory, hence not reported.

*The error correction does not exist

Appendix

ADF Test: Manufacturing Industries

Table A1: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 15

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-4.06* -3.20*	-3.56* -1.68	-0.94 -0.66	-0.88 -0.71
	First difference	-4.04* -2.90*	-4.18* -3.97*	-4.91* -3.99*	-4.93* -3.67*
An intercept but not a trend	Level	-2.57 -2.38	-3.87* -2.71	-3.72* -3.92*	-3.92* -3.97*
	First difference	-4.65* -3.40*	-4.66* -4.65*	-4.77* -3.85*	-4.85* -3.60*
An intercept and a linear trend	Level	-4.62* -4.59*	-6.59* -6.46*	-4.03* -4.11*	-3.72* -3.79*
	First difference	-4.63* -3.30	-4.12* -4.10*	-4.67* -3.66*	-4.77* -3.48

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A2: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 16

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-1.87 -2.16*	-0.42 -0.56	-3.04* -2.57*	-0.60 -0.45
	First difference	-6.87* -5.02*	-12.94* -7.55*	-6.44* -5.23*	-5.84* -5.83*
An intercept but not a trend	Level	-2.18 -1.65	-4.80* -3.20*	-3.34* -2.93	-5.03* -3.16*
	First difference	-7.45* -6.05*	-12.65* -7.32*	-6.31* -5.11*	-5.69* -5.68*
An intercept and a linear trend	Level	-4.61* -3.85*	-5.48* -3.80*	-4.39* -3.98*	-5.59* -3.72*
	First difference	-7.45* -6.11*	-12.41* -7.02*	-6.32* -5.27*	-5.55* -5.60*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A3: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 17

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-1.96* -2.14*	-2.44* -3.15*	-0.26 -0.20	-0.57 -0.63
	First difference	-5.27* -3.61*	-4.43* -2.19*	-6.30* -6.80*	-6.43* -6.86*
An intercept but not a trend	Level	-7.30* -7.15*	-5.87* -3.19*	-6.18* -6.66*	-6.49* -7.14*
	First difference	-4.65* -3.40*	-4.66* -4.65*	-4.77* -3.85*	-4.85* -3.60*
An intercept and a linear trend	Level	-4.34* -3.60*	-3.04 -2.27	-2.78 -2.59	-3.59 -3.61*
	First difference	-7.20* -7.06*	-5.68* -3.12	-6.05* -6.60*	-6.33* -6.92*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A4: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 18

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-2.34* -2.28*	-2.74* -2.23*	-0.67 -0.68	-0.06 -0.06
	First difference	-4.75* -2.80*	-3.67* -2.57*	-4.78* -2.92*	-5.31* -2.93*
An intercept but not a trend	Level	-2.15 -2.11	-0.29 -0.35	-1.28 -1.33	-1.23 -1.16
	First difference	-4.88* -2.93	-4.40* -3.45*	-4.68* -2.86	-5.20* -2.87
An intercept and a linear trend	Level	-1.59 -1.50	-2.38 -3.08	-1.84 -1.81	-1.74 -1.62
	First difference	-5.11* -3.10	-4.34* -3.36	-4.71* -2.81	-5.43* -2.95

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A5: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 19

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-2.06* -2.32*	-1.58 -1.66	-0.57- 0.56	-0.41 -0.59
	First difference	-8.04* -6.12*	-5.12* -4.23*	-6.92* -5.66*	-7.96* -6.33*
An intercept but not a trend	Level	-2.67 -2.02	-0.62 -0.44	-3.54* -2.87	-5.22* -4.03*
	First difference	-8.26* -6.92*	-5.47* -4.90*	-6.78* -5.56*	-7.84* -6.28*
An intercept and a linear trend	Level	-5.15* -3.66*	-2.19 -2.08	-3.92* -3.42	-5.13* -3.95*
	First difference	-8.15* -7.02*	-5.46* -4.88*	-6.66* -5.43*	-7.68* -6.19*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A6: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 20

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-1.38 -1.20	-067 -0.72	-0.16 0.27	0.10 0.44
	First difference	-7.31* -5.60*	-5.54* -3.67*	-6.83* -4.76*	-7.56* -5.44*
An intercept but not a trend	Level	-3.25* -2.31	-1.91 -1.73	-1.78 -1.24	-2.32 -1.48
	First difference	-7.25* -5.67*	-5.49* -3.65*	-6.76* -4.77*	-7.43* -5.38*
An intercept and a linear trend	Level	-3.53 -2.58	-1.91 -1.73	-2.77 -2.01	-3.45 -2.37
	First difference	-7.09* -5.54*	-5.38* -3.60*	-6.60* -4.67*	-7.25* -5.26*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A7: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 21

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-0.97 -0.69	-0.86 -0.74	-0.31 -0.28	-0.31 -0.34
	First difference	-6.31* -4.94*	-3.85* -2.87*	-7.14* -5.38*	-7.42* -5.80*
An intercept but not a trend	Level	-1.34 -1.04	-1.00 -1.07	-3.10* -2.55	-2.94* -2.42
	First difference	-6.69* -5.63*	-3.94* -3.05*	-7.05* -5.34*	-7.41* -5.85*
An intercept and a linear trend	Level	-3.62 -3.54	-1.91 -2.13	-3.27 -2.70	-3.61 -3.16
	First difference	-6.57* -5.43*	-3.75* -2.76	-6.85* -5.17*	-5.65* -5.65*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A8: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 22

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-0.20 0.33	-0.30 -0.35	0.60 0.69	0.13 0.24
	First difference	-6.32* -3.52*	-5.38* -3.56*	-5.07* -3.11*	-7.03* -4.51*
An intercept but not a trend	Level	-0.47 0.10	-2.59 -2.46	-1.35 -1.24	-2.31 -1.68
	First difference	-6.73* -3.96*	-5.28* -3.51*	-5.18* -3.24*	-6.92* -4.45*
An intercept and a linear trend	Level	-2.74 -1.88	-2.44 -2.30	-1.78 -1.68	-2.81 -2.08
	First difference	-6.82* -4.07*	-5.26* -3.49	-5.14* -3.20	-6.81* -4.38

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A9: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 23

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	0.63 0.82	-1.01 -0.97	-0.81 -0.74	-0.46 -0.46
	First difference	-5.47* -4.03*	-4.90* -4.07*	-5.64* -4.37*	-5.74* -4.51*
An intercept but not a trend	Level	-1.33 -1.13	-2.15 -2.13	-2.28 -2.10	-2.41 -2.20
	First difference	-5.77* -4.47*	-5.02* -4.24*	-5.53* -4.28*	-5.64* -4.43*
An intercept and a linear trend	Level	-2.71 -2.57	-1.15 -1.12	-2.23 -2.05	-2.36 -2.15
	First difference	-5.65* -4.36*	-6.05* -5.68*	-5.40* -4.18*	-5.51* -4.32*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A10: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 24

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	1.69 1.35	-3.95* -3.36*	-1.62 -1.65	-1.51 -1.55
	First difference	-4.17* -3.32*	-3.75* -2.07*	-5.13* -4.53*	-5.15* -4.45*
An intercept but not a trend	Level	-1.40 -1.44	-1.83 -1.90	-2.45 -2.39	-2.10 -2.05
	First difference	-5.43* -5.44*	-5.34* -3.17*	-5.32* -4.99*	-5.39* -4.97*
An intercept and a linear trend	Level	-2.45 -2.27	-3.31 -3.15	-2.80 -2.69	-2.53 -2.40
	First difference	-5.47* -5.75*	-5.39* -3.22	-5.27* -5.12*	-5.36* -5.10*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A11: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 25

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-0.40 -0.27	-4.63* -5.01*	-1.13 -1.57	-1.03 -1.57
	First difference	-5.95* -2.10*	-3.91* -2.21*	-9.36* -3.01*	-9.27* -3.17*
An intercept but not a trend	Level	-1.90 -2.42	-0.86 -0.52	-4.50* -3.15*	-4.99* -4.30*
	First difference	-7.97* -3.07*	-7.00* -5.00*	-9.45* -3.07*	-9.38* -3.21*
An intercept and a linear trend	Level	-3.99* -2.39	-3.29 -2.65	-4.84* -3.13	-5.58* -4.13*
	First difference	-8.12* -3.12	-6.92* -4.87*	-9.16* -2.87	-9.14* -2.90

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A12: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 26

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-1.03 -1.01	-2.24* -2.19*	-0.85 -0.95	-1.01 -1.18
	First difference	-4.72* -3.13*	-4.36* -2.78*	-6.54* -3.25*	-6.25* -3.42*
An intercept but not a trend	Level	-0.76 -0.68	-1.24 -1.21	-1.96 -1.32	-2.06 -1.63
	First difference	-5.80* -4.63*	-5.01* -3.42*	-6.49* -3.25*	-6.28* -3.50*
An intercept and a linear trend	Level	-3.70* -3.62*	-1.66 -1.67	-1.90 -1.17	-2.41 -2.04
	First difference	-5.64* -4.46*	-5.03* -3.48	-6.76* -3.44	-6.34* -3.50

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A13: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 27

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	1.21 1.69	-1.23 -1.26	-0.76 -0.94	-0.75 -1.06
	First difference	-5.64* -3.06*	-4.93* -2.91*	-7.26* -3.51*	-7.33* -3.56*
An intercept but not a trend	Level	-0.17 0.18	-1.27 -1.19	-1.79 -0.76	-1.48 -0.52
	First difference	-6.65* -4.06*	-5.05* -3.04*	-7.29* -3.58*	-7.43* -3.70*
An intercept and a linear trend	Level	-4.03* -3.37	-1.92 -1.87	-3.13 -2.03	-3.66 -2.53
	First difference	-6.60* -4.07*	-4.91* -2.96	-7.37* -3.69*	-7.44* -3.76*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A14: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 28

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	0.52 0.39	-3.28* -2.23*	-1.16 -1.30	-1.22 -1.62
	First difference	-4.50* -2.23*	-2.97* -2.47*	-5.72* -3.70*	-6.25* -3.19*
An intercept but not a trend	Level	0.54 1.23	0.14 -0.06	-.044 0.32	-0.48 0.64
	First difference	-6.63* -4.16*	-3.77* -3.49*	-5.91* -3.96*	-6.62* -3.53*
An intercept and a linear trend	Level	-2.28 -1.32	-1.32 -1.70	-1.41 0.63	-1.91 -0.78
	First difference	-6.97* -4.64*	-3.79* -3.52*	-6.35* -4.55*	-6.98* -3.91*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A15: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 29

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	0.60 0.92	-2.02* -2.62*	-1.01 -0.93	-1.10 -0.93
	First difference	-5.55* -3.42*	-5.93* -3.47*	-4.27* -3.27*	-4.02* -3.37*
An intercept but not a trend	Level	-0.43 -0.05	-1.07 -0.86	-1.45 -2.28	-0.88 -1.61
	First difference	-6.66* -4.78*	-6.93* -4.63*	-4.28* -3.31*	-4.09* -3.48*
An intercept and a linear trend	Level	-3.86* -3.41	-3.74* -2.96	-1.57 -2.35	-1.48 -2.40
	First difference	-6.56* -4.73*	-6.78* -4.52*	-4.32* -3.34	-4.14* -3.54*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A16: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 30

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	0.51 1.08	-4.03* -6.44*	-1.62 -1.70	-0.87 -1.38
	First difference	-6.53* -3.35*	-5.04* -1.27	-8.90* -7.01*	-8.82* -6.82*
An intercept but not a trend	Level	-1.17 -0.96	-0.32 0.12	-3.14* -2.02	-2.66 -1.85
	First difference	-8.41* -6.32*	-10.20* -3.27*	-8.90* -7.56*	-8.88* -7.62*
An intercept and a linear trend	Level	-5.08* -3.49	-2.59 -1.18	-5.92* -4.19*	-5.07* -3.30
	First difference	-8.28* -6.15*	-9.96* -3.21	-8.70* -7.40*	-8.71* -7.49*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A17: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 31

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	1.44 1.76	-2.92* -3.32*	-1.61 -1.60	-1.30 -1.36
	First difference	-5.13* -3.63*	-5.18* -2.71*	-4.97* -3.89*	-5.08* -4.08*
An intercept but not a trend	Level	-0.56 -0.15	-1.16 -1.15	-1.27 -1.20	-1.25 -1.11
	First difference	-6.24* -5.35*	-6.61* -3.72*	-5.11* -4.16*	-5.21* -4.35*
An intercept and a linear trend	Level	-3.61 -3.32	-2.39 -1.87	-2.30 -2.51	-2.43 -2.55
	First difference	-6.20* -5.41*	-6.44* -3.61*	-5.08* -4.16*	-5.17* -4.35*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A18: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 32

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	1.72 1.96	-3.81* -3.16*	-2.20* -2.38*	-2.17* -2.64*
	First difference	-5.05* -2.36*	-3.50* -1.72	-5.61* -3.01*	-6.02* -3.55*
An intercept but not a trend	Level	0.05 0.68	1.40 2.07	-0.61 -0.16	-1.24 -1.01
	First difference	-7.97* -4.79*	-5.42* -3.20*	-6.36* -3.71*	-6.90* -4.49*
An intercept and a linear trend	Level	-2.87 -1.45	-0.63 0.05	-2.08 -1.46	-3.28 -2.71
	First difference	-8.08* -5.01*	-6.37* -4.22*	-6.42* -3.77*	-6.74* -4.31*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A19: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 33

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	1.47 1.65	-4.77* -4.05*	-1.51 -1.69	-1.04 -1.36
	First difference	-5.42* -2.84*	-2.21* -0.91	-6.15* -3.86*	-6.95* -4.36*
An intercept but not a trend	Level	0.19 0.39	-0.17 -0.21	-0.42 0.01	-1.06 -0.41
	First difference	-7.57* -4.70*	-4.44* -3.54*	-6.53* -4.32*	-7.10* -4.59*
An intercept and a linear trend	Level	-2.29 -1.42	-3.75* -3.83*	-1.62 -1.11	-1.95 -1.25
	First difference	-7.73* -4.78*	-4.15* -3.20	-6.82* -4.56*	-7.36* -4.84*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A20: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 34

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	1.21 0.74	-4.59* -3.50*	-0.53 -0.49	-0.42 -0.34
	First difference	-3.90* -2.90*	-3.29* -2.19*	-4.23* -2.48*	-4.31* -2.61*
An intercept but not a trend	Level	-0.59 -0.63	-1.06 -1.05	-1.89 -2.51	-1.79 -2.29
	First difference	-4.41* -3.54*	-5.03* -3.95*	-4.13* -2.39	-4.23* -2.52
An intercept and a linear trend	Level	-2.69 -3.51	-3.04 -3.22	-1.89 -2.49	-2.05 -2.62
	First difference	-4.30* -3.45	-4.92* -3.86*	-4.06* -2.34	-4.15* -2.46

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A21: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 35

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-0.23 0.11	-2.23* -4.25*	-1.43 -1.63	-1.43 -1.82
	First difference	-6.33* -2.91*	-7.46* -2.72*	-5.46* -3.58*	-5.93* -4.68*
An intercept but not a trend	Level	-018 0.75	-0.50 -0.01	-1.33 -0.96	-1.05 -0.57
	First difference	-8.43* -4.68*	-10.45* -4.95*	-5.69* -3.89*	-6.32* -5.58*
An intercept and a linear trend	Level	-2.45 -1.51	-4.00* -1.86	-2.94 -2.63	-3.69 -3.12
	First difference	-8.59* -5.07*	-10.23* -4.84*	-5.55* -3.79*	-6.20* -5.54*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Table A22: Dickey-Fuller and Augmented Dickey-Fuller Tests: Industry 36

		Log(Y/L)	Log (W)	Log(Y/K)	Log (R)
No intercept, no trend	Level	-2.10* -1.99*	-1.79 -2.01*	-1.75 -1.73	-0.83 -0.97
	First difference	-5.80* -3.25*	-5.40* -3.17*	-6.53* -3.81*	-6.69* -4.02*
An intercept but not a trend	Level	-2.00 -1.85	-1.84 -1.79	-2.68 -2.27	-2.72 -2.26
	First difference	-6.19* -3.62*	-6.24* -3.98*	-6.61* -3.93*	-6.75* -4.12*
An intercept and a linear trend	Level	-2.75 -2.37	-2.76 -2.41	-2.92 -2.34	-3.05 -2.42
	First difference	-6.46* -3.91*	-6.76* -4.53*	-6.77* -4.14*	-6.87* -4.31*

Note: In each cell, the upper value is the DF statistic, and the lower value is ADF(1) statistic.
*exceeds simulated critical value

Regional Disparity and Convergence of the Growth of Output of Indian Pharmaceutical Industry: Evidence based on Structural Break Unit Root Test

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Abstract

This paper applies a recent development in estimation and testing of Structural Break in econometric time series model, using unit root test to estimate the break point of the growth of output of Indian Pharmaceutical Industry for the period 1983-84 to 2007-08 by using state level data from Annual Survey of Industries and employing endogenous structural break analysis. The distinguishing feature of this method is that the break point is not dependent on the prior belief of the researcher; rather it is endogenously determined depending on properties of the time series. The results of estimation suggest that for most of the states the endogenously determined break point turned out to be the years after the signing of TRIPS agreement in 1995. An interstate and regional variation of the growth of output is strongly evident. The growth of output of sixteen among the seventeen selected states converges towards a deterministic trend, out of which seven show positive movement. The study clearly identifies the regions and the states whose performance is satisfactory and others showing relatively poor performance and hence needs special attention.

1. Introduction

1.1 Indian Pharmaceutical Industry (IPI) has undergone a massive makeover–from a modest beginning of "process patents regime" in the seventies to a modern and WTO compatible regime under the TRIPS Agreement in 2005. It ranked 3rd in volume and 14th in value in the global pharmaceutical market (Kalani, 2011).

1.2 During the period 1990s some significant changes occurred in the Pharmaceutical sector with the introduction of trade liberalization measures like amendment of FERA and MRTP Acts and delicensing of the drugs, reserved for production by the public sector. During this period Government of India signed the TRIPS agreement which came into existence with World Trade Organisation (WTO) established on 1 Jan1995 replacing the General Agreement on Tariff and Trade (GATT). The private sector grew rapidly along with increase in the competition among the domestic firms and foreign companies. As a result production of IPI increased manifold along with a sharp and steady increase in export. Net export as a percentage of total exports has also increased (Chaudhuri 2005).

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Since 2005, India has started full-fledged product patent regime in pharmaceuticals and are to develop new drugs themselves or to collaborate with the MNCs as manufacturing or marketing partners for the new drugs developed by the MNCs (Chaudhuri 2005).

Given the high growth of this industry the following questions can be raised:

- What is the nature of the growth of output of IPI?
- Is there any change in the growth of output in the period after the signing of TRIPS agreement?
- Whether the outputs of states are converging towards a stationary process having deterministic trend?
- Is there any regional variation of the growth of output of IPI?

1.3 The literature survey revealed that not much attempt has been made to analyze the behaviour of IPI quantitatively. Mention may be made of few studies like Singh (1989), Nagarajan and Barthwal (1990), Majumder (1994), Madanmohan (1997), Kumar (2001), Chaudhuri (2005), Chaudhuri and Das (2006), Ghose and Chakraborty (2008), Mazumdar and Rajeev (2009), Mazumdar, Rajeev and Ray (2009), Saranga and Banker (2010), Chakraborty and Ghose (2011, 2010) and Ghose and Chakraborty (2012).

1.4 Singh (1989), Madanmohan (1997) and Kumar (2001) in their study using firm level data focused on different aspects of IPI like export, import and net import, technology, profitability, patterns of MNCs activity and plant exit process. Majumder (1994), Chaudhuri and Das (2006), Mazumdar and Rajeev (2009), Mazumdar, Rajeev and Ray (2009), Saranga and Banker (2010) and Ghose and Chakraborty (2012) were concerned with the measurement of productivity or efficiency of the industry. Studies which attempted to analyze the growth performance of the industry or to test for exogenous and endogenous structural break using modern time series approach are due to Nagarajan and Barthwal (1990), Chaudhuri (2005), Ghose and Chakraborty (2008), Chakraborty and Ghose (2010) and Chakraborty and Ghose (2011).

1.5 But none of them looked either at the variation in the growth of output among different states or at the variation in the growth of output among different regions.

1.6 Indian plans have been always concerned with the removal of economic backwardness of the country and make it a developed economy. They have taken care to ensure equal development across different states as well as different regions such that the weaker sections of the population benefit from the economic progress of the country. Hence analysis of growth process for different states and the regions will be meaningful and helpful for identifying the states and the regions for which the growth performance is not satisfactory and thus proper measure can be taken for promoting growth for those backward states and regions.

1.7 The present paper contributes to the literature from the above perspective and tests for endogenous structural break in the series of output based on unit root test of IPI for 17 major selected states of India as well as for All India for the period 1983-84 to 2007-08.

1.8 The contribution of the present study is that it might be the first attempt to employ endogenous structural break analysis based on unit root test by using Amit Sen's (2003) approach to find out the nature of growth process of output of IPI. This paper also tests whether the states are converging towards a stationary process having deterministic trend in terms of the output of IPI as well as the variation in the growth of output among different states and among different regions.

1.9 The format of the present study is as follows: Section 2 gives the methodology and data sources. Section 3 presents the result of analysis. Section 3.1 represents interstate analysis, whereas regional level analysis is presented in Section 3.2. Section 4 summarizes the conclusion of this study.

2. Methodology and Data Source

2.1 Methodology

2.1.1 Regarding the nature of macroeconomic data a major debate has been going on until Nelson and Plosser (1982) published in their seminal work, that the underlying process is Difference Stationary (DS) rather than Trend Stationary (TS). For a TS process the effect of random shock is temporary around a trend whereas for a DS process this random shock has a permanent effect. Moreover in case of DS process the variance of the series depends on time.

2.1.2 The unit root test due to Dickey and Fuller (1979, 1981) can detect whether a series is DS or TS. To understand this process the following regression equation is considered:

$$\Delta Y_t = \delta_0 + \delta_1 t + \nu Y_{t-1} + U_t \text{ where } U_t = \alpha U_{t-1} + \varepsilon_t$$

The test procedure is as under:

- The null hypothesis is $H_0: \nu = 0$. Rejection of the null hypothesis implies that the underlying series is TS and failure of the rejection implies that the underlying series is DS. But the coefficient of Y_{t-1} does not follow the standard t distribution which was solved by Fuller by getting limiting distribution of this coefficient and finally these distributions were approximated empirically by Dicky (1976). From a much larger set of replications McKinnon (1990) has derived critical values.
- A TS process and statistically significant coefficient of time implies that there exists a trend in the series.
- Statistically significant constant term suggests that there exists a drift in the model.

If ΔY_t depends on ΔY_{t-j} (where j=1, 2, K, K<T) then the above test procedure is called as Augmented Dickey Fuller test.

2.1.3 Perron (1989) in his path breaking work has shown that the standard unit root test is not consistent against trend stationarity in the presence of structural break and has

suggested a procedure which is appropriate for testing unit root in presence of one time structural break in the series which is assumed to be exogenously determined from consideration of visual examination of the plots of the data.

2.1.4 But Zivot and Andrews (1992) argued that Perron's procedure for finding out the break point is not an appropriate method, because Perron's method was based primarily on visual inspection of data. He argued that the break point should be endogenously determined and can be evaluated considering the models as follows:

$$\text{Model A: } Y_t = a_1 + b_1 DU_t + c_1 t + d_1 Y_{t-1} + e_1 \Sigma \Delta Y_{t-1} + e_t$$
$$\text{Model B: } Y_t = a_2 + g_2 DT_t + c_2 t + d_2 Y_{t-1} + e_2 \Sigma \Delta Y_{t-1} + e_t$$
$$\text{Model C: } Y_t = a_3 + b_3 DU_t + c_3 t + g_3 DT_t + d_3 Y_{t-1} + e_3 \Sigma \Delta Y_{t-1} + e_t$$

where

$$DU_t = 1 \quad \text{if} \quad t > T\gamma$$
$$= 0 \quad \text{otherwise}$$

$$DT_t = t - T\gamma \quad \text{if} \quad t > T\gamma$$
$$= 0 \quad \text{otherwise}$$

The following are the important points:

- Model A allows an endogenous break in the level of the series, Model B permits an endogenous break in the rate of growth and Model C admits both changes in the level as well as growth.
- If DT_t is positive (negative) and significant, then it is concluded that there has been an acceleration (deceleration) in the growth.
- T stands for total time period and γ stands for time break, i.e., $\gamma = T_B/T$.
- The parameters of the i^{th} regression are denoted by a_i, b_i, c_i, d_i, e_i, g_i and T_B is the break point.
- The above three regressions can be estimated by OLS method and with the break fraction γ ranging from 2/T to (T-1)/T.
- Regarding the choice of the lag value, Perron has suggested the following procedure: One should start with a reasonably high value of k, and choose that particular k, say k*, such that the value of the statistic for k* is greater than 1.64 in absolute value and for all other is less than 1.64.

2.1.5 However, the present paper does not follow Perron's procedure in case of the choice of lag as this procedure is sensitive to a particular value of 't' statistic around 10% level of significance. Rather the paper uses visual descriptions of the series and in particular the figures of the correlogram. It suggests that the series is AR(1) type with the autocorrelations dying out and only the first partial correlation coefficient being significant, for all the major states of India as well as All India over the entire sample period.

- From the estimated regression the value of the 't' statistics for testing the null hypothesis $d_i=1$ can be obtained.
- Zivot and Andrews (1992) proved that among the overall T-2 regressions one can choose that year as break point year which gives us the minimum value of the 't' statistics corresponding to the coefficient of Y_{t-1}.
- Choose that model as the best fitted model which gives us the minimum 't' value of the coefficient Y_{t-1}.
- The estimated results are compared with the critical values given by the Zivot and Andrews to determine the nature of the series.

2.1.6 Again Sen (2003) argued that Zivot and Andrews (1992) procedure can be improved by considering maximum 'F' statistic instead of taking minimum 't' statistic and also argued that Model C has a higher power than either Model A or Model B. So Sen (2003) considered model C and suggested the test based on the maximum F statistic, having the following form:

$$F^{Max} = Max_{T_b \in \{[\lambda_0 T],[\lambda_0 T]+1,\ldots,T-[\lambda_0 T]\}} F_b(T_b)$$

The test procedure is as below:

- Among the overall T-2 regressions choose that year as break point year which gives us the maximum value of the 'F' statistics corresponding to the coefficient of Y_{t-1}.
- After finding out the break point one can compare the results with the critical values provided by Amit Sen (2003) to determine the nature of the series.

2.2 Data Source

2.2.1 The present paper uses the data on output measured by gross value added (Y) in real terms for All India (AI) as well as for 17 major selected states of India namely Andhra Pradesh (AP), Assam (AS), Bihar (BI), Gujarat (GU), Haryana (HA), Himachal Pradesh (HP), Jammu & Kashmir (JK), Karnataka (KA), Kerala (KE), Maharashtra (MH), Madhya Pradesh (MP), Orissa (OR), Punjab (PU), Rajasthan (RA), Tamilnadu (TN), Uttar Pradesh (UP) and West Bengal (WB) for the period 1983-84 to 2007-08 obtained from the various issues of "Annual Survey of Industries, Summary Results for the Factory Sector" and uses Wholesale Price Index published by the Central Statistical Organisation, Government of India to deflate the output series in real terms.
The seventeen sample states are classified in different regions as under:

(A) Eastern Region: AS, BI, WB and OR

(B) Northern Region: HA, HP, JK, PU and UP

(C) Southern Region: KA, KE, AP and TN

(D) Western Region: GU, MH, MP and RA

3. Estimated Results of Endogenous Structural Break Analysis Using Amit Sen's Approach

3.1 An Interstate Analysis

- For all the states considered in the present study except BI i.e. for the sixteen states the underlying series is of TS type implying convergence towards a stationary process. The underlying process is DS for BI suggesting existence of a stochastic trend in the output level and hence no definite conclusions can be said about the pattern of the output trend or about the break point of the series. Further existence of TS series for all the sixteen states in turn implies *variability of the series remains constant over time*. For BI we have a DS series suggesting that the *variability of the series is not constant*. The performance of **BI is very poor** because for this state growth process follows a stochastic trend suggesting that no definite conclusion can be made on the nature of the growth process and also the output series does not possesses constant variability over time. However, the coefficient of time is positive but not statistically significant showing one cannot infer about the change in the variability of the output series.

- The break points for all the sixteen states showing TS process like **AP, AS, GU, HA, HP, JK, KA, KE, MP, MH, OR, PU, TN, RA, UP and WB** corresponds to 1997-98 except KA, PU and WB. The break point years are 1995-96, 1988-89 and 1994-95 respectively for KA, PU and WB. Thus only for PU the break point is strictly before TRIPS as well as before the starting of liberalization process.

- **The results of analysis of sixteen states(excluding Bihar) can be listed under different categories as follows:**

Group-A: *This group consists of only one state **HP** where the growth of output increases for the entire period of study as well as after the break point. However there is a fall in the level of output after the break point.* These observations can be justified in the sense that for HP the coefficient of time turns out to be positive and statistically significant implying a positive significant trend for the entire period of study. The growth dummy is also positive and significant suggesting that the growth rate has increased after the break (1997-98). However, the intercept dummy is found to be negative and significant showing movement of output in negative direction after the break. Thus after the break point although growth of output increased but the level of output has declined. Thus, on the whole more or less the performance of HP is satisfactory as it performed very well in terms of the entire sample period and moderately well after the break point.

Group-B*: It consists of **AS, GU, HA, MH, KE and OR** where there is a positive output trend for the entire period of study but no definite conclusion can be said about the growth of output after the break point. Also there occurs a fall in the level of output after the break point*. The reasons for these observations are: in case of **AS, GU, HA, MH, KE and OR,** a positive and significant time coefficient is found suggesting a positive output trend for the entire period of study. The coefficient of growth dummy is found to be positive and insignificant, so no definite conclusion can be said about the growth of output

after the break (1997-98). There is evidence of a fall in the level of output after 1997-98 as the intercept dummy is negative and significant. *Hence the performance of these states is satisfactory for the entire sample period but not so after the break point.*

Group-C: ***UP and JK*** *forms this group. Here one cannot surely conclude about the trend of output for the entire period of analysis. But after the break point, the growth of output increases and there is a fall in the level of output.* The above observation can be justified in the sense that for **UP and JK** the coefficient of time dummy turned out to be positive but not significant. Hence no definite conclusion about the trend of output can be made for the entire sample period. But the coefficient of growth dummy is positive, whereas the intercept dummy is negative and both are statistically significant. So after the break point, 1997-98 the growth of output increases and there is a fall in the level of output. *So these two states performed to some extent satisfactorily after the break but not so satisfactorily for the entire period of analysis.*

Group-D: *Only two states* ***KA and PU*** *form this group. There occurs a negative output trend for the entire sample period and the output decreases at an increasing rate. But the level of output increases after the break point*. The reasons for these observations are: KA **and PU** witnessed negative and significant coefficient of time implying a negative significant trend in output for the entire sample period. Also a positive and significant coefficient of growth of output is obtained. Hence, for these states the output decreases at an increasing rate. Also there is evidence of a rise in the level of output after the break points of these two states, i.e., 1995-96 and 1988-89 respectively as intercept dummy is found to be positive and significant. *Hence these states performed poorly for the entire sample period but after the break the performance is moderately satisfactory.*

Group-E: *This group comprises of* ***MP, RA, TN and WB*** *where one cannot definitely conclude about the trend and growth of output for the sample period and also after the break point. But there is a fall in the level of output after the break.* The above findings can be justified as follows: For **MP, RA, TN and WB**, the coefficient of time although obtained positive but is not significant. Therefore no definite conclusions can be inferred about the trend of output for the entire sample period. The break points are 1997-98 for MP, RA and TN and 1994-95 for WB. The coefficient of growth dummy is also found to be positive and insignificant. So no definite inference can be made regarding the growth of output after the break point. But there is evidence of a fall in the level of output after the break point as the coefficient of intercept dummy is negative and statistically significant. *Therefore these states performed poorly both for the entire sample period and also after the break point.*

Group-F: *Only* ***AP*** *forms this group. Here one cannot definitely infer either about the trend of output for the entire period of study or about the growth of output after the break point and also regarding the change in the level of output after the break point*. This observation can be justified in the sense that the state **AP** shows all the three coefficients i.e. the coefficient of time, growth dummy and intercept dummy to be positive but insignificant. As a result no inference can be made either about the trend of output for the entire period of study or growth of output after the break point and also regarding the existence of break in the level of output after the break point, 1997-98. *Hence AP is a bad performer both for the entire sample period and also after the break point.*

- In case of **All India** the output series is of TS type and hence converges towards a stationary process. The break point is found to be 1997-98 i.e. the period after the signing of the TRIPS agreement in 1995. The coefficients of time and growth dummy although found positive but are not significant. So no definite conclusion can be made regarding the output trend and on the growth of output for the entire period of study and also after the break point. But the intercept dummy is found to be negative and significant suggesting a fall in the level of output after 1997-98. The rate of growth of output at All India level is 1.52%.

3.2 The Regional level Analysis

- The interstate analysis as described above will permit us to have some idea regarding the regional behavior of the output of IPI:

Eastern Region: All the **Eastern region** states follow TS process except **BI**. Our earlier discussion shows that **AS and OR** belongs to **Group B** where *there is a positive output trend for the entire period of study but not so after the break point. Also there occurs a fall in the level of output after the break point* 1997-98. Thus these two states performed satisfactorily for the entire sample period but not satisfactory after the break point. The state **WB** belongs to **Group E** where one cannot *definitely infer about the trend and growth of output either for the entire sample period or after the break point 1994-95. But there is a fall in the level of output after the break point.* Thus on the whole WB is a bad performer. Among the four states belonging to **Eastern region** only the performance of **AS and OR** are moderately good, as both these states showed positive and significant trend in the output level for the entire sample period. Further, all the states of the eastern region are not good performer in the regime after the signing of TRIPS agreement.

Western Region: In case of **Western region** all the states are of TS type. **GU and MH** belongs to **Group B** *where there is a positive output trend for the entire period of study but nothing can definitely be said about the growth of output after the break point. Also there occurs a fall in the level of output after the break point.* This implies that GU and MH is satisfactory performer for the entire sample period but acted poorly after the break point. For the other two states belonging to Western region **MP and RA** corresponds to **Group E** *where one cannot definitely conclude about the trend of output for the entire sample period and also about the growth of output after break point. Further there is a fall in the level of output after the break point.* Thus among the states under **Western region** MP and RA are bad performer as their performance is not satisfactory either with respect to the entire period of analysis or after the break point. Only **GU and MH** performed satisfactorily as they showed positive and significant trend for the entire period under consideration.

Northern Region: It witnessed the existence of TS process for all the states. The state **JK and UP** belongs to **Group C.** *Here one cannot definitely conclude about the trend of output for the entire period of analysis. But after the break point, the growth of output increases and there is a fall in the level of output.* So these states performed moderately well after the break point but are bad performer for the entire period of study.

The other state **PU** corresponding to northern region belongs to **Group D** *where there occur a negative output trend for the entire period of study. The growth of output decreases at an increasing rate and the level of output increases after the break.* So **PU** is a bad performer in the sample period but showed more or less satisfactory performance after the break. The remaining state **HA belongs to Group B** shows a positive output trend for the entire sample period. But no definite conclusion can be made about the growth of output after the break point. After the break there is a decline in the level of output. So HA performed well in the sample period but performed badly after the break. For **HP**, there exists a positive significant trend and the growth of output increases for the entire period of study as well as after the break point but there is a fall in the level of output after 1997-98. So HP performed very well for the entire sample period but acted moderately well after the break. Thus out of five **Northern region** states **HP** performed very well for the entire period. **JK and UP** performed moderately after the break point because their output growth increases but the level of output falls after the break point. For **PU** although bad performance is seen for the sample period as the output falls at an increasing rate but after the break it acted moderately as the level of output increases after the break point.

Southern Region: Among the **Southern region states**, all being of TS type, for **KA**, *there occurs a negative output trend for the entire sample period and the output decreases at an increasing rate. But the level of output increases after the break point.* So **KA** is a bad performer in the sample period but showed moderately satisfactory performance after the break. **KE belongs to Group** B *where there is a positive output trend for the entire period of study but no definite conclusion can be said about the growth of output after the break point. Also there occurs a fall in the level of output after the break point*. Therefore KE performed satisfactorily in the sample period but poorly after the break. The other state AP corresponding to southern region belongs to **Group F** where one cannot say anything definitely either about the trend of output for the period of analysis or about the level or growth of output after the break point. So AP acted very badly in both the sample period and also after the break. The state TN in the southern region belongs to **Group E** *where one cannot definitely conclude about the trend and growth of output for the sample period and also after the break point. But there is a fall in the level of output after the break.* So TN is a bad performer both for the entire period of analysis and after the break.

The result of four states of **Southern region** reveals that only the performance of **KE** is satisfactory for the sample period as it shows positive and significant movement of output. But for **KA** although bad performance is seen for the sample period as the output falls at an increasing rate but after the break it acted moderately as the level of output increases. AP and TN is a bad performer both for the entire period of analysis and after the break.

- Coming to the break points of different states belonging to different regions shows that in case of **Eastern region** the lowest break point year is 1994-95 for WB and highest break point year is 1997-1998 for AS and OR. Break point year 1997-98 is same for all the states i.e. GU, MP, RA and MH in case of **Western region**. For **Northern region** 1988-89 is the lowest break point year for PU and 1997-98 is the highest break corresponding for HA, HP, JK and UP. For **Southern region** the lowest break point year is 1995-96 for KA and 1997-98 is the highest break point year for KE, AP and TN.

4. Conclusion

4.1 This paper applies a recent development in estimation and testing of structural break in the econometric time series model to measure interstate and regional variation in the output of IPI for the period 1983-84 to 2007-08. The states are classified into different regions namely Eastern, Western, Northern and Southern. The distinguishing feature of this method is that it is not dependent on the prior belief of the researchers regarding the occurrence of the break point. Rather the study tested for endogenous structural break in the series using Amit Sen's(2003) approach and finds out the break point of the series of output for each of the 17 selected major states and also at All India level. It then examines whether All India and the states are converging towards a stationary series having deterministic trend. The following conclusions emerge from the analysis:

- All India and the states considered in the present study except BI shows convergence towards stationary process having constant variability over time.
- For all the sixteen states showing TS process the break point occurred after 1995 i.e. period after TRIPS agreement except PU, thus highlighting the role of TRIPS agreement in promoting the growth of IPI. In case of PU the break point occurred before 1991-92, i.e. the period when policies of liberalization were introduced in the Indian economy
- An interstate and regional variation of the growth of output is strongly evident.

4.2 The study of the growth of output of Indian Pharmaceutical Industry by using modern time series technique clearly identifies the states whose performance are satisfactory and other states showing relatively poor performance and hence needs special attention. However, it is to be noted that the growth of output of sixteen among the seventeen selected states converges towards a deterministic trend and seven states shows a positive movement. One of the limitations of the present study is that the reasons behind the emergence of break point of different states as well as for All India are not properly been explored. This pharmaceutical output specific study of states as well as for All India is the agenda of our future research.

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Table 1 : Endogenous Structural Break Analysis for Output of IPI by Amit Sen's Approach

Place	Cons-tant	DU_t	T	DT_t	Y_{t-1}	ΔY_{t-1}	F-Value	Break Point	Under lying Series
AI	0.559 (0.665)	-0.204*** (3.766)	0.0152 (0.808)	0.015 (1.399)	-0.091 (0.586)	0.449*** (4.826)	12.586***	1997-98	TS
AP	0.264 (0.562)	-0.807*** (2.637)	0.004 (0.039)	0.079 (0.811)	0.011 (0.029)	0.557*** (3.253)	9.557**	1997-98	TS
AS	-0.418	-1.678*** (0.653)	0.065** (2.776)	0.127 (1.924)	-0.162 (1.451)	0.497*** (0.603)	16.318*** (4.381)	1997-98	TS
BI	-1.936 (1.235)	1.753*** (2.221)	0.071 (0.760)	-0.145 (1.456)	-0.431 (1.461)	0.345*** (2.112)	6.236	1995-96	DS
GU	-0.028 (0.033)	-1.513*** (4.597)	0.086** (1.926)	0.032 (0.416)	-0.098 (0.402)	0.463*** (3.706)	13.826***	1997-98	TS
HA	-0.247 (0.619)	-1.449*** (3.499)	0.081** (1.935)	0.072 (1.098)	-0.143 (0.546)	0.453*** (3.389)	11.643***	1997-98	TS
HP	-1.833 (1.473)	-4.651*** (2.308)	0.355** (1.983)	0.625** (1.999)	-1.284** (1.962)	0.064 (0.281)	13.786***	1997-98	TS
JK	-0.186 (0.192)	-2.633*** (2.432)	0.036 (0.415)	0.394*** (2.696)	-0.153 (0.745)	0.452*** (4.693)	14.288***	1997-98	TS
KA	2.465*** (2.947)	1.023*** (3.892)	-0.054*** (2.025)	0.087** (1.896)	-0.609*** (2.367)	0.247*** (2.001)	14.101***	1995-96	TS
KE	-0.071 (0.252)	-1.517*** (4.622)	0.065** (1.931)	0.048 (0.645)	-0.094 (0.542)	0.466*** (5.343)	19.135***	1997-98	TS
MH	0.077 (0.088)	-1.116*** (5.658)	0.058** (1.958)	0.028 (0.611)	-0.073 (0.394)	0.461*** (3.968)	15.523***	1997-98	TS
MP	-0.048 (0.196)	-0.989*** (4.615)	0.018 (0.232)	0.061 (0.687)	0.061 (0.211)	0.543*** (4.183)	15.465***	1997-98	TS
OR	-0.876 (1.348)	-2.385*** (3.944)	0.124** (1.821)	0.072 (0.522)	-0.002 (0.007)	0.489*** (3.383)	11.921***	1997-98	TS
PU	2.171* (1.776)	2.774*** (4.243)	-0.519*** (2.036)	0.526** (1.988)	-0.492*** (2.582)	0.288*** (2.651)	14.005***	1988-89	TS
RA	-0.329 (0.605)	-2.498*** (3.836)	0.051 (0.701)	0.122 (0.979)	0.292 (1.285)	0.619*** (5.568)	14.226***	1997-98	TS
TN	-0.504 (0.911)	-1.428*** (3.798)	0.031 (0.546)	0.079 (0.944)	0.156 (0.157)	0.566*** (4.172)	12.213***	1997-98	TS
UP	-1.260*** (2.344)	-1.824*** (5.395)	0.033 (0.943)	0.155* (1.890)	0.308* (1.721)	0.656*** (5.772)	15.482***	1997-98	TS
WB	-1.493 (1.668)	-1.487*** (2.569)	0.052 (0.827)	0.041 (0.401)	0.413 (1.320)	0.669*** (5.425)	17.397***	1994-95	TS

***, ** and *represents significant at 1%, 5% and 10% level of significance respectively

Issues in Activity and Product Classification for ASI

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Abstract

National Industrial classification 2008 (NIC-2008) is a revised version of NIC-2004. The 38th session of the UN Statistical Commission recommended that countries should make an effort either to adopt national versions of the ISIC-Revision 4, or to adjust their national classifications in such a way that data can be presented according to the categories of the ISIC- Revision 4. Whenever a revised classification is adopted, concordance with the older one becomes necessary for generating time-series data. ISIC 4 and ISIC 3.1 have also provided a concordance at 4 digit level based on which concordance tables of NIC 2008 and NIC 2004 have been constructed. But such concordance is leading to over-estimation of parameters in many cases due to many to one/many references. In all such cases a word "p" is used to denote partial but for all practical purpose the "full data" are taken to generate time-series data where concordances are required. To sort out this problem, it is suggested that a rule may be defined to estimate a more reliable p for each class. So far as ASI in India is concerned, a method has been thought of to construct 'p' with reference to classification NIC 2004 (based on ISIC-3.1) conform to NIC 2008 , based on ISIC- 4. Similarly issues relating to product classification in manufacturing sector with reference to the recommendation of the UNSD are discussed in this paper.

1. Issue of classification in Industrial Statistics

1.1 The Annual Survey of Industries (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 organized manufacturing sector comprising activities related to manufacturing processes, repair services, gas and water supply and cold storage.

1.2 The Standard Industrial and Occupation Classification 1962 developed on the basis of the UN International Standard Industrial Classification (ISIC) of all Economic Activities 1958 (Rev. 1) was adopted from its first ASI survey in 1960. With effect from ASI 1973-74, the National Industrial Classification (NIC) 1970 developed subsequently on the basis of ISIC 1968(Rev.2) has been adopted. The NIC 1987 that strictly followed UNISIC 1968 was adopted from ASI 1989-90 to ASI 1997-98. The classification, i.e. NIC 1998, developed on the basis of ISIC, 1990 (Rev. 3) has been adopted from ASI 1998-99. The classification NIC 2004 , based on ISIC, 2002 Rev 3.1 has been adopted from ASI 2004-05 and finally NIC 2008, based on ISIC, 2006 Rev 4 has been adopted fully at 4 digit level and implemented from ASI 2008-09.

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1.3 National Industrial classification 2008 (NIC-2008) is a revised version of NIC-2004. The 38th session of the UN Statistical Commission recommended that countries should make an effort either to adopt national versions of the ISIC-Revision 4, or to adjust their national classifications in such a way that data can be presented according to the categories of the ISIC- Revision 4. Specifically, countries should be able to report data at the two-digit (division) level of the classification without a loss of information; that is, national classifications should be fully compatible with this level of the ISIC, or it should be possible to arrange them.

1.4 NIC 2008 is based on ISIC-4 where most of the sub-class level classification is satisfactorily meeting the ASI requirement. At sub-class or ultimate 5-digit level Indianisation has been done in appropriate cases. But, some more are suggested to be done considering the diversification of product and growth of small enterprises. So far as NIC 2008 classification is concerned, some newly growing industries will remain uncaptured due to multiple activity grouping. Industrial diversification of growing Indian industries demands more sub-class classification. Some example can be highlighted:

i) In Section C, Division 10, as revealed from various market knowledge and papers, industry like Rabbit –slaughtering, preparation, Koel, Emu, Ostrich slaughtering, preparation have been growing steadily in Indian market. Thus to net the growth of these industries those should be separated out from general Poultry which chiefly includes chicken/hen/cock. Processing and preservation of crustacean, Processing and preservation of Lobster/Tiger Prawn/ Shrimp may be separated out to capture the growth of this specific high-return industry.

ii) In Division 11, Manufacturing of low alcoholic drinks (below 8%) like Breezer may be separated out from 11011. This industry is growing and enjoys a considerable share in the market having a different customer base.

iii) In Division 13, sub-classification of Khadi industries is required at 5-digit level under 1312, 1313, 1391-99 in NIC 2008. Khadi , being very important textile industry in India needs a separate classification at 5-digit level. In NIC-2004, a shadow classification at 4-digit level was done to net khadi industry but that had disturbed the concordance with ISIC. To keep concordance with ISIC, it will be better to include khadi industries under respective ISIC 4-digit group. Enough spaces are left for such inclusion at 5-digit level without changing 4-digit classification of ISIC.

iv) In Division 20, Manufacturing of Caustic Soda, Caustic Potash, main input items of all soap and detergent industries needs a separate sub-class classification. The classification 20116: Manufacture of basic chemical elements – is a too omnibus term to even moderately capture the diversification in this industry. It is a fact that mushrooming of various basic chemical industries in unorganized sector is well known. Actually entire manufacturing of inorganic alkali group needs a separate sub-class classification like inorganic acid group. Such products are basic input

material in class 2023: Manufacture of Soap, detergent etc. In ASI 2007-2008, around 2 million tonnes of caustic soda was produced in India.

v) In Division 23, newly emerging industry of Manufacturing of Vitrified Tiles in organized sector needs a separate classification. With growing need of infrastructure building, demand of vitrified tile is expected to rise sharply. This is different mechanism and plant for manufacturing of tiles which is not similar with 23952 or 23912. As of now this activity is not separately traceable.

vi) In Division 24 : Whether Washeries Plant are to be considered as manufacturing activity or not needs to be determined ?

vii) In Division 26, Manufacture of Surveillance equipment should be included in a sub-class under class 2630: Manufacture of communication equipment otherwise it may lead to misclassification or may be missed being classified under 'n.e.c.'.

viii) Under Division 27, a new upcoming industry with big domestic market Manufacture of Kitchen Chimney may be included in class 2750 .

ix) Under Division 31: Manufacture of Furniture , another activity Manufacture of decorative and ornamental articles (non-precious) may be included, otherwise this specific high return industry will be missed or misclassified. Moreover, sub-class 31003: Manufacture of furniture of metal is omnibus. Newly upcoming Manufacture of furniture of wrought iron may be classified separately.

x) In Group 32, the sub-class 32120: manufacture of imitation jewellery does not reflect the entire industry in product, cost and plant variation. A separate sub class 'Manufacture of junk jewellery with semi precious stone , metal' may be included. The activity like '32404: Manufacturer of Playing Card' needs explanation. Primarily this is a printing activity. Some industries under Division 18 are also producing playing cards.

xi) Now, non-availability of separate classification of a major polluting activity like Manufacture of chlor-alkali (caustic soda, caustic potash), with around 2 million tone production per year, as well as problem of concordance over various NICs will hinder making such database of organized sector through ASI.

2. Issues of Environment and NIC

2.1 A major challenge faced by the human race in the twenty-first century relates to insult to the environment, and the depletion of the natural resources including the threat of climate change. Be it so, there is no denying that the measurement of development in an economy must be linked with sustainability. Industrial growth is one of the important

factors in a country like India where around 25 % of GDP is contributed by the manufacturing sector. Without a doubt, industry is also the major source of pollution but, it is a global happening that environmental regulations always add to the private cost of the polluters and consequentially affect the sustainability of industrial growth.

2.2 When the trend is observed among the environmentalists or the green benches to shut down the polluting industries on the basis of complaints, public interest litigation, etc. as an immediate or interim measure to stop pollution and protect environment *causing economic loss*, this study attempts to guide the *social choice issue* to tackle the problem of sustainability through abetting industrial pollution that may also lead to a higher genuine savings while *accounting for Green GDP*.The nature that manifested its infinite variety in its own way from the time immemorial was used and mindlessly tampered with by the mankind for variety of temporal achievement that ultimately placed the man over *everything* in nature. Consequentially, the industrial growth that is instrumental in all round economic development has appeared as a serious threat to the environmental natural order. For achieving the social choice for sustainable development, a conflict is emerging *that lead to study* the growth and contribution and spatial distribution of polluting organized manufacturing sector of the country through time-series analysis of ASI data. The social choice in a welfare state like India where shut down is also considered as a measure for pollution abatement will be more explicit if ASI can pinpoint the growth and structure of such polluting industries for *understanding sustainable* development vis-à-vis national income, capital formation and employment generation.

2.3 Now, the biggest survey of the organized manufacturing sector of the government faces difficulty to provide such data from one window because of (i) non availability of proper classificatory environmental indicators related activity and product (ii) Problem on concordance at ultimate digit to prepare time-series data.

2.4 There is need to classify activities which are being carried out only for environmental protection. Such activities are now mixed up with many activities within various Divisions. Manufacturing of Pollution Control Equipment like Manufacture of Stag, Manufacture of Effluent Treatment Plant, Manufacture of exhaust fan(Industrial) , Manufacture of Sound Proof Material, Manufacture of Water Treatment Plant etc. may be taken as a separate class with a view to understanding the growth of industry producing pollution control equipment as it is understood that pollution control awareness and strict implementation policy of pollution norm in India and may be in developing economy, such industry is showing a steady rise. Therefore, a separate classification will be helpful in easy tabulation of such industry required for policy planning.

2.5 The next revision of NIC may focus towards creating a sub-group under in each for classifying only such activities as being carried for pollution control in any form. In India there are three categorization of industry by Ministry of Environment in defining polluting capacity of such industry viz. Red, Orange and Green. Depending upon the pollution potential of different industries, Pollution Control Board has classified the industrial units into three different categories: 'Red', 'Orange' and 'Green'. The Red category units have maximum pollution potential, the Orange category units have moderate pollution potential and the Green units have the least pollution potential. Further,

considering the degree of pollution among the Red units, these are classified into 'Special Red' and 'Ordinary Red' categories. Even, non-availability of separate classification of a major polluting activity like Manufacture of chlor-alkali (caustic soda, caustic potash), with around 2 million tone production per year in India hinders making such database of organized sector through ASI. It is suggested that considering the pollution potential of an industrial activity, **an alphabetic digit can be prefixed with the existing ISIC code**.

Ex:

EXAMPLES OF INDUSTRIES UNDER "RED" CATEGORIES		
Sl. No.	**Manufacturing Activity producing**	**Suggested NIC at 4 digit**
1	Cement	R-2394
2	Chlor alkali(Basic Chemicals)	R-2011
3	Iron and Steel (Involving processing from ore/scrap/Integrated steel plants.)	R-2410
4	Pulp and Paper (Paper manufacturing with or without pulping).	R-1701
5	Sugar (excluding Khandsari)	R-1072
6	Tanneries.	R-1511

EX. OF INDUSTRIES UNDER "ORANGE" CATEGORIES		
Sl. No.	**Manufacturing Activity producing**	**Suggested NIC at 4 digit**
1	Brick Manufacturing	O-2392
2	Fish processing	O-1020
3	Flour mills (excluding Domestic Aatta Chakki)	O-1061

EX. OF INDUSTRIES UNDER "GREEN" CATEGORIES		
Sl. No.	**Manufacturing Activity producing**	**Suggested NIC at 4 digit**
1	Bakery products, biscuits, confectionery	G-1071
2	Cotton and woollen hosiery	G-1312

2.6 The above examples are only illustrative. But the major issue of environment and industry will not end with environmental classification of the above industries. Most of such industries are under strict compliance rules of Pollution Control Board. But globally, the scenario has taken a shape after IPCC recommendations. The environment has to be seen from both local and global point of view. The use of input and fuel in manufacturing industry need to be analyzed from this angle. **Carbon depositing** in the environment can be an important indicator to classify industries in two distinct sectors where one sector will be the industry depositing carbon and other which are not depositing carbon. Therefore, suitable activity classification is required to be incorporated in ISIC which can be followed as a model by each participating nation.

2.7 This will help easy understanding and quick classification of stratified pollution load of a country and its spatial distribution. One digit enhancement will solve the problem of consulting multi-organisational data, in- built with definitional and coverage variation, in policy planning to stratify and study the polluting industries of a country and to create an environmental policy.

3. Issue of Mixed Activity in ISIC

3.1 One point is often felt about defining "Mixed Activity". In fast developing country like India, diversification of industrial activities , forward and backward integration, synergic management have led to mixed activities within an enterprise. The rule of choosing only major activity in determining the industry misses the major subsidiary activity at classification stage. The concept of mixed activity needs to be reviewed while further revising ISIC creating a separate guideline for recording all such subsidiary activities that are either contributing between 25-50% value additions or polluting the environment. Such classification will give answer to many micro level business queries.

4. Issue of Concordance and NIC

4.1 Whenever a revised classification is adopted, concordance with the older one becomes necessary for generating time-series data. ISIC 4 and ISIC 3.1 have also provided a concordance at 4 digit level based on which concordance tables of NIC 2008 and NIC 2004 have been constructed. But such concordance is leading to over-estimation of parameters in many cases due to many to one/many references. In all such cases a word "p" is used to denote partial but for all practical purpose the 'full data'' are taken to generate time-series data where concordances are required. In some cases for two separate 4 digit ISIC-4 code , same ISIC-3.1 codes are provided. Examples based on manufacturing sector in ASI are given below:

Ex.1

Activity	ISIC-4 (NIC - 2008)	ISIC-3.1 (NIC-2004)	Relevant activity under NIC-2004	Corresponding NIC-2004 5–digit (based on ISIC-3.1)	% share of no. of workers under each NIC-4 digit level
(1)	(2)	(3)	(4)	(5)	(6)
Manufacture of prepared meals and dishes	1075	1512(p) + 1513(p) + 1544(p) + 1549(p)	Manufacturing of fish meal	15125	1.63
			Manufacture of potato flour & meals and prepared meals of vegetables	15138	2.41
			Manufacture of macaroni, noodles, couscous and similar farinaceous products	15440	100
			Manufacture of malted foods including food for infants and invalids	15494	0.64

Ex.2

Activity	ISIC-4	ISIC 3.1
Spinning, weaving and finishing of textiles	1311	1711(p)
Weaving of textiles	1312	1711(p)

4.2 Now it is clear from the above two illustrative examples that unless 'p' is refined further, anomaly in preparing data based on such concordances is inevitable. To sort out this problem, it is suggested that a rule may be defined to estimate a more reliable p for each class. So far as ASI in India is concerned, a method has been thought of to construct ' p' with reference to classification NIC 2004 (based on ISIC-3.1) to concord with NIC 2008 , based on ISIC- 4 . It is assessed that 'worker' can be a robust variable to further refine "p" beyond 4-digit level. To work this out, within each 4-digit class, proportionate representation of each 5-digit sub-class based on number of workers has been worked out from ASI data. The said number is taken as the multiplier to tone down the relevant data for all parameters for that particular year. If under each 4-digit class , say xxxx, there are two 5-digit sub-classes , say, yyyyy with total worker size m and zzzzz with total worker size n, then multiplier for yyyyy will be m/(m+n), expressed in terms of percentage. In col. (4) of the following table, such multipliers are provided. While making concordances, the entire data set of respective 4-digit level should be toned down by such multipliers to avoid overestimation as well as duplication. This will be a better estimate than reproducing entire data at 4 –digit level. Thus it is suggested that a working rule in this regard may be adopted in ISIC.

An example based on NIC 2004 (Ref: ISIC 3.1)

NIC04-(4 digit)	NIC04-5 digit	No. of workers estimated	Multiplier
(1)	(2)	(3)	(4)
1512	15121	1482	5.39
	15122	355	1.29
	15123	12	0.04
	15124	18548	67.49
	15125	449	1.63
	15127	5898	21.46
	15129	741	2.70
1512	**Total**	**27484**	**100.00**
1513	15131	900	2.37
	15132	4892	12.89
	15133	1334	3.52
	15134	6341	16.71
	15135	1754	4.62
	15136	7074	18.64
	15137	8782	23.14
	15138	916	2.41

NIC04-(4 digit)	NIC04-5 digit	No. of workers estimated	Multiplier
(1)	(2)	(3)	(4)
	15139	5952	15.69
1513	**Total**	**37945**	**100.00**
1544	15440	3971	100.00
1544	**Total**	**3971**	**100.00**
1549	15491	88676	26.77
	15492	3886	1.17
	15493	205100	61.91
	15494	2122	0.64
	15495	9838	2.97
	15496	4823	1.46
	15497	2194	0.66
	15499	14623	4.41
1549	**Total**	**331262**	**100.00**

4.3 As concordance is a major issue in revision of any classification for preparing any relevant time series data, ISIC may issue a policy guideline in this regard in the spirit of above. As of now, in ISIC-4, the common term 'p' is used for concordance with past ISIC-3.1 to flag that the entire 4-digit level is not concordable. The same is followed in NIC. But for all practical purpose and in absence of any international guideline, the full 4-digit data of past are taken for creating reference with present which lead to serious over-estimation. Here the 'p' value is approximated by using a multiplier which is percentage representation in terms of worker strength based on ASI data of the exactly matching 5-digit (sub-class) industry within that 4-digit industry for concordance at 4-digit level. It is further clarified that such value of p is applicable only for data related to ASI. For different domain, similar method should be applied to find out the value of p on the basis of available data.

5. Issues on Product Classifications for Manufacturing Sector

5.1 The commodity classification in ASI has not been done following the UNSD recommendation since the year 2011. ASI Commodity Classification (ASICC) has been used in ASI for input and output classification for last few years. As it has not been developed in a robust manner or following any internationally accepted classificatory norms, it is suffering from many infirmities like duplication, unrecognized product, heterogeneous grouping, etc. Moreover, concordance with CPC or HS is also almost impossibility with ASICC.

5.2 Now that CPC Ver 2 is an internationally accepted product classification, CSO, IS Wing has developed National Product Code for Manufacturing Sector, 2011 (NPCMS) with the same principle.

5.3 The structure of NPCMS may be:

Five digit CPC Code + two digit Indian requirement.

CPC has a concordance with HS so there can be an easy concordance of NPCMS with ITC-HS. This is also being developed making old ASICC a subset of the entire NPCMS. Thus the main advantage of this coding structure will be the continuation with existing ITC and international comparability. It is also felt that adopted any local classificatory system for very narrow objectives may finally lead to anarchy in classification causing almost impossible task either for concordance of data sets and preparing time series data and therefore from beginning international standard and practice should be adopted.

5.4 With this principle, NPCMS has been developed and a concordance has also been established between NPCMS and ASICC for all **valid items** of ASICC.

5.5 While adopting CPC ver. 2 for NPCMS, it is often felt that the subclass level stratification in CPC is not sufficient for capturing Indian variety. As incorporation of a new subclass is beyond our scope and can only be done by UNSD for maintaining international comparability, some suggestions are given below for consideration of the appropriate body before revision of CPC ver. 2 which is due.

i) In Section 0 , agricultural primary product like beetle-leaves, bettle-nut, catechu(katha) may have a separate class classification as 0166 to avoid being classified under 'n.e.c'. Under the group 012, a new class of "Greens" may be added to accommodate variety of greens common to Indian agriculture. Product like Spinach is more suitable under this group than under ' 0121-leafy-stem vegetable' along with cabbage.

ii) In Section 2, for Food Products etc. , the sub-class like 23921- 23928 are too specific to accommodate all Indian processed varieties like onion paste, garlic paste, mixed spices paste. Again, a new group may be formed under group 231 as 2318 for Papad.

iii) Some products like pan masala, kimam, chaman-bahar cannot find a suitable place in CPC due to non-availability of proper classificatory group. Inclusion of a separate division under Section 2 may be an appropriate solution. Again, group like processed plants or parts of plants used for pharmacy, medicine etc. are not available in CPC.

6. Environment and Product (Waste) Classification

6.1 Product classification must specially stratify the waste under three categories of waste which is output of an industrial activity or any other economic activity : Hazardous Waste, Solid Waste, Biomedical Waste**.** In framing the environmental policy and management, the knowledge and data base of non-agriculture waste is considered necessary. As of now, CPC or ITC, do not provide for separate strata for all types of non-agricultural waste. It may so happen that waste of one industry can be an input of another industry and therefore, waste can either be output or input of an industry and therefore, it should get a place in product classification or waste. Therefore, a separate section in Product Classification should be started to classify all non-agricultural waste to get the necessary statistics from one window.

Determinants of Manufacturing FDI in India: A Sectoral Analysis

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Abstract

A panel data analysis has been carried out to find out the determinants of manufacturing sector FDI in India. The data used for analysis have been collected from Annual Survey of Industries and matched with FDI data from Department of Industrial Promotion and Policy (DIPP, GOI) and firm-level data from PROWESS database (CMIE). Appropriate price deflators were used to account for movement of prices for the variables used over time. This data set was collected from Department of Economic Affairs (GOI). Eleven sectors at three-digit NIC level (2004) were used for the study which spanned across 2003-04 to 2009-10. The concordance between FDI figures and NIC 2008 sectors were done by NCAER in their study on FDI in 2009. We have used the concordance between NIC 2004 and NIC 2008 to use the FDI data for our purpose. The various theories of industry-level FDI explain the motives in terms of market-seeking, asset exploiting, strategic asset exploiting and technology sourcing, among others. In case of India FDI flows picked up after the significant dose of liberalization happened in early 1990s. The flows became significantly higher in the year 2000 and thereafter specifically in services sectors. Manufacturing FDI poured in significantly in drugs and pharmaceuticals, chemicals (excluding fertilizers) and automobiles. Much of the FDI were domestic market driven, cost-efficiency seeking and export-oriented. We have used appropriate variables from past studies and according to theoretical conjectures to find out the driving forces behind manufacturing FDI in India. Our results show that manufacturing FDI in India is significantly negatively affected by tariffs, import-intensity and R&D intensity, whereas it is significantly positively impacted by concentration of market power. FDI inflows has been higher in those sectors where market imperfections gives an opportunity to exploit ownership advantages of FDI making companies to increase their margins and hence profits. The negative relationship between tariffs and FDI shows that FDI has been efficiency-seeking. Further, FDI flows have been lower in high cost sectors more dependent on imports. High-tech firms are generally less dependent on FDI.

1. Introduction

1.1 According to AT Kearney's 2007 Global Services Location Index INDIA ranks second in the world in terms of financial attractiveness, people and skills availability and business environment. Until recently, country's financial stability in the current environment of financial turbulence and a possible unwinding of macro imbalances sent clear message

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to the prospective foreign investors about India's position as an expanding investment destination. "India's external sector has displayed considerable strength and resilience since the reforms in 1991- despite several domestic as well as global political events and supply shocks in food and fuel.....we partner with the global economy fully on the trade and current account while there is progressive liberalization of the capital account, consistent with the progress in reforms in the real, fiscal and financial sectors", observed Dr Y.V.Reddy, Governor of India's central banking authorities, Reserve Bank of India (RBI) at the World Leaders Forum in New York in April, 2012. "The strong macroeconomic fundamentals, growing size of the economy and improving investment climate had attracted global corporation to invest in India. A major outcome of the economic reforms process aimed at opening up the economy and embracing globalization has led to tremendous increase in Foreign Direct Investment inflows into India.

1.2 The National Manufacturing Policy (NMP) ratified by the Union Cabinet in 2011 seeks to achieve a 25% share for the manufacturing sector by 2022. It aims at additional 100 million employment in manufacturing sector by 2022[2]. The government wants to achieve this without subsidies through fiscal incentives. The basic thrust would be on providing an enabling environment to tap potential in private sector, young population and entrepreneurial skills[3]. The ambitious target set by the government cannot only be achieved by tapping savings from within the country. The Planning Commission estimates that to achieve a rate of growth of 9.5% during the Twelfth Plan period the investment rate has to increase to 41.4% if the inflation rate stays in 5 to 5.5% range[4]. To achieve this rate of investment, private sources have to take a lead of which a major portion has to come from foreign sources (Assocham, 2012).

1.3 The major benefits of Foreign Direct Investment (FDI) in case of India have been identified as filling the gap between investment funds required and domestic sources of funds. Technology transfer leading to knowledge diffusion and spillover effects on domestic firms. Transfer of superior organizational and management practices through links between the foreign investing company and the domestic firm (DIPP, 2004). The flow of funds to country depends on economic, political and social factors.

1.4 The literature on determinants of FDI can be classified into firm-level, industry-level, macro-level partial equilibrium and general equilibrium approaches. A survey of all such studies can be found in Blonigen (2005). At the firm-level most important determinant of establishing cross-border facilities is the profit motive where the surplus is higher from internalizing the processes than from sourcing it from outside the firm (Rugman 1980, Dunning 2001). Though it is recognized that firm-level decisions are inherently unobservable and hence proxies like R&D intensity and advertisement intensity are used to understand the motives behind FDI. At the industry-level the motives are derived from that at the firm-level. Karpaty and Poldahl (2006) survey the theories behind firm and

[2] The Hindu, 26th October 2011

[3] Union Commerce Minister, Mr. Anand Sharma

[4] Approach Paper of Twelfth Plan, Planning Commission, Government of India.

industry-level determinants of FDI. They categorize the theories into asset exploiting, vertical and horizontal integration, strategic asset seeking and technology-sourcing types. Asset exploiting type has already been explained under firm-level determinants. Horizontal FDI (Markusen 1984) happens when trade costs are high whereas vertical FDI (Venables et al 2005 and Dunning 1993) happens when the relative endowments of factors differ across countries and the MNE feels the urge to fragment the production process according to the locational advantages. Strategic asset seeking motive is found in oligopolistic markets for motives such as confronting the rival in their home market to create concentration of market power [5](Dunning 1993). In case of technology-sourcing motive the firm invests or acquires to gain knowledge about superior technology in the acquired firm (Kuemmerle, 1999; Griffith et al, 2003). Partial equilibrium macro-level studies consider market size, growth in market size, exchange rate, taxes, government policies towards FDI, trade barriers and quality of institutions as major determinants of FDI flows (Blonigen 2005). In the general equilibrium framework initially simple motives like horizontal and vertical integration (Markesen 1984 and Helpman 1984) have been modeled. Later studies concentrated on more complicated motives from using the host country as an 'export platform' (Eckholm, Forslid, and Markusen, 2003, and Bergstrand and Egger, 2004) to using a number of locations as processors of intermediate goods which is shipped back to the parent country in more finished form (Baltagi, Egger and Pfaffermayr, 2004).

1.5 In this study we would concentrate on industry-level determinants of FDI inflows. Specifically we try to find out the determinants of manufacturing FDI in India. In the opening paragraphs we have discussed the importance of FDI and specifically FDI in manufacturing sector for India. The study considers eleven manufacturing sectors selected on the basis of their share of cumulative FDI received (<0.5) from the year 2000 to 2012. Various industry-level determinants of FDI have been used to find out the driving factors behind such flows into manufacturing sector in India. The period of analysis depending on data availability (as discussed later) is 2003-04 to 2009-10. The rest of the paper is organized as follows: section 2 gives a brief description of FDI flows in India. Section 3 deals in the appropriate theories in the Indian context and selection of variables for the study. Section 4 discusses the data issues and sources. Section 5 specifies the empirical model for our study. Section 6 analyses the results and their implications. Section 7 concludes our study.

2. FDI in India

2.1 FDI policy in India has become increasingly liberal over the past half a century. In the first phase between 1969 and 1991 MRTP and FERA Acts restricted the operation of foreign firms in terms of size, type of products, equity participation etc. In the second phase during 1991 to 2000 FDI policy was substantially liberalized by allowing 51% foreign participation through automatic route in 35 high priority industries. During this period the Foreign Investment Promotion Board (FIPB) was constituted to consider FDI

[5] Caterpillar an earth moving Machinery Company entering Japan to confront its potential rival Komatsu which helped it sustain its market power for considerable amount of time. It delayed Komatsu's growth by ten years.

under the government route. The third phase 2001 to present the FDI policy has been substantially liberalized with a negative list approach with all other activities permitted through the automatic route and substantial relaxation in terms of equity caps have also been made (ASSOCHAM 2012).

2.2 Figure 1 show that for most of the sectors foreign technological collaboration through automatic route has surpassed that through approval route. This shows the impact of FDI policy liberalization on technology collaborations. The number of investment proposals across states show that Chattisgarh have received the maximum proposals in terms of magnitude, Rs. 1045645 crores between 1991 to 2010 which is around 13.72% of that received by all the states (DIPP, 2011). Almost 70% of the investments are in electricity and around 26% is in manufacturing (IBEF, 2010). This flows have been aided by enabling policy at the state-level and commensurate investment in infrastructure. Chattisgarh is closely followed by Orissa and Gujarat. In Orissa the major investments have happened in coal, thermal power and cement[6]. Gujarat on the other hand attracts most of the FDI in oil and gas, food processing, infrastructure and gems and jewelry among others[7]. Thus most of the FDI in high inflows recipient states have exploited the natural resource bases available in those locations. The pie chart (Figure - 2) gives an overall view about regional distribution of foreign investment proposals.

2.3 Sector-wise bulk of the FDI proposals in the same period has come to electrical equipments and metallurgical industries. The pie chart (figure-2) shows the sector-wise distribution of FDI proposals.

2.4 In terms of business environment India still has a long way to go compared to China since on many aspects of 'Doing Business'[8] we lack behind China and our rankings are also worsening over time (Table 1).

2.5 Registering property, dealing with construction permits and trading across borders have become more difficult in India. Recent rulings in case of 2G spectrum case and policy paralysis in case of FDI in multi-retail have not helped the Indian cause either. Thus FDI flows in the future would among other things depend on clarity regarding policy and safeguard of foreign assets in our country.

3. Framework of the Study

3.1 In this study we would be considering demand side or internal factors which determine FDI inflows into a country. Cross country studies have concentrated on location-specific factors related to market-size, growth, low cost resources, exchange rate movements, tax policy, tariffs, quality of institutions etc. Industry-level studies on the other hand have considered intra-firm exports as an indicator for vertical integration;

[6] http://www.teamorissa.org/Investment%20Proposals%20Cleared%20till%2036th%20SLSWCA%20(%20as%20of%2031%20Dec%202010)_new.pdf

[7] http://business.mapsofindia.com/fdi-india/states/gujarat-economy.html

[8] Doing Business Reports, The World Bank, Washington D.C.

tariffs and growth in sales as indicators of market seeking FDI; R&D, sales promotion and productivity as indicators of asset exploiting motive; firm size, export share and market share as indicators of strategic asset exploiting motive; and R&D and productivity as indicators for technology sourcing motives (Karpaty and Poldahl (2006)).

3.2 Karpaty and Poldahl (2006) is one of the most comprehensive studies on determinants of FDI at the industry-level in case of Sweden. They find technology, skill intensity, export intensity, and dummy for differentiated product industry positively affects industry-level FDI whereas size has a significant negative impact on such flows. Bellak et. al. (2008) studies the US, six European Union countries and four Central and Eastern European countries (CEEC) over the period 1995-2003. They use a dynamic panel data model to segregate economy-wide and industry-level effects. In case of CEEC countries R&D intensity closes the gap between potential and actual FDI whereas for US-EU countries it is labour cost decrease due to increase in productivity and taxes that helps to close this gap.

3.3 Banga (2003) studies the impact of policies by the governments in developing countries on FDI inflows. The author finds that tariff reductions attract FDI from developing countries whereas removal of restrictions on their operations increases flows from developed countries. Bera and Gupta (2009) studies FDI inflows into Indian industrial sectors originating from developing and developed countries. Authors try to find whether the determinants of FDI flows are different for FDI coming from developed compared to that coming from developing countries. FDI inflows from both sets of countries are found to be positively related to market size, export orientation and negatively related to import intensity. FDI from developing countries are attracted towards more growing sectors in India, while no such evidence is found for such flows from developed countries. Behera and Parida (2011) (and Behera et al 2012) study the technology spillover effects of FDI in Indian manufacturing industries. The authors find that spillovers are higher for industries like food products, textiles, chemicals etc. Labour productivity and market size are found to be major determinants of FDI inflows into the Indian manufacturing sectors.

3.4 For our purpose we have considered net value added of the industry as the size variable, growth of value of output as the growth indicator, applied tariff (MFN), export intensity, import intensity, skill labour intensity and market concentration as determinants of FDI flows across manufacturing sectors in India.

4. Data and Sources

4.1 The data used for analysis have been collected from Annual Survey of Industries and matched with FDI data from Department of Industrial Promotion and Policy (DIPP, GOI) and firm-level data from PROWESS database (CMIE). Appropriate price deflators were used to account for movement of prices for the variables used over time. This data was collected from Department of Economic Affairs (GOI) (Table 3). Eleven sectors at three-digit NIC level (2004) were used for the study which spanned across 2003-04 to 2009-10. The concordance between FDI figures and NIC 2008 sectors were done by NCAER in their study on FDI in 2009. We have used the concordance between NIC 2004 and NIC 2008 to use the FDI data for our purpose. Table 2 depicts the matching of sectors

used in the study. The sectors have been chosen according to share of total FDI between the years 2000 and 2012. The manufacturing sectors with more than 0.50 share have been chosen for the study.

4.2 Variables like net value added, value of output and skill-intensity have been obtained from Annual Survey of industries (ASI) various issues. Export-intensity, import-intensity and market concentration[9] have been calculated from firm-level data aggregated to the industry-level from PROWESS database. Tariff data across sectors for the study period have been obtained from Planning Commission, Data Hand Book (DHB). DHB gives yearly tariff data across broad categories like intermediate goods, capital goods, consumer goods and mining. We have taken simple average MFN (Most Favored Nation) applied tariffs in these categories for our purpose.

5. Empirical Methodology

5.1 The following empirical model was used for our study:

$$l(fdi)_{it} = \beta_0 + \beta_1 l(nva)_{it} + \beta_2 l(gr\_vao)_{it} + \beta_3 l(tar)_{it} + \beta_4 l(ex\_sal)_{it} + \beta_5 l(imp\_sal)_{it} + \beta_6 l(lab\ int)_{it} + \beta_7 hhi_{it} + \varepsilon \quad (1)$$

where $(fdi)_{it}$ is the inflow of FDI into the i^{th} sector at the t^{th} time period;

nva_{it} is the net value added by the i^{th} sector at the t^{th} time period;

gr_vao_{it} is the annual growth of the value of output of i^{th} sector at the t^{th} time period;

tar_{it} is the average MFN applied tariff rate imposed for i^{th} sector at the t^{th} time period;

ex_sal_{it} is the export intensity for i^{th} sector at the t^{th} time period, calculated as the ratio of value of export to the net value added.

imp_sal_{it} is the import intensity for i^{th} sector at the t^{th} time period, calculated as the ratio of value of import to the net value added.

$lab\,\text{int}_{it}$ is the labour intensity of the i^{th} sector at the t^{th} time period, calculated as the ratio of skilled wage to the total emoluments.

hhi_{it} is the measure of competition among the firms in terms of Herfindahl-Hirschman Index (HHI) of the i^{th} sector at the t^{th} time period.

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[9] Herfindahl Index (HHI) has been calculated from firm-level data in each of the industry categories.

$HHI = \sum_i S_i^2$, where S_i is the share of the ith firm.

First we use a pooled OLS regression estimation method flowed by the panel data estimation. The panel data methodology can be presented briefly considering the following model.

$$y_{it} = \alpha + \beta\, x_{it} + v_i + \varepsilon_{it} \quad (2)$$

where y is the dependent and x is the set of explanatory variables for the i^{th} cross section unit in t^{th} time period. v_i is the unit-specific residual; it differs between units, but for any particular unit, its value is constant. The variable v_i captures all unobserved, time constant factors that affect Y_{it}. ε_{it} is the usual residual with the usual properties (mean zero, uncorrelated with itself, uncorrelated with x, uncorrelated with v, and homoskedastic). Here the error part is correlated with the explanatory variables and OLS regression is not possible. Time demeaning of the variables removes the unobserved factors as below.

$$\left(y_{it} - \overline{y_i}\right) = \beta\left(x_{it} - \overline{x_i}\right) + \left(\varepsilon_{it} - \overline{\varepsilon_i}\right) \quad (3)$$

$$Y_{it} = \beta X_{it} + u_{it} \quad (4)$$

In this case OLS regression method can be used for fixed effect estimation.

5.2 For random effects the unobserved factor v_i is uncorrelated with other explanatory variables that are independent of all explanatory variables and in all time periods. This results in violating the assumption of non autocorrelation and homoscedasticity of the disturbance term. Generalised least square estimation in this case provides estimates of random effects.

5.3 Before doing the formal panel data estimation stationarity of the variables were examined through unit roots test by applying Levin-Lin-Chu (2002) procedure considering the restriction that all panels share a common autoregressive parameter. For this test panels need to be balanced. Consider a simple panel data with first order autoregressive component as

$$y_{it} = \rho_i y_{it\text{-}1} + z_{it}^{'}\gamma_i + \varepsilon_{it}$$

Where y_{it} is the panel variable of interest and z_{it} can represent panel specific intercept and trend or nothing. ρ and γ are the parameters of the process. Now panel unit-root tests are used to test the null hypothesis $H_0 : \rho_i = 1 \forall i$ against the alternative hypothesis $H_a : \rho_i < 1$. In case of Levin-Lin-Chu test we consider $\rho_i = \rho$. The test assumes that ε_{it} is independently distributed across panels and follows a stationary ARMA process for each panel.

In an alternative way we can express the specification as

$$\Delta y_{it} = \varphi y_{i,t\text{-}1} + z_{it}^{'}\gamma_i + \varepsilon_{it}$$

In Levin-Lin-Chu test in order to mitigate the serial correlation of ε_{it} the model is augmented with additional lags of the dependent variable specified as,

$$\Delta y_{it} = \varphi y_{i,t-1} + z_{it}^{'}\gamma_i + \sum_{j=1}^{p} \theta_{ij} \Delta y_{i,t-j} + u_{it}$$

The test assumes that ε_{it} is independently distributed across panels and follows a stationary invertible autoregressive moving-average process for each panel. By including sufficient lags of Δy_{it} , u_{it} will be white noise.

In our case, the Levin-Lin-Chu test found the variables to be stationery at levels. The results of the test are presented in Table 4 at the end of the paper.

6. Estimation Results

6.1 The fixed effects model has been found to be appropriate for our purpose given the Hausman test (Hausman 1978) results reported in Table 5. The results show that manufacturing FDI in India is significantly negatively affected by tariffs, import-intensity and R&D intensity, whereas it is significantly positively impacted by concentration of market power. FDI inflows has been higher in those sectors where market imperfections give an opportunity to exploit ownership advantages of FDI allowing companies to increase their margins and hence profits. Overall, our results support the efficiency-seeking objective of inward FDI flows. The negative relationship between tariffs and FDI shows that reduction of tariff barriers has encouraged FDI which is efficiency seeking (Goldar and Banga (2007)). Further, FDI flows are negatively impacted by import-intensity across sectors. The period of study considered had experienced consolidation of FDI flows into India and overall reduction in tariffs. Since lower resource cost is one of the pull factors for FDI, sectors more dependent on imports (meaning non-availability or higher cost of local factors) have received lesser foreign inflows.

6.2 In case of R&D intensity similar results have been found by Chung and Alcacer (2002) who find that on average high tech firms locate their FDI in low-tech industries. Mishra (2011) finds a similar result in case of India. The author concludes that low-tech firms invite foreign participation for assimilation of better technology. Caves (1996) were one of the first studies which found positive relationship between FDI flows and market concentration in empirical work. In case of India Athreye and Kapur (1999) found a positive correlation between FDI inflows and HHI at the three-digit industry classification level. The reasons given for such flows are possibility of higher profit for FDI making firms given the market imperfection present in the sector in the host country.

7. Conclusion

7.1 In case of India FDI flows picked up after the significant dose of liberalization happened in early 1990s. The flows became significantly higher in the year 2000 and thereafter specifically in services sectors. Manufacturing FDI poured in significantly in drugs and pharmaceuticals, chemicals (excluding fertilizers) and automobiles. Much of

the FDI were domestic market driven, cost-efficiency seeking and export-oriented. We have used appropriate variables from past studies and according to theoretical conjectures to find out the driving forces behind manufacturing FDI in India. Our results show that manufacturing FDI in India is significantly negatively affected by tariffs, import-intensity and R&D intensity, whereas it is significantly positively impacted by concentration of market power. FDI inflow has been higher in those sectors where market imperfections give an opportunity to exploit ownership advantages of FDI making companies to increase their margins and hence profits. The negative relationship between tariffs and FDI shows that FDI has been efficiency-seeking. Further, FDI flows have been lower in high cost sectors more dependent on imports. High-tech firms are generally less dependent on FDI.

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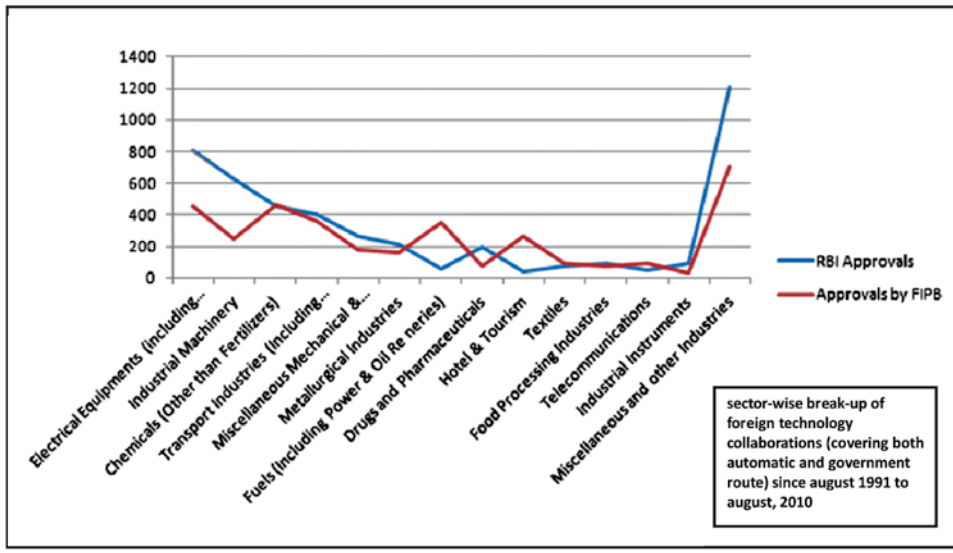
Figure 1: Sector-wise Automatic vs. Approval Route 1991 to 2010



Source: DIPP Annual Report 2011

Figure 2: Distribution of FDI Proposals across States/UTs 1991 to 2010

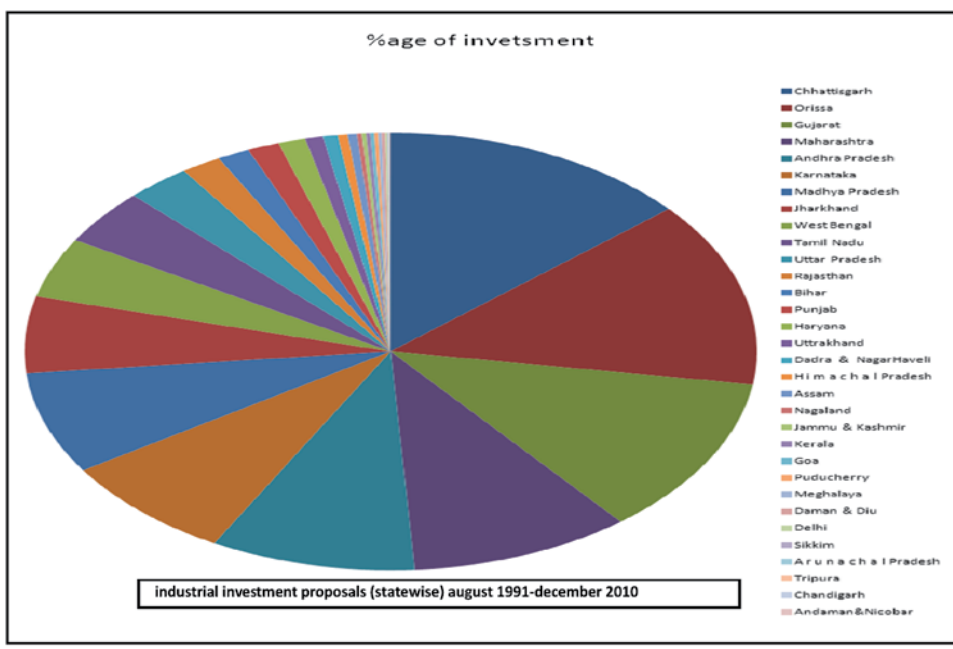
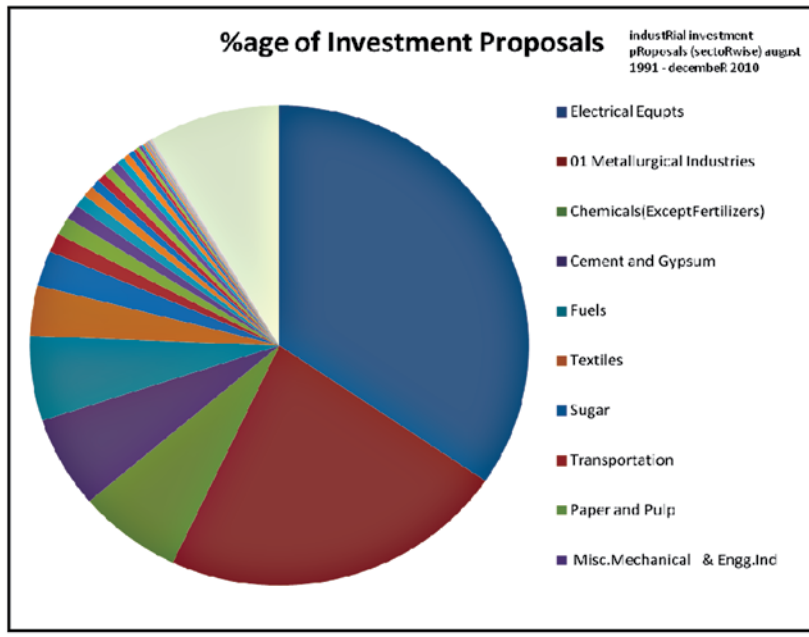


Figure 3: Distribution of FDI proposals Sector-wise 1991 to 2010



Data Source: DIPP

Table 1: Change in Doing Business Ranking of India between 2010 and 2011

Items	dB 2011	dB 2010	Change in rank
(Overall)	134	135	1
Starting a Business	165	168	3
Dealing with Construction Permits	177	176	-1
Registering Property	94	90	-4
Getting Credit	32	30	-2
Protecting Investors	44	41	-3
Paying Taxes	164	168	4
Trading Across Borders	100	93	-7
Enforcing Contracts	182	182	No change
Closing a Business	134	137	3

Table 2: Matching Industry data with FDI data

NIC 2004	NIC 2008	FDI Sectors
151, 152, 153, 155	101-108, 110	Food Processing & Fermentation
171	131	Textiles
210	170	Paper
233,241, 242	201,202,210	Chemicals & Drug and Pharmaceuticals
269	239	Cement
271,272,273	241,242, 243	Metallurgical
300, 321, 322, 323, 331-333	261-268	Electronics
293, 311-315, 319	271-275, 279	Electrical Equipment
292	282	Industrial Machinery
341-343	291-293	Automobile & Ancillary

Table 3: Deflators used

Variables	Deflators
Wages	CPI (IW)
skilled wage	CPI (UNME)
value of output	IIP of that sector
net VAD	IIP of that sector

Table 4: Panel data unit root test results (Levin-Lin-Chu Test)

Variable	Description	Value of LLC bias adjusted test statistic t^*_σ	P-Value	Conclusion
lfdi	Log of FDI	-6.6671	0.0000	Panels are stationary
lnva	Log of net VAD	-1.8e+04	0.0000	Panels are stationary
gr_vao	Growth of Value of Output	-4.4517	0.0000	Panels are stationary
lex_sal	Log of export to sales ratio	-16.4110	0.0000	Panels are stationary
limp_sal	Log of Imports to Sales ratio	-25.4063	0.0000	Panels are stationary
lres_sal	Log of R&D to Sales ratio	-80.1268	0.0000	Panels are stationary
hhi	Herfindahl Index	-3.3797	0.0004	Panels are stationary
llabint	Log of skilled labour wages to total wages	-30.1724	0.0000	Panels are stationary

Table 5: Panel Estimation Results

Description	Variable	(1)	(2)
Log of FDI	lfdi	**Fixed Effects**	**Random**
Log of net VAD	lnva	0.483	1.846**
		(0.46)	(3.04)
Growth of Value of Output	gr_vao	1.010	-0.146
		(1.47)	(-0.21)
Log of tariff	ltar	-3.938***	-0.860
		(-3.60)	(-1.31)
Log of export to sales ratio	lex_sal	-1.459	-0.519
		(-1.46)	(-0.91)
Log of Imports to Sales ratio	limp_sal	-2.217*	0.0165
		(-2.03)	(0.03)
Log of R&D to Sales ratio	lres_sal	-2.231*	0.156
		(-2.04)	(0.65)
Herfindahl Index	hhi	43.44*	8.984
		(2.51)	(1.06)
Log of skilled labour wages to total wages	llabint	0.641	1.802
		(0.52)	(1.63)
	_cons	-9.694	-5.387
		(-0.66)	(-0.82)
	N	66	66

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Hausman Test
χ^2 (8) = 53.56
Prob > χ^2 = 0.000

Pooling of Central and State Sample ASI 2009-2010 data – Gujarat experience

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Abstract

Given the sampling design currently followed in ASI, district level estimates cannot be obtained from central sample alone whereas estimates at NIC-4 digit level cannot be obtained from state sample alone. It is only through pooling the central and state samples, that estimates at district and NIC-3digit level can be generated provided the two sets of data fulfil a few basic conditions of poolability.

In this paper, an attempt has been made to estimate the parameters at District level after pooling the state level data of ASI for the state of Gujarat, with the corresponding central data. Comparison between the overall state estimates, trend with time series data and utility of survey of state sample ASI units were studied.

This study also analyses the change in variance estimates and points of validation of the data and non-response cases for last five years.

1. Introduction

1.1 Annual Survey of Industries (ASI) is the principal source of industrial statistics on the registered manufacturing sector of the economy and a main component for estimating state domestic product. A part of the ASI frame is surveyed every year by the Field Operations Division (FOD) of National Sample Survey Office (NSSO) and is called the *central sample*. In addition to that, *state samples* are drawn from the *residual frame*, which are surveyed by the State Directorates of Economics and Statistics (DES). A major drawback of the central sample is that it cannot generate district level estimates, which is of paramount importance for micro-level planning. Since districts are taken into consideration at the time of stratum formation for state sample, it is possible to generate district level estimates from state sample. However, a pooled sample (central + sample) should ideally give a better estimate provided the criteria for pooling are satisfied.

1.2 Reference period for ASI 2009-2010, data for which have been used in this study, was the accounting year of the factory, ending on any day during the fiscal year 2009-2010. Thus in ASI 2009-2010, data collected from respective establishment relate to their accounting year ended on any day between 1st April 2009 and 31st March 2010. The Survey was conducted in the year 2010-2011.

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1.3 This paper attempts to generate the district level estimates for the state of Gujarat based on pooled sample. Before doing so, the paper also discusses the issues relating to poolability of the central and the state samples and checks for the quality of estimates in terms of RSE. The paper also generates state level estimates of a few important economic parameters and compares them with the estimates based on central sample alone. As an academic exercise, an attempt has also been made in this paper to generate district level estimates from central sample alone based on the available sample observations. In order to do so, notional stratification has been imposed on the central sample, considering that the samples were selected from the entire frame ignoring the census units with District X NIC 3 digit classes as strata. Accordingly, the multipliers have been adjusted.

1.4 The presentation of the study is as follows: Section 2 of the paper describes the ASI frame from which central and state samples are drawn. Section 3 and 4 respectively gives a detailed account of the survey design followed for ASI 2009-10 and the estimation procedures adopted to generate the estimates for this study. Some issues relating to pooling and poolability of central and state sample are discussed in Section 5. A brief account of the data validation carried on the state sample data collected by the DES Gujarat is given in Section 6. Major findings of the study are presented in Section 7. Finally, Section 8 offers some concluding remarks.

2. ASI Frame

2.1 The ASI frame is based on the lists of registered factory units maintained by the Chief Inspector of Factories (CIF) in each state and those maintained by registration authorities in respect of bidi and cigar establishments and electricity undertakings. The frame is being revised and updated periodically by the Regional Offices of the Field Operations Division of NSSO in consultation with the Chief Inspector of Factories in the state. At the time of revision, the names of the de registered factories are removed from the ASI frame and those of the newly registered factories are added. In spite of regular updating of the frame, quite a number of small sized factories selected for the survey are found to be non existing in the field and are termed as deleted factories. However, such factories are not taken into consideration for the purpose of tabulation and analysis in the report. All electricity undertakings other than captive units as well as all departmental undertakings such as Railway workshops, etc. have been kept outside the purview of ASI from 1999-2000.

3. Sample Design and Sample Allocation

3.1 Sample design in ASI has undergone changes from time-to-time keeping in view of technical as well as procedural aspects and also the time and resource constraints for data collection. From the very beginning, the entire ASI frame has been divided into two sectors, viz. Census and Sample, based primarily on some worker size criteria. While the census sector has always been surveyed every year, a part of sample sector has been surveyed following some sampling methodology. The definition of census sector, however, has undergone changes over the time. A brief review of the sample design followed in 2009-10 is given in the following paragraph, which is important for a better understanding of the results.

As per the sample design followed in 2009-10, a census sector has been defined as

(1) All industrial units belonging to the six less industrially developed states/ UT's viz. Manipur, Meghalaya, Nagaland, Sikkim, Tripura and Andaman & Nicobar Islands.

(2) For the rest of the twenty six states/UTs, (a) units having 100 or more workers and (b) all units covered under 'joint return'.

(3) Strata (State by 4-digit of NIC-08) having less than or equal to four units after selecting the Census Sector units as defined above were also selected as census sector.

3.2 All the remaining units in the frame were collectively called the sample sector. For central sample, samples have been drawn circular systematically from the sample sector considering a uniform sampling fraction of 19% within each stratum (State X Sector X NIC-4 digit) for each state. An even number of units with a minimum of four units from each stratum were selected and were distributed evenly in two sub-samples. The sectors considered here were Biri, Manufacturing and Electricity.

3.3 After selecting the central sample, the remaining units in the sample sector were treated as residual frame for selection of sample units for the States/UTs. For selecting samples from the residual frame for the State/UTs, stratification was done afresh by grouping units belonging to *District X 3-digit NIC* for each state to form strata. Considering sampling fraction of 10% in general within each stratum, the sample units were then drawn circular systematically from each stratum with a minimum of four units and evenly distributed in two sub-samples. Strata having less than or equal to 4 units were again completely enumerated. The basic purpose of introducing the residual sample was to increase the sample size for the sample sector of the states so as to get more reliable estimates at district level.

3.4 Following this sample design, for ASI 2009-10, the size of the frame along with the sizes of the central and state sample for the state of Gujarat were as follows:

Number of Units in ASI Frame	Central Sample			State Sample	Total selected Units (for pooled sample)
	Census	Sample	Total		
20,919	1,611	3,792	5,403	3,154	8,557

4. Estimation Procedure:

4.1 For estimating the characteristics at state (district) level using the pooled sample, the entire sample (census as also sample) has been treated as census i.e. with multiplier 1. The details of the estimation procedure is given below:

Notations:

i = subscript for i-th district, s = subscript for s-th stratum in the i-th district

m = subscript for sub-sample (m =1, 2),

k = subscript for k-th sample enterprise under a particular stratum

E = total number of factories in the residual frame in a stratum
e = number of factories surveyed out of total number of factories in the residual frame in a stratum
x, y = observed value of characteristics x, y under estimation
$\hat{X}$, $\hat{Y}$ = estimate of population total X, Y for the characteristics x, y

Under the above symbols,

y_{ismk} = observed value of the characteristic y for the k-th enterprise belonging to the m-th sub-sample for the s-th stratum in the i-th district.

The estimate for any characteristic based on the residual sample is obtained first for each district using formula (1) below. Then, the estimate for the i-th district based on the state sample is obtained using formula (2), where $\hat{Y}''_i$ corresponds to the estimate for that characteristic of the enterprise for the census sector of the i-th district. Note that the census sector of the i-th district would comprise of all units of the census sector as well as sample sector of the central sample belonging to the i-th district. Lastly, the state level estimates are obtained by using formula (3) below, that is, by aggregating the estimates over all the districts in the state.

Estimation formula for any characteristic of the enterprises for the residual sample of the i-th district is:

$$\hat{Y}'_i = \sum_{s=1}^{e_s} \left[\frac{E_{is}}{e_{is}} \left[\sum_{k=1}^{e_{is1}} y_{is1k} + \sum_{k=1}^{e_{is2}} y_{is2k} \right] \right] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The corresponding sub-sample wise estimate from the residual sample of the i-th district is:

$$\hat{Y}'_{im} = \sum_{s=1}^{e_s} \left[\frac{E_{is}}{e_{ism}} \sum_{k=1}^{e_{ism}} y_{ismk} \right], \quad m = 1,2. \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.1)$$

If $\hat{Y}_i''$ be the corresponding estimate for the central sample (treated like census sector in case of a state sample) of the i-th district, then the estimate for that characteristic for the i-th district as a whole is given by:

$$\hat{Y}i = \hat{Y}'_i + \hat{Y}_i'' \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The estimate of the characteristic for the entire state is:

$$\hat{Y} = \sum_i \hat{Y}_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

4.2 Estimates of Error for Aggregate $\hat{Y}$: The variance is to be estimated for the residual sample units only. The estimated variances of the estimates at district level are as follows:

$$\hat{Var}(\hat{Y}_i) = \sum_s \hat{Var}(\hat{Y}_{is}) \quad \text{..... (4)}$$

where $\hat{Var}(\hat{Y}_i)$ are

$$\hat{Var}(\hat{Y}_i) = \sum_s \{(\hat{Y}_{is1} - \hat{Y}_{is2})/2\}^2 \quad \text{..... (5)}$$

For the entire state, the estimated variances of the estimates are as follows:

$$\hat{Var}(\hat{Y}) = \sum_i \hat{Var}(\hat{Y}_i) \quad \text{..... (6)}$$

4.3 Estimates of RSE:

$$\hat{RSE}(\hat{Y}) = \frac{\sqrt{\hat{Var}(\hat{Y})}}{\hat{Y}} \times 100 \quad \text{..... (7)}$$

4.4 Multipliers for enterprises:

The formulae for multipliers for a stratum are given below:

formula for sub-sample wise multiplier	formula for combined sample multiplier
$\frac{E_{is}}{e_{ism}}$, i= 1 or 2.	$\frac{E_{is}}{e_{is}}$

4.5 Treatment for surveyed cases and casualty cases:

While counting the number of units surveyed (e_{ism}) in the m-th sub-sample of a stratum, all the units with survey codes 1 to 6 and 11 to 14 in Item 12, Block A have been considered, i.e., all the units which were open & functioning, closed but chance of opening in future and units which were not functioning during the reference period.

Casualty cases: Units with survey codes 7 to 10 and 15 as per Item 12, Block A were treated as casualties, i.e. for those units, ASI return were not received due to non-response but the units were functioning during the reference period.

While processing the state sample, eighteen casualty units' data were extracted from last year central sample data as the same procedure is followed in the processing of central sample too. There were three cases where sub-sample was found void and these strata were merged within the district.

In this study, as the Subsample codes for State Sample were not available, pseudo codes were generated to calculate RSE of the characteristics.

5. Poolability of central and state sample data

5.1 There are some basic principles of pooling. Pooling of any two sets of data (central and state sample) require a few fundamental conditions to be satisfied. The most basic requirements for pooling is that State and Central sample data should have common layout, should be poolable and processed simultaneously. In order to achieve them, there should be a mechanism in place which will ensure:

(a) Use of common software / layout for both State and Central sample data.

(b) Uniform standard of processing by the state and the central agency (CSO).

(c) Timely processing of State sample data.

From application point of view, there are a few aspects that are required to be taken care of. Some of these aspects are listed below:

(a) Both the data sets should be validated. In other words, there should not be wide divergence in the extent of non-sampling errors in two data sets.

(b) The estimates based on two data sets should be *poolable*, in the sense that the estimated variances of two estimates, primarily, should not vary much and secondly, the two estimates are perceptible, that is, they should closely describe the true situation of the population. In case two estimates are widely divergent, one may seriously doubt their closeness to the true value of the parameter and look for an external source to get an idea of the true value of the parameter.

(c) Two sets of validated data should be available within a reasonable time after completion of survey.

5.2 As per the methodology suggested by Sardana and Minhas[2], the question of poolability depends largely on the quality of data – generally measured in terms of the magnitude of the estimates obtained compared to its actual value and secondly, the magnitude of the relative standard errors of the estimates. For the estimates of an indicator (θ), say t_1 and t_2 with relative standard errors r_1 and r_2, respectively obtained from the central sample and state sample data, if the divergence, $d = t_1 - t_2 \approx 0$ (i.e., small) and r_1 and r_2 are within the acceptable margins (r_0), one may argue that the estimates are acceptable in the sense that they are close to each other and the pooling of the two estimates t_1 and t_2 would improve the reliability. Pooling of both the estimates, even though lie on the same side of the true value, may result in a small loss of information in respect of error, i.e., its closeness to its true value, but may result in significant gain in the precision.

Almost all these issues of pooling central and state sample have been taken into consideration in this paper.

[2] Sardana and Minhas, Sarvekshana, 1990

6. State Sample Data Validation

6.1 Central Sample data were processed by CSO (I S Wing) and results for ASI 2009-10 have already been published. State Sample data for Gujarat were processed by Gujarat, DES and supplied to CSO (I S Wing) to generate central & state pooled estimates. The same data validation rules, that are followed for processing the central sample were given to the State DES of Gujarat along with some software packages used for this purpose. Hence it may assumed that data validation for both central and state sample were done in a similar manner which is a necessity for pooling such data. However, as the DES Gujarat processed the ASI data for the first time, the state sample unit level data were checked and further validated before pooling the same with the central sample. Some observations are given in the following paragraphs.

6.2 Status of unit code given in the item 12 of Block A of ASI schedule is a very important figure for ASI tabulation as the multipliers are calculated on the basis of these figures. Percentage of units falling in different status for the last few years for central sample and for the Gujarat state sample for the year 2009-10 are given in Annexure-I.

6.3 It may be seen from the table that a significant percentage (21.72%) of state samples were found deleted (less than 3 years). This may be due to the fact that status of a sample sector factory, unless selected for survey, is not updated at the time of dynamic updation of the ASI frame, and hence remains in the frame as a live factory, making it eligible for selection. Another important feature of the state sample is high (more than 5.42%) percentage of casualty (with status of unit code 7, 8, 9, 10) in comparison to the central sample (1.58% in 2009-10). Considering the total size of the state sample, this number is quite high and affects the quality of the estimates.

Validation of other Blocks C to J were also carried on and some observations are given below:

Block-A:

- In DSL-241468, PSL No. was not matching with the Sample List and it was posted.

Block-C:

Block C was checked for column totals in Col. 7 (Closing Gross Value), Col. 11 (Depreciation up to the yearend), Col. 12 (Net opening value) & Col. 13 (Net closing value) and for row totals in Item 8 (Sub-totals) & 10 (Totals). In many cases, figures in col. 7, 11, 12 & 13 were available without the detailed figures in other columns. Details of such cases are given below:

- Details of Col. 12 not available for 6,426 cases.
- Details of Col. 13 not available for 803 cases.
- Details of Col. 11 not available for 6 cases.
- Details of Col. 7 not available for 16 cases.
- Column total mismatch for Col.13 in 6,012 (58%) cases.

- Column total mismatch for Col.12 in 5,677 (55%) cases.
- Column total mismatch for Col.11 in 5,766 (56%) cases.
- Column total mismatch for Col.7 in 2,596 (25%) cases.
- Row total mismatch for Col.13 in 1,451 (33%) cases.
- Row total mismatch for Col.12 in 1,383 (32%) cases.
- Row total mismatch for Col.11 in 48 (1%) cases.
- Row total mismatch for Col.7 in 717 (16%) cases.

It is to be noted that 'cases' here refer to individual records within a schedule and not a schedule as a whole. As Block C detailed data were not available for many small units, Col.13 figures for total item 10 were taken for generating pooled estimates.

Block-D & Block-G:

- All the sub-totals were checked and found correct.

Block-E:

- All the sub-totals were checked and found correct.
- Wages per worker appeared to be very high in many cases. Unit-wise these cases may be checked and modified, if found wrong.

Block-F:

- Mismatch was observed in Item-7, column 3, sub-total (total expenses) in DSL-241553, and the same was corrected with total of Item 1 to Item 6.

Block-H:

- Only column 6, purchase values were checked for sub-totals at item 12 & item 23.
- Item 12 (Total Basic item), column 6 did not match in two cases (DSL-242076 & 242200) with the constituent individual entries and the same were corrected with corresponding individual entries.
- Item 23 (Total input items), column 6 did not match in 2165 cases and all the sub-totals were corrected with the corresponding detailed item values.

Block-I:

- Only column 6, purchase values were checked for sub-total item 7 and mismatch was found in only one case DSL-242257, which was corrected with the corresponding detailed item values.

Block-J:

- Columns 5 to 13 (quantity manufactured, quantity sold, gross sale value, excise duty, sales tax/VAT, other distributive expenses and total distributive expenses respectively in that order) were checked mainly for calculation of ex-factory values.
- In one return (DSL 240891), there was an abnormal variation in the quantity sold and quantity manufactured figure which resulted in an abnormally high unit rate for that item and consequent high ex-factory value of output. The

same was corrected using the mean rate of the item and corresponding adjustment in quantity sold.

- Mismatch in Sub-total for col.13 were found in four cases and were corrected.
- Col.13, calculation of ex-factory values did not match in more than 1500 cases and in all such cases, the same were calculated using the figures in items 5 to 11 using the relation given in the schedule [i.e. Ex-factory value = Quantity manufactured * (Gross Sale Value-Total Distributive Expenses)/Quantity sold].
- 14 cases were found where item 5, quantity manufactured and item 6, quantity sold were non-zero but item 7 or item 13 were zero. These were not modified and need to be checked.

6.4 Overall, it was found that, in 26 cases, entire data were duplicated. The list of DSL No.s is given in Annexure II. These cases should be checked and if found duplicate, accordingly, data may be corrected. However, data for all these units were considered for estimation in this study as the identification particulars (DSL and PSL numbers) of these units were different. It is assumed that the units might have submitted one consolidated return (joint return) and as there cannot be a joint return in the state sample, the figures have been equally distributed (apportioned) among the individual returns.

7. Data Analysis and Major Findings

7.1 District and state level estimates for a few selected characteristics for the state of Gujarat have been generated using the estimation procedure described in Section 4. Table 1 shows the estimated figures obtained from central sample alone (published by CSO) and from the pooled sample (central and state sample pooled) for a few important characteristics.

7.2 It may be observed from the table that only for wages to worker, the variation in two estimates is little more than 10%. For all other characteristics the two estimates resemble closely (with less than 10% variation) with estimates from pooled sample being higher for almost all the parameters except the estimated number of total and open units, and number of female and contractual workers. The GVA from the pooled sample is 9.7% higher from the central sample for the state.

7.3 The growth rate (in current prices) observed in these characteristics for the last four years is given in Table 2. The growth rates in table 2 are calculated from the central sample alone for the years 2006-07 to 2008-09. For the year 2009-2010, the same has been calculated using the central as well as pooled sample. Both the estimates for 2009-2010 show a marked increase in growth rate for parameters like fixed capital, invested capital, input, output, GVA over the last few years. However, for fixed capital, invested capital, GVA, wages to worker and total emoluments, the growth rate calculated using the pooled sample estimate is significantly higher than that computed from central sample for the year 2009-2010.

7.4 RSE of estimates for these characteristics calculated from the pooled and central sample is given in table 3. Table-3 shows that the RSE of estimates generated from the

central sample alone is consistently lower than that calculated from the pooled sample. However, it may be noted that stratification of the central sample is *NIC-4 digit within State* and state sample is stratified by *District x NIC-3 digit*. Thus, two sets of RSE may not be exactly comparable. As per common notion, state sample stratification is much more heterogeneous than the central sample stratification and that is revealed in these RSE estimates. Although in an ideal situation one would expect the RSE of the pooled estimates to be better than that of the central sample estimates, this may not hold good if the heterogeneity in the state sample is much more.

7.5 The state and central sample results broadly satisfy almost all the pre-requisites for pooling viz. use of same layout and validation rules for data processing, timely availability of state and central data. However, there is ample scope of improvement in the quality of processing of the state sample (even the central sample, so to say). Also it seems that both the estimates are not very widely divergent, indicating thereby that both sets are close to the true population parameter. Although, the estimated RSEs of two sets of estimates are not quite close in many cases, but, pooled estimates is the only option to generate estimates at district level.

7.6 The district level estimates of the selected characteristics based on the pooled sample are given in Annexure-IV. The estimates of RSE for these district level estimates are given in Annexure-V.

7.7 The same district names and district codes as used for ASI frame for 2009-2010 has been used for this study. It is observed from the ASI 2009-10 frame that there is no factory in two districts viz. Dang and Tapi.

7.8 It may be seen from Annexure-IV, that highest number of factories is observed in Ahmedabad (3595) followed by Vadodara (1896), Rajkot (1855) and Surat (1783). Although the district Jamnagar has only 243 factories it has got the highest fixed capital and invested capital followed by Surat, Varuch and Vadodara. However, the total invested capital in Jamnagar is more than double the invested capital in Surat, which indicates presence of some large units in this district. The first three ranking among the states remain the same in terms of total input consumed and total output produced. However, in terms of Gross Value Added (GVA), Jamnagar again tops the list, closely followed by Rajkot and Surat. Among all the districts in Gujarat, Surat generated the highest employment both in terms of total number of workers and total persons engaged, with Ahmedabad being the second in the list. Total compensation paid to the workers in terms of wages to worker and total emoluments to the employees has been highest in the district of Surat followed by Ahmedabad and Vadodara. Wages paid per worker is highest Vadodara with districts Panch Mahal, Bharuch and Amreli being the next in the list in that order. Emolument per employee is, however, highest in Amreli followed by Vadodara.

7.9 An attempt to impose the state-sample stratification criteria (i.e. District X NIC 3 digit) in central sample to generate district level estimates from central sample alone reveals that out of 868 such strata at the state level, there are 283 strata which were not represented by the central sample. All the sample units were assigned pseudo sub-sample (SS) codes (SS1 and SS2) for the purpose of calculation of RSE for such estimates. In 218

cases, it was found that either of the subsamples was void and the affected strata were merged in such cases. Details of the method used are given in Annexure III.

7.10 It may, however, be remembered that such an estimate (district level estimates generated from central sample only) is essentially a post stratification estimate as the (post) stratification variables (i.e. district) is different from the original stratification variables (state) for central sample. A problem with such post stratification is that non-representation of a post stratified domain in terms of sample points does not necessarily mean the stratum (population) itself is void.

7.11 It may be observed from the tables (4 & 5) that the post-stratification estimates from the central sample closely resemble the original estimates obtained from the central sample at the state level. The difference in RSE of estimates for these two sets of estimates from central sample is mainly due to the reconstruction of the stratum.

7.12 District-wise estimates for a few important parameters have been generated from the post-stratified central sample and the results of 4 major districts selected in terms of Output, Fixed capital, Employment and Emoluments are given in the table-6. It may be observed from the table-6 that although district level estimates can theoretically be generated based on the selected central sample units falling under a district, such estimates may significantly differ from the pooled estimates. In case of Jamnagar, the difference in two sets of estimates (post-stratified census sample and pooled sample) is very low because of the presence of a very strong census sector in the district. It has been calculated that more than 99% of the total output, input, GVA, fixed capital of the entire district is contributed by the census factories leaving very little scope of variation among the post-stratum census estimates and pooled estimates. It is also seen that the proximity of two sets of estimates in all other parameters for all other districts is also due to the same fact, i.e. presence of an overwhelmingly strong census sector (with 80% or more contribution) that controls the estimate of the entire district. On the other hand, in case of Rajkot, where contribution of the census sector towards the estimates of the entire district is very low for almost all the parameters, the estimates are largely dependent on the sample sector units (sample units of central sample and state samples respectively), which are quite divergent in many cases.

8. Concluding Remarks

8.1 The study shows that if the state sample is surveyed and processed concurrently with the central sample maintaining a uniform standard of data validation and data processing using the same layout, tabulation strategy and same sets of data validation rules, pooling of state and central sample is possible. Moreover, if the estimates are reasonably close and the variance estimates are also close, such a pooling would result in a better estimate at state level. It may, however, be remembered that RSE of central and state sample may not be exactly comparable because of difference in stratum formation for the two sets of sample. Most importantly, with the help of a pooled sample one can generate estimates at district level which can be used for estimates of District Domestic Product and for micro-level planning. Maintaining a certain quality of data is, however, of utmost importance for such estimates both at central and state level. However, estimated

RSE of principal characteristics at district level from pooled samples are very high in many cases and this requires a thorough evaluation of the sample design that uses different stratification criteria for selection of central and state sample. Moreover, care should be taken to reduce the non-response in the state sample to the maximum extent possible. The ASI state data of Gujarat can be further improved by making some more probing and referring the data back to the field, if required. High incidence of deletion cases in the state sample probably points out to the dynamic updation of the ASI frame using the state sample (surveyed cases) too in addition to the central sample, as is the practice now. Also, noting the small samples from a few districts, it is recommended to increase the size of the state sample, so as to ensure a better representation in terms of units selected for survey and consequent better control over the variability of the estimates.

Table 1: Table showing estimates of a few selected characteristics from central and pooled sample for the state of Gujarat for ASI 2009-10 along with their percentage difference.

Estimated Principal Characteristics**	(Value Figures in Rs.Lakhs & Others in numbers)		
	Central Sample	Pooled Sample	Percentage difference
1. Number of units	15,576	15,349	-1.46
2. Number of Open Units	15,339	15,183	-1.02
3. Fixed Capital	2,40,38,135	2,56,84,246	6.85
4. Invested Capital	3,42,81,035	3,62,59,863	5.77
5. Total Input	5,34,38,782	5,59,69,037	4.73
6. Total Output	6,42,65,756	6,78,49,688	5.58
7. Gross Value Added	1,08,26,974	1,18,80,651	9.73
8. Workers	8,90,600	9,05,870	1.71
8.1 Male Worker	5,23,057	5,63,150	7.67
8.2 Female Worker	27,741	27,539	-0.73
8.3 Contractual Workers	3,39,803	3,15,181	-7.25
9. Wages to Worker	6,79,673	7,49,143	10.22
10. Wage per worker*	0.76	0.83	9.21
11. Total Persons Engaged	11,59,239	12,25,235	5.69
12. Total Emoluments	15,58,915	16,58,415	6.38
13. Emolument per person employed*	1.34	1.35	0.75

* Rates in Item 10 & 13 are in Rs. Lakh

** All the figures are estimated based on the central sample alone or pooled sample, as the case may be.

Table 2: Table showing growth rate (in current prices) using last five years data

Principal Characteristics	Central Sample				Pooled ASI 09-10
	ASI 06-07	ASI 07-08	ASI 08-09	ASI 09-10	
1. Number of units	1.9	5.4	-1.6	4.8	3.3
2. Number of Open Units	1.9	4.9	-0.6	5.6	4.6
3. Fixed Capital	10.1	10.5	18.5	39.5	49.0
4. Invested Capital	12.9	13.2	17.8	38.8	46.9
5. Total Input	24.7	19.6	16.2	23.3	29.2
6. Total Output	21.0	20.3	13.4	26.5	33.5
7. Gross Value Added	5.0	24.2	-0.6	44.8	58.9
8. Workers	12.0	6.4	9.3	2.2	3.9
8.1 Male Worker	11.4	2.7	4.9	5.3	13.4
8.2 Female Worker	1.2	1.6	-0.9	1.5	0.8
8.3 Contractual Workers	14.4	13.5	17.3	-2.2	-9.3
9. Wages to Worker	21.1	18.9	12.2	14.5	26.3
10. Wage per worker	7.3	11.9	3.0	11.8	22.1
11. Total Persons Engaged	10.9	6.3	7.7	3.0	8.9
12. Total Emoluments	21.5	19.1	18.1	19.6	27.2
13. Emolument per person employed	9.3	12.8	9.4	15.5	16.4

Table 3: RSE of selected characteristics from central and pooled sample for the state of Gujarat for ASI 2009-2010

Principal Characteristics	Central Sample	Pooled Sample
1. Total Output	1.36	2.39
2. Total Input	1.02	1.72
3. Gross Value Added	4.46	9.57
4. Fixed Capital	0.63	1.87
5. Invested Capital	0.58	1.61
6. Worker	1.34	2.65
7. Wages to worker	1.06	3.32
8. Employee	1.26	3.49
9. Total Emoluments	2.15	2.64

Table 4: Table showing estimates of a few selected characteristics from central sample maintaining the original stratification and with the new stratification (District X NIC 3 digit) and pooled sample for the state of Gujarat for ASI 2009-10

Principal Characteristics	(Value Figures in Rs. Lakhs & Others in Numbers)		
	Central Sample (original)	Central Sample (post-stratification)	Pooled Sample
1. Number of units	15,576	14,951	15,349
2. Number of Open Units	15,339	14,721	15,183
3. Fixed Capital	2,40,38,135	2,38,31,148	2,56,84,246
4. Invested Capital	3,42,81,035	3,39,70,313	3,62,59,863
5. Total Input	5,34,38,782	5,29,95,246	5,59,69,037
6. Total Output	6,42,65,756	6,37,41,073	6,78,49,688
7. Gross Value Added	1,08,26,974	1,07,45,828	1,18,80,651
8. Workers	8,90,600	8,77,372	9,05,870
9. Wages to Worker	6,79,673	6,71,855	7,49,143
10. Wage per worker*	0.76	0.77	0.83
11. Total Persons Engaged	11,59,239	11,40,188	12,25,235
12. Total Emoluments	15,58,915	15,35,512	16,58,415
13. Emolument per person employed*	1.34	1.35	1.35

* Rates in Item 10 & 13 are in Rs. Lakh

Table 5: RSE of selected characteristics from central sample maintaining the original stratification and with the new stratification (District X NIC 3 digit) and pooled sample for the state of Gujarat for ASI 2009-2010

Principal Characteristics	Central Sample (original)	Central Sample (post-stratification)	Pooled Sample
1. Total Output	1.36	1.17	2.39
2. Total Input	1.02	1.04	1.72
3. Gross Value Added	4.46	4.18	9.57
4. Fixed Capital	0.63	0.71	1.87
5. Invested Capital	0.58	0.69	1.61
6. Worker	1.34	1.86	2.65
7. Wages to worker	1.06	1.46	3.32
8. Employee	1.26	1.72	3.49
9. Total Emoluments	2.15	2.13	2.64

Table 6: Estimates of a few selected characteristics from post-stratified central sample and pooled sample for 4 selected districts of Gujarat for ASI 2009-10 along with their percentage difference.

Principal Characteristics	Pooled Sample	Central Sample	Percentage difference	Pooled Sample	Central Sample	Percentage difference
	RAJKOT			JAMNAGAR		
1. Number of units	1,855	1,761	5.37	243	237	2.48
2. Number of Open Units	1,840	1,739	5.81	234	232	0.73
3. Fixed Capital	7,18,978	3,70,763	93.92	81,93,415	81,94,610	-0.01
4. Invested Capital	10,59,415	6,84,703	54.73	1,10,62,018	1,10,62,108	0.00
5. Total Input	18,78,441	17,82,747	5.37	1,83,38,640	1,83,28,194	0.06
6. Total Output	37,86,991	20,53,566	84.41	2,06,94,682	2,06,82,854	0.06
7. Gross Value Added	19,08,550	2,70,819	604.73	23,56,042	23,54,660	0.06
8. Workers	91,562	63,296	44.66	35,006	34,083	2.71
9. Wages to Worker	47,563	37,564	26.62	33,598	32,923	2.05
10. Total Persons Engaged	1,19,449	78,957	51.28	40,577	39,387	3.02
11. Total Emoluments	88,584	70,765	25.18	51,454	51,422	0.06

Table 6(Contd.): Estimates of a few selected characteristics from post-stratified central sample and pooled sample for 4 selected districts of Gujarat for ASI 2009-10 along with their percentage difference.

Principal Characteristics	Pooled Sample	Central Sample	Percentage difference	Pooled Sample	Central Sample	Percentage difference
	VADODARA			SURAT		
1. Number of units	1,896	1,934	-1.96	1,783	1,757	1.51
2. Number of Open Units	1,887	1,921	-1.79	1,752	1,732	1.14
3. Fixed Capital	25,84,073	24,05,325	7.43	36,19,819	34,94,609	3.58
4. Invested Capital	36,80,296	34,08,525	7.97	54,18,612	53,28,552	1.69
5. Total Input	68,49,335	64,17,287	6.73	69,37,090	69,43,221	-0.09
6. Total Output	81,40,463	76,11,078	6.96	88,04,784	93,45,332	-5.78
7. Gross Value Added	12,91,128	11,93,791	8.15	18,67,694	24,02,111	-22.25
8. Workers	83,067	84,800	-2.04	1,88,681	1,93,263	-2.37
9. Wages to Worker	1,03,005	88,956	15.79	1,68,622	1,72,043	-1.99
10. Total Persons Engaged	1,23,482	1,21,319	1.78	2,28,388	2,33,856	-2.34
11. Total Emoluments	2,73,698	2,40,753	13.68	2,85,119	2,95,825	-3.62

Annexure I

Table A-I: "Status of unit" code (A12) wise percentage distribution of units

Status of Unit code	Status of Units	Central Sample (%)								State (%)
		ASI 02-03	ASI 03-04	ASI 04-05	ASI 05-06	ASI 06-07	ASI 07-08	ASI 08-09	ASI 09-10	ASI 09-10
1	Open	76.00	76.34	76.99	75.67	72.68	72.16	75.00	76.50	67.91
2	Closed	1.31	1.66	1.63	1.78	1.72	2.00	1.30	0.96	0.76
3	Not in operation	6.67	5.49	4.78	5.80	4.33	4.51	4.94	5.62	0.82
4	Deleted less than 3yr	6.19	7.26	6.42	10.09	11.54	11.58	10.59	10.25	21.72
5	NR closure	1.95	2.27	1.00	0.93	1.38	1.10	1.83	1.76	1.08
6	NR non-existence	0.18	0.43	0.33	0.13	0.29	0.78	0.67	0.68	2.28
7	NR records with IT/Court	0.31	0.16	0.15	0.09	0.03	0.08	0.21	0.02	0.00
8	NR reactant/ Refusal	0.41	0.28	0.31	0.33	0.69	0.65	0.44	0.24	3.01
9	NR prosecution	0.08	0.02	0.00	0.02	0.05	0.00	0.10	0.02	0.00
10	NR other	1.77	0.57	1.04	0.48	1.57	1.83	1.83	1.30	2.41
11	Deleted more than 3yr	2.75	4.60	6.20	3.03	4.20	3.10	2.02	1.07	0.00
12	De-registered	0.62	0.10	0.08	0.02	0.13	0.34	0.17	0.26	0.00
13	Out of coverage	0.21	0.16	0.13	0.07	0.05	0.08	0.08	0.02	0.00
14	Identical PSL	1.13	0.55	0.40	0.67	0.84	1.07	0.57	0.87	0.00
15	Deleted any other reasons	0.44	0.12	0.54	0.87	0.51	0.72	0.25	0.43	0.00
ALL		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Note: NR means Non-response, thus NR closure means Non-response due to closure of the units etc.

Annexure II

Table A-II: The duplicate DSL numbers found in the state data

Srl.	DSL duplicate
1	240536 with 240896
2	240487 with 240797
3	242013 with 242045
4	240215 with 240216
5	242967 with 242968
6	242077 with 242083
7	240100 with 240111
8	242911 with 242912
9	241709 with 241710
10	240375 with 240380
11	241905 with 241911
12	241760 with 241829
13	240263 with 240288
14	240109 with 240121
15	242824 with 242847
16	242468 with 242493
17	240642 with 240651
18	240997 with 240998
19	242232 with 242259
20	240131 with 240134
21	240252 with 242137
22	242943 with 242944
23	242368 with 242369
24	240189 with 240190
25	242494 with 242496
26	240151 with 240152

Annexure III

Method used for generation of District level estimates from Central Sample alone

ASI units are stratified at NIC 4 digit level within state/u.t. for Central Samples. Then two sets of samples are selected from each stratum one for Sub-sample 1 and other for Sub-sample 2. RSE is calculated as sum of the function of the sub-sample 1 and sub-sample 2 estimates of each stratum as given in formula (7) of *Estimation Procedure.*

Whereas, stratification used for State sample is at District X NIC 3 digit level. Now, from the 20,919 ASI units of Gujarat (during 2009-2010), 868 strata at District x NIC 3 digit level can be formed. Now, considering 5,403 Central Sample units selected from these strata, it is found that there is no selected units from 283 such strata and 218 strata do not have any sample in either sub-sample 1 or in sub-sample 2.

Pseudo Sub-sample numbers were allotted to each Central Sample units as 1 or 2 as alternate numbers within each stratum, starting randomly with the ascending order of DSL number of the selected units. (DSL number is despatch serial number, a unique running number allotted to each selected unit each year.) The process is adopted to divide the units of each stratum into two equal sub-samples. In case of odd number of samples, divisions are not equal.

As RSE is function of both sub-sample estimates, stratum void cases will not have any effect in RSE estimate, therefore, each such void stratum were merged with other homogeneous stratum, in this case, it is merged with same 3-digit NIC with nearer District or nearer 3-digit NIC within the same District. In case, such stratum is not available, then it is merged with nearer 3-digit NIC with nearer District.

After merging, total number of units in each stratum and number of surveyed units are calculated to generate multiplier for each such merged stratum. Accordingly, as per the formulae given in the section *Estimation Procedure,* estimates of Principal Characteristics and RSE are calculated.

Annexure IV

Table A-IV: District wise estimates of Principal Characteristics from Pooled Sample of Gujarat for ASI 2009-10

Principal Characteristics	GUJARAT STATE	KACHCH	BANS KANTHA	PATAN
1. Factories	15,349	294	82	83
2. Open Units	15,183	290	81	82
3. Fixed Capita	25,684,246	1,858,991	58,387	93,343
4. Invested Capital	36,259,863	2,623,723	96,801	199,111
5. Total Input	55,969,037	3,470,410	524,805	467,157
6. Total Output	67,849,688	4,069,673	535,289	709,171
7. Gross Value Added	11,880,651	599,263	10,484	242,015
8. Workers	905,870	53,818	4,651	3,965
8.1 Male Worker	563,150	22,089	3,695	2,550
8.2 Female Worker	27,539	2,939	17	52
8.3 Contractual Workers	315,181	28,791	939	1,362
9. Wages to Worker *	749,143	38,243	3,298	3,506
10. Wage per worker	0.83	0.71	0.71	0.88
11. Total Persons Engaged	1,225,235	67,617	7,977	4,841
12. Total Emoluments	1,658,415	80,991	8,064	7,477
13. Emolument per person employed*	1.35	1.20	1.01	1.54

Principal Characteristics	MAHESANA	SABAR KANTHA	GANDHI NAGAR	AHMEDA-BAD
1. Factories	659	141	748	3,595
2. Open Units	656	141	748	3,547
3. Fixed Capita	387,082	73,615	740,705	1,330,621
4. Invested Capital	637,255	135,258	991,658	2,142,422
5. Total Input	1,673,927	294,469	1,799,423	4,274,156
6. Total Output	1,932,873	322,925	2,103,941	4,960,243
7. Gross Value Added	258,946	28,456	304,518	686,087
8. Workers	30,185	10,054	45,323	144,485
8.1 Male Worker	17,692	5,172	27,112	72,955
8.2 Female Worker	791	535	550	3,241
8.3 Contractual Workers	11,702	4,347	17,661	68,289
9. Wages to Worker *	20,372	6,030	34,153	115,212
10. Wage per worker	0.67	0.60	0.75	0.80
11. Total Persons Engaged	41,202	12,749	62,970	197,608
12. Total Emoluments	47,707	12,149	92,328	283,936
13. Emolument per person employed*	1.16	0.95	1.47	1.44

* Rates in Item 9 & 13 are in Rs. Lakh

Annexure IV

Table A-IV(Contd.): District wise estimates of Principal Characteristics from Pooled Sample of Gujarat forASI 2009-10

Principal Characteristics	SURENDRA NAGAR	RAJKOT	JAM NAGAR	POR BANDAR
1. Factories	296	1,855	243	31
2. Open Units	292	1,840	234	31
3. Fixed Capita	34,319	718,978	8,193,415	69,054
4. Invested Capital	56,045	1,059,415	11,062,018	89,387
5. Total Input	103,011	1,878,441	18,338,640	94,141
6. Total Output	124,192	3,786,991	20,694,682	115,039
7. Gross Value Added	21,182	1,908,550	2,356,042	20,898
8. Workers	6,020	91,562	35,006	5,259
8.1 Male Worker	3,855	79,252	6,359	1,508
8.2 Female Worker	590	6,321	473	143
8.3 Contractual Workers	1,576	5,989	28,174	3,608
9. Wages to Worker *	3,230	47,563	33,598	2,921
10. Wage per worker	0.54	0.52	0.96	0.56
11. Total Persons Engaged	8,711	119,449	40,577	6,395
12. Total Emoluments	7,689	88,584	51,454	5,507
13. Emolument per person employed*	0.88	0.74	1.27	0.86

Principal Characteristics	JUNAGADH	AMRELI	BHAV NAGAR	ANAND
1. Factories	199	32	255	415
2. Open Units	197	30	247	410
3. Fixed Capita	494,718	265,005	154,659	143,698
4. Invested Capital	571,231	336,422	342,166	254,755
5. Total Input	306,286	249,157	443,118	509,014
6. Total Output	386,149	477,962	524,470	531,575
7. Gross Value Added	79,863	228,805	81,352	22,561
8. Workers	12,201	3,160	10,233	15,308
8.1 Male Worker	7,093	1,178	6,957	8,924
8.2 Female Worker	1,136	6	299	235
8.3 Contractual Workers	3,973	1,976	2,977	6,150
9. Wages to Worker *	11,969	3,174	6,409	10,473
10. Wage per worker	0.98	1.00	0.63	0.68
11. Total Persons Engaged	15,550	4,692	14,000	21,130
12. Total Emoluments	19,863	10,784	14,287	27,243
13. Emolument per person employed*	1.28	2.30	1.02	1.29

* Rates in Item 9 & 13 are in Rs. Lakh

Annexure IV

Table A-IV(Contd.): District wise estimates of Principal Characteristics from Pooled Sample of Gujarat for ASI 2009-10

Principal Characteristics	KHEDA	PANCH MAHAL	DOHAD	VADO DARA
1. Factories	206	251	59	1,896
2. Open Units	204	251	59	1,887
3. Fixed Capita	129,682	371,358	58,813	2,584,073
4. Invested Capital	176,692	562,685	79,981	3,680,296
5. Total Input	254,378	750,295	108,836	6,849,335
6. Total Output	308,895	886,055	162,534	8,140,463
7. Gross Value Added	54,516	135,760	53,699	1,291,128
8. Workers	10,523	16,930	1,416	83,067
8.1 Male Worker	4,294	10,265	970	48,053
8.2 Female Worker	477	315	26	1,667
8.3 Contractual Workers	5,753	6,350	420	33,348
9. Wages to Worker *	6,256	20,943	1,179	103,005
10. Wage per worker	0.59	1.24	0.83	1.24
11. Total Persons Engaged	13,541	27,113	2,109	123,482
12. Total Emoluments	12,205	56,930	3,646	273,698
13. Emolument per person employed*	0.90	2.10	1.73	2.22

Principal Characteristics	NARMADA	BHARUCH	SURAT	NAVASARI
1. Factories	9	659	1,783	282
2. Open Units	9	647	1,752	278
3. Fixed Capita	15,864	3,362,180	3,619,819	94,162
4. Invested Capital	26,945	4,386,060	5,418,612	172,175
5. Total Input	24,658	4,625,385	6,937,090	296,581
6. Total Output	27,225	5,792,087	8,804,784	311,898
7. Gross Value Added	2,567	1,166,703	1,867,694	15,317
8. Workers	761	44,726	188,681	15,018
8.1 Male Worker	551	22,586	157,460	10,394
8.2 Female Worker	40	762	1,465	1,873
8.3 Contractual Workers	170	21,379	29,756	2,751
9. Wages to Worker *	653	52,381	168,622	8,958
10. Wage per worker	0.86	1.17	0.89	0.60
11. Total Persons Engaged	958	63,989	228,388	20,981
12. Total Emoluments	1,148	139,690	285,119	26,511
13. Emolument per person employed*	1.20	2.18	1.25	1.26

* Rates in Item 9 & 13 are in Rs. Lakh

Annexure IV

Table A-IV(Contd.): District wise estimates of Principal Characteristics from Pooled Sample of Gujarat for ASI 2009-10

Principal Characteristics	VALSAD
1. Factories	1,275
2. Open Units	1,267
3. Fixed Capita	831,709
4. Invested Capital	1,158,750
5. Total Input	1,696,326
6. Total Output	2,140,571
7. Gross Value Added	444,245
8. Workers	73,518
8.1 Male Worker	42,187
8.2 Female Worker	3,589
8.3 Contractual Workers	27,742
9. Wages to Worker *	46,995
10. Wage per worker	0.64
11. Total Persons Engaged	119,206
12. Total Emoluments	101,404
13. Emolument per person employed*	0.85

* Rates in Item 9 & 13 are in Rs. Lakh

Annexure V

Table A-V: District wise RSE of Principal Characteristics from Pooled Sample of Gujarat for ASI 2009-10

Principal Characteristics	GUJARAT STATE	KACHCH	BANS KANTHA	PATAN
1. Total Output	2.39	2.88	53.40	2.82
2. Total Input	1.72	3.55	54.14	4.76
3. Gross Value Added	9.57	1.59	18.67	1.67
4. Fixed Capital	1.87	0.67	37.28	1.18
5. Invested Capital	1.61	0.88	41.89	2.54
6. Worker	2.65	1.40	22.47	4.83
7. Wages to worker	3.32	1.52	33.22	2.99
8. Employee	3.49	1.43	40.32	4.61
9. Total Emoluments	2.64	1.50	43.69	1.79

Principal Characteristics	MAHESANA	SABAR KANTHA	GANDHI NAGAR	AHMEDA BAD
1. Total Output	8.05	4.72	15.98	14.00
2. Total Input	8.16	5.61	18.74	14.71
3. Gross Value Added	10.44	5.91	9.01	11.18
4. Fixed Capital	16.34	19.23	26.95	15.30
5. Invested Capital	10.97	13.47	20.47	13.11
6. Worker	9.17	9.06	5.56	5.56
7. Wages to worker	13.95	11.29	10.25	18.42
8. Employee	7.55	7.40	4.73	4.99
9. Total Emoluments	7.17	5.95	7.17	11.94

Principal Characteristics	SURENDRA NAGAR	RAJKOT	JAM NAGAR	POR BANDAR
1. Total Output	6.17	34.17	0.15	2.22
2. Total Input	8.20	11.89	0.13	2.70
3. Gross Value Added	8.95	60.62	1.13	4.73
4. Fixed Capital	4.69	40.99	0.02	1.22
5. Invested Capital	5.93	33.94	0.03	1.18
6. Worker	7.31	23.58	1.52	0.45
7. Wages to worker	4.69	15.67	0.65	2.43
8. Employee	5.33	23.76	1.79	1.00
9. Total Emoluments	5.21	15.75	0.88	2.22

Annexure V

Table A-V (Contd.): District wise RSE of Principal Characteristics from Pooled Sample of Gujarat for ASI 2009-10

Principal Characteristics	JUNAGADH	AMRELI	BHAV NAGAR	ANAND
1. Total Output	5.24	15.29	11.67	4.29
2. Total Input	5.79	6.29	17.49	4.67
3. Gross Value Added	11.62	25.09	22.32	73.00
4. Fixed Capital	0.23	0.12	0.68	13.02
5. Invested Capital	1.69	0.18	4.22	9.45
6. Worker	4.22	0.25	4.23	6.64
7. Wages to worker	1.74	0.05	3.08	5.79
8. Employee	3.73	0.22	2.73	7.30
9. Total Emoluments	1.62	0.04	6.97	8.60

Principal Characteristics	KHEDA	PANCH MAHAL	DOHAD	VADO DARA
1. Total Output	11.12	6.10	3.53	4.86
2. Total Input	10.57	4.71	5.09	4.65
3. Gross Value Added	21.00	17.18	0.41	13.48
4. Fixed Capital	7.14	10.38	0.40	5.24
5. Invested Capital	6.08	7.33	0.79	5.40
6. Worker	4.07	4.77	0.40	3.47
7. Wages to worker	3.94	4.82	0.25	7.23
8. Employee	6.09	12.65	0.27	4.67
9. Total Emoluments	6.77	9.01	2.06	6.71

Principal Characteristics	NARMADA*	BHARUCH	SURAT	NAVA SARI
1. Total Output	0.00	2.49	4.02	14.99
2. Total Input	0.00	2.68	5.06	12.56
3. Gross Value Added	0.00	2.22	2.62	248.99
4. Fixed Capital	0.00	2.40	5.02	31.62
5. Invested Capital	0.00	2.00	3.54	31.47
6. Worker	0.00	2.31	3.68	12.56
7. Wages to worker	0.00	2.57	3.32	8.79
8. Employee	0.00	2.01	3.81	14.30
9. Total Emoluments	0.00	2.83	3.01	22.74

* All the units of Narmada district were surveyed under complete enumeration of state sample.

Annexure V

Table A-V(Contd.): District wise RSE of Principal Characteristics from Pooled Sample of Gujarat for ASI 2009-10

Principal Characteristics	VALSAD
1. Total Output	3.41
2. Total Input	4.49
3. Gross Value Added	7.47
4. Fixed Capital	4.18
5. Invested Capital	3.64
6. Worker	2.56
7. Wages to worker	2.07
8. Employee	24.01
9. Total Emoluments	3.33

Industrial Structure and Performance in Andhra Pradesh and Gujarat vis-à-vis India: A Comparative Study using ASI Data

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Abstract

This paper examines the industrial structure and performance, at all India, AP and Gujarat levels using the ASI data from 2000-01 to 2010-11 on some of the major structural and technical parameters. To analyze the structural changes at all India and selected states level, variables like the number of factories, fixed capital, working capital, total number of workers, net value added, gross fixed capital formation, total input, total output and depreciation are used. To examine the industrial performance, structural ratios such as workers per factory, fixed capital per factory, gross real output per worker and net real value added per worker and technical coefficients like fixed capital to gross output (capital output ratio) and net value added to gross output are employed.

Analysis established that, some of the key industrial indicators like fixed capital, working capital, total output and net value added both at the selected states and national level were observed to be increasing during the period of study. The analysis also confirmed that the number of factories operating under Factories Act, 1948 in AP, Gujarat and at all India level has marginally increased. The growth in the Gross fixed capital formation showed a mixed response of rise and fall.

The analysis of structural ratios confirmed that the ratio of real output per worker at national and states level has increased, the ratio of number of workers per factory and the ratio of fixed capital per factory has mildly increased. Finally, the technical coefficient viz., the capital output ratio was found to be dropping.

On the whole the analysis revealed that the industrial sector of Gujarat is significantly contributing to the national average compared to AP.

I. Background

1.1 The Indian Industrial sector has gained momentum in the last decade or so with the proactive role by the government of India in general and by the respective states in particular. Several proactive industrial promotion and investment policies have been initiated and implemented by many states to usher growth of the industrial sector. To promote industrial investments, single window clearance and provision of several economic

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incentives has become the norm of the day for many states. Also, over a period of time the states have thrived to establish world class industrial infrastructure (such as ports, airports, expressways, quality power supply, water supply) along with ensuring supply of power at the cheapest industrial tariff, promoting entrepreneurial energies in private as well as public sector. More importantly, a positive mindset and increased skilled labour force across the industries in the states have also played constructive role in the overall development and growth of the industrial sector.

1.2 Against this backdrop, if one observes over the last decade or so the Indian industrial sector has grown tremendously though the industrial sector experienced some dip in the growth during 2011-12 and thereafter largely on account of the global economic meltdown (Table 1). During 2004-05 to 2008-09, India's average growth rate of net state domestic product in industry was 8.54 percent. The major contributors of this growth among other states are the southern states such as Andhra Pradesh, Karnataka and Tamil Nadu (Table 1). Similarly, states like Bihar, Gujarat, Madhya Pradesh, Maharashtra and Orissa among others have also contributed significantly to this impressive growth (Table 1). For instance, the average growth rate of net state domestic product in industry of Orissa and Gujarat was 17.53 percent and 12.65 percent respectively during 2004-05 to 2008-09.

1.3 Today, the state of Gujarat is considered as one of the highly industrialized states in India. Gujarat's Gross State Domestic Product (GSDP) and per capita Net State Domestic Product (NSDP) have increased significantly showing all signs of a developed, urbanized and progressive economy. Gujarat has strategically developed some of the key sectors like energy, industry and agriculture. It has been observed that the domino effects of economic liberalization is very much clearly evident in Gujarat vis-à-vis other states and it has emerged stronger and a beacon of hope for the rest of the country in terms of economic and industrial development leading the way for other states to emulate.

1.4 Today, Gujarat has a reputation of being a highly investor-friendly state which has helped the state to attract high volumes of industrial investment besides making it the most favoured investment destination in the country. More importantly, the investment climate and industry friendly policies of Gujarat have made it industrially vibrant state in the country. Today, Gujarat is among the top few states in India to attract investments and create jobs. In line with this the state began organizing the Vibrant Gujarat Global Investment Summit from 2003 onwards to showcase Gujarat as a major investment destination.

1.5 On the industrial infrastructure facade, Gujarat has moved from conventional industrial clusters to industrial estates and advanced further to establish several Special Economic Zones (SEZs) mainly to boost manufacturing sector, increase exports and generate employment. The State has further moved to set up truly world class huge-sized Special Investment Regions (SIRs) by enacting Gujarat Special Investment Regions Act in 2009 to provide for establishment, operation and management of large size investment regions and industrial areas and to specially enable their development as global hubs of economic activities supported by world class infrastructure, premium civic amenities, centre of excellence and proactive policy framework.

1.6 Establishing these SIRs is in line with the upcoming Dedicated Freight Corridor between Delhi and Mumbai and the Delhi-Mumbai Industrial Corridor. Similarly, these SIRs will have a great synergy with Gujarat's upcoming International Finance Tech-City popularly known as Gujarat International Finance Tech-City.

1.7 The state has also established the District Industries Centres which function at the districts level in the State. The main purpose of establishing them is to provide all assistance under one roof to the entrepreneurs engaged in dispersed and diversified industries and to those proposing to establish small and cottage industries.

1.8 On the same lines, the state of Andhra Pradesh (AP) has also shown significant growth in the state economy both in terms of GSDP and per capita NSDP and is also considered as highly industrially progressing state. Especially in the last decade, AP has witnessed significant and remarkable growth in all the three sectors of the state economy. Over a period of time AP has taken a number of economic measures and initiatives to promote industrial establishment, investment and growth mainly after economic liberalization. One such prominent measure is the enactment of "Industrial Single Window Clearance Act" in 2002 for speedy processing and issue of various approvals, clearances and permissions required for setting up of an industrial undertaking and also to create an investment friendly environment in the State.

1.9 Continuing the trend of providing various industrial incentives, the government of AP has approved a new "Industrial Investment Promotion Policy 2005-2010" emphasizing on creation of quality infrastructure, building industrial competency in women, improving quality competitiveness, promoting export, creating environmental friendly climate, attracting foreign direct investment and other mega investments, providing access to market, securing intellectual property rights, fostering industrial clusters, prevention of industrial sickness, preventing migration and permitting industries to exit are some of the highlights of the aforesaid industrial policy.

1.10 Apart from its industrial policies the government has provided additional benefits for the establishment of industries and promotion of investment from time to time. Prominent among them are: (1) The provision of "Industrial Infrastructure Development Fund" (IIDF) to provide infrastructure facilities such as roads, electricity, water drainage and other infrastructure facilities at the doorstep of the proposed industry in all those areas identified by the state government as industrial areas and (2) The introduction of Critical Infrastructure Balancing Scheme (CIBS) to the industrial Associations, Service Societies and other NGOs for the development of certain critical infrastructure which are essential to guarantee the viability of the infrastructure projects and for the up gradation of the infrastructure amenities such as water supply, electric sub-stations, laying of roads or effluent treatment plants in the existing industrial estates, Small Scale Industries (SSI) clusters identified under the SSI cluster development programme.

1.11 Today, the state of AP has several industrial parks which directly or indirectly provide quality infrastructural facilities. Prominent among them are Mega Infrastructure Park, Apparel Export Park, Hardware Park, Genome Valley, Bio Technology Park, Food Processing Park, Green Industrial Park and also a Special Economic Zone (SEZ) at

Visakhapatnam. Further, the state has provided a network of Industrial Estate (IEs) and Industrial Development Areas for locating industries at specific growth points. For instance, the gas exploration in the Krishna Godavari basin raised scope for setting up of Petro-Chemical Complexes and a host of gas based industries.

1.12 To accelerate the industrial growth, AP has taken up several initiatives by enhancing the infrastructure network through road widening and surface improvement of roads, upgrading the local airports to international airports, extension and introduction of new trains and railway lines, development of new sea ports, increasing the power generation by promoting new power projects and so on. The focus is on development of key sectors like pharmaceuticals, biotechnology, food processing and agro-based, chemicals, leather, textiles, precision components, aero-space engineering, electronics and semiconductors and automobile & auto-components to accelerate the industrial growth in the state by creating sector specific industrial infrastructure such as Biotech Parks, Textile Parks, Leather Parks, Auto Parks, Fabcity and Hardware Parks.

II. Growth and Sectoral Contribution: AP, Gujarat and All India

2.1 The most important aggregate of the state accounts is the growth of GSDP. This is a crucial macro economic indicator used to measure the growth and to study the structural changes taking place in the state's economy. The growth estimates of GSDP over a period of time reveal the extent and direction of the changes in the level of economic development. The growth of GSDP at factor cost is regarded as the most important single economic indicator to measure the growth and pattern of economic development of a state. The state economies normally mirror the national economy growth patterns. Therefore, in order to study the state GDP growth trends, it is important to examine the growth pattern experienced by India. Therefore, a comparative picture of real growth of India vis-à-vis AP and Gujarat during 2005-06 to 2011-12 is depicted in Figure[2] 1.

2.2 As can be observed from Figure 1, India registered a high year-on-year real growth rate especially during 2005-06 to 2007-08. The registered year-on-year growth was 9.48 percent, 9.57 percent and 9.32 percent respectively during 2005-06 to 2007-08. There was some deceleration in growth of real GDP (6.72 percent) during 2008-09 which again increased to 8.39 percent during 2009-10 and 2010-11. However, the year-on-year growth of GDP fell to 6.48 percent during 2011-12 (Figure 1). This high growth momentum is popularly attributed to policy reforms initiated in 1991 that led to greater private sector participation and entrepreneurial activity, market reforms that increased the flow of foreign investments into the country and globalization which gave a boost to India's trade.

2.3 During 2007-08, the world was shaken by the onset of the financial crisis that began in the US and other developed economies. India, though showing immense resilience, could not completely escape the recessionary winds. There was thus a decline in the country's growth momentum in the year 2008-09 due to the ripple effect of the global financial crisis hitting the economy. As a result the country's GDP expanded at a modest rate of 6.72 per cent in the year 2008-09. However, the Indian economy exhibited some

[2] Figures 1 to 33 are compiled by authors based on the data collected from CSO and RBI database.

recovery in the second half of the year 2009-10 on account of strong domestic demand and due to effectiveness of policy responses by the government and the central bank which helped improve the growth rate.

2.4 Gujarat has performed well since the economic reforms began in the country and liberalization has benefited the state perhaps more than any other state in India. Especially, Gujarat could manage a high real growth during 2005-06 to 2011-12 compared to AP (Figure 1). The economy of Gujarat witnessed a deceleration beginning 2006-07 which again increased to 11 percent in 2007-08 before falling again to 6.787 percent during economic crisis. From 2009-10 onwards the state of Gujarat has been growing steadily above India's GDP growth.

2.5 Contrary to Gujarat's deceleration, during 2006-07 and 2007-08 the state economy of AP registered a handsome growth (11.18 percent and 12.02 percent respectively). However, during 2008-09 (6.88 percent) and 2009-10 (4.53 percent) AP experienced a deceleration in growth. From 2010 onwards both the selected states could increase their respective SGDP moderately. The decline in the growth of these states of late can perhaps partly be attributed to the sub-prime crisis and fear of recessionary conditions across the globe. The fall in the total industrial output and a negative growth of agricultural sector in some of the years led to further decline. The growth in the industrial sector is mainly dependent on the performance of the manufacturing sector (a key sub sector of industry). The industrial sector in India showed significant resilience in the face of global economic crises that began in the year 2007-08 and which continued well into 2008-09. However, there were glimpses of revival in 2009-10 with manufacturing performing better than the previous two years (CII, 2012).

2.6 The percentage share of AP's GSDP at factor cost vis-à-vis all India compared to Gujarat is considerably significant and higher. For instance, the percentage share of AP's GSDP vis-à-vis all India has been consistently recorded at around 7.5 percent during 2004-05 to 2011-12 (Figure 2) which means that nearly 7.5 percent of national income of the country is contributed alone by the state of AP. The important point to be noted here is the percentage share of Gujarat's GSDP at factor cost vis-à-vis all India has been considerably increasing during 2004-05 to 2011-12.

2.7 The sectoral contribution of GDP provides the requisite information regarding the relative position of different sectors in the economy which not only exhibits the relative importance of these sectors in the economy's overall income national income but also helps the policy makers to develop the sectors lagging behind and also to encourage the sectors which are leading in front. The structure of the Indian economy as well as of the several state economies has undergone significant changes over time. At India and respective selected state levels, the percentage share of the industrial[3] and tertiary[4] sector

[3] This sector is also known as secondary sector which generally includes income generated from industrial mining and quarrying, manufacturing both registered and un-registered and electricity, gas and water supply.

[4] This sector is also known as tertiary sector which generally includes income generated from construction, transport, storage and communication, trade, hotels and restaurant, banking and insurance, real estate, ownership of dwellings and business services, public administration, defense and quasi-government bodies.

in GDP and GSDP respectively has increased phenomenally where as the percentage share of the agricultural[5] sector in GDP and GSDP respectively has decreased significantly over a period of time (Table 2 and 3).

2.8 For example, India's share of the industrial sector in GDP has increased from 16.6 percent to 25.9 percent during the period from 1950-51 to 1980-81 where as the share of the services sector increased from 30.3 percent during the same period. It started growing rapidly thereafter and this phenomenon became more prominent in the 1990s. Thereafter, since 1980-81, the share of the industry sector has remained in the range of 26 to 28 percent of GDP, while the entire decline in share of agriculture has been balanced by an increase in share of the services sector (Table 2).

2.9 The industrial sector is of particular importance to Gujarat compared to AP (24 percent of GSDP) which consistently contributed about 40 percent to GSDP during 2004-05 to 2011-12 (Table 3). The prominence of this sector in Gujarat's GSDP can be seen from its high level of contribution which remained more of less stable despite the economic turbulence.

2.10 The sectoral share of primary sector in the GSDP of the selected states has been declining over the period of time as has been the experience of the Indian economy (Table 3). As evidenced, the sectoral share of agriculture and other allied activities in the GSDP of Gujarat declined from 16.08 percent in 2004-05 to 12.92 percent by the end of 2011-12 (Table 3). Similarly, the sectoral share of agriculture and other allied activities in the GSDP of AP declined from 25.07 percent in 2004-05 to 19.29 percent by the end of 2011-12 (Table 3). This declining share of primary sector indicates significant structural changes in economies of these selected states over the period of time.

2.11 However, the percentage share of tertiary sector of AP and Gujarat has registered growth. For instance in Gujarat it has increased from 43.92 percent in 2004-05 to 46.01 percent by the end of 2011-12 (Table 3). Similarly, the sectoral share of tertiary sector in the GSDP of AP has increased from 50.65 percent in 2004-05 to 56 percent by the end of 2011-12 (Table 3). The main reason for this sectoral shift from agriculture to industry to services sector during 2000s could be attributed to the growth of sub-sectors of tertiary sectors like construction, transport, storage and communication, trade, hotels and restaurant, banking and insurance, real estate and business services and insurance in all both the selected states which have recorded phenomenal growth.

2.12 From the aforementioned facts it is clear that Gujarat and AP among other states have emerged as one of the highly industrially progressing states in India. Therefore, the objective of the present paper is to conduct a comparative study, analyzing the structural changes, structural ratios and technical coefficients of the Indian industrial sector with that of the state of AP and Gujarat using ASI data. This will show us the relative importance of AP and Gujarat with the other states of the country in the overall growth of the industrial sector.

[5] This sector is also known as primary sector which generally includes income generated from agriculture, forestry and logging and fishing.

2.13 The rest of the paper is organized as follows: Section III deals with the sources and nature of the data used in the analysis. Section IV examines the structural changes in the patterns of some of the important variables besides with examining the share of AP and Gujarat vis-à-vis all India. Section V analyses the industrial performance using some of the structural and technical coefficients comparing the industrial performance of India with that of AP and Gujarat. Section VI presents some of the key findings of the present study. Finally Section VII summarizes the key notes of the present paper.

III. Sources and Nature of the Data

3.1 The present study uses the data collected from Annual Survey of Industries (ASI) compiled by Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation, Government of India. Important structural and technical variables relevant to the industrial sector have been collected from 2000-01 to 2010-11 in general at all India level and in particular at AP and Gujarat level from the various issues of ASI.

3.2 To examine the industrial structure and performance of the industries registered under Factories Act, 1948; at all India and AP and Gujarat level the present study uses the following variables: Number of Factories, Fixed Capital, Working Capital, Total Number of Workers, Net Value Added, Gross Fixed Capital Formation, Total Input, Total Output and Depreciation. The concepts and the definitions as adopted by ASI pertaining to these variables are discussed in the respective section of analysis.

IV. Analysis of the Structural Parameters: A Comparison

4.1 In the following section an attempt is made to examine the changes in the industrial structure by analyzing and comparing important structural variables at India and selected states level. As mentioned earlier, the analysis is carried out covering a period of 2000-01 to 2010-11. To study the structural changes at national and state level the important variables used for the analysis are the Number of Factories, Fixed Capital, Working Capital, Total Number of Workers, Net Value Added, Gross Fixed Capital Formation, Total Input, Total Output and Depreciation.

Number of Factories

4.2 The primary unit of the enumeration in the survey is a factory in the case of manufacturing industries, a workshop in the case of repair services, an undertaking or a licensee in the case of electricity, gas and water supply undertakings and an establishment in the case of bidi and cigar industries (ASI, various issues). As noted earlier, the data collected from the respective industrial units relate to their accounting year ended on any day between 1st April and 31st March of the respective fiscal year. This implies that in any particular financial year, if the number of factories are de-registered in comparison to the preceding year, it indicates that there is a decline in the number of factories in that particular year operating under Sections 2(m)(i) and 2(m)(ii) of the Factories Act, 1948.

4.3 In figures 3 and 4, it is evident that there is a year on year marginal rise in the number of factories registered in both AP and Gujarat and at the all India level during the

period of study. It is observed that at all India level and Gujarat the number of factories registered have declined during 2001-02 to 2003-04 before they started marginally rising from 2004-05 onwards. Especially, from 2004-05 onwards the number of factories operating at all India level and Gujarat have increased where as in case of AP a year on year marginal rise in the number of factories was evident during the entire period of study. By the end of 2010-11, it is observed that the number of factories registered have steeply increased[6] at all India level, AP and Gujarat. Also, it is important to note that the number of factories operating under Sections 2(m)(i) and 2(m)(ii) of the Factories Act, 1948 in AP are considerably high compared to Gujarat. The initial decline from 2001-02 to 2003-04 at all India level and Gujarat may be due to inefficient operation of some factories in production and therefore might have become non-viable which led to the closure of those units.

4.4 AP's percentage share of number of factories vis-à-vis all India, stood between 10 percent to 12 percent where as Gujarat's percentage share of number of factories vis-à-vis all India, stood between 9 percent to 10 percent during the period of study (see figure 5). This clearly shows that AP has considerable and significant share in the factory sector as compared to Gujarat vis-à-vis all India.

Fixed Capital

4.5 According to ASI, fixed capital represents the depreciated value of fixed assets owned by the factory and those that have a normal productive life of more than one year as on the closing day of the accounting year. Fixed capital includes land including lease-hold land, buildings, plant and machinery, furniture and fixtures, transport equipment, water system and roadways and other fixed assets such as hospitals, schools, used for the benefit of the factory personnel. These fixed assets are not expected to vary in the short-run (Pani, (2007) and are generally used as an index of measuring the size of the firm. Baumol (1959) noted that the larger the firm size, the higher are the profits and perhaps earn profits at a higher rate than the small size firms. Thus, higher the investment in fixed capital, higher will be the profits besides the unit getting the benefits of economies of large scale production.

4.6 The year on year growth of the fixed capital, at the national as well as at the selected states level has been observed to be increasing during the study period (see figures 6 and 7). During the entire period of study it is evident from figure 7 that the level of fixed capital of Gujarat is significantly higher compared to AP suggesting that the level and pace of investment in fixed assets in AP is not as much as in case of Gujarat during the study period.

4.7 AP's percentage share of fixed capital vis-à-vis national level stood around 6 percent to 9 percent where as Gujarat's percentage share vis-à-vis national level stood around 16 percent to 20 percent indicating that though the number of factories is high in

[6] This steep increase in number of factories can be attributed to the changes made in the methodology adopted for estimating the number of factories for ASI 2010-11.

AP compared to Gujarat the contribution of Gujarat is significantly high in fixed capital formation vis-à-vis national level.

Working Capital

4.8 First, ASI defines working capital as the sum total of the Physical Working Capital which comprises of total inventories including raw materials and components, fuels and lubricants, spares, stores and others, semi-finished goods and finished goods as on the closing day of the accounting year. Second, working capital also includes the cash deposits in hand and at bank and the net balance receivable over amounts payable at the end of the accounting year. Working capital is required to meet day to day operational needs of a manufacturing unit and the various components of working capital held by a business enterprise helps in stabilising the production without any interruption.

4.9 As evident from the figures 9 and 10, the working capital at the national and at the selected states level has year on year mildly increased with some fluctuations observed in case of AP where it declined during 2005-06. During the entire period of study it is observed from figure 10 that the level of working capital of Gujarat is significantly higher than AP suggesting that the level of various components of working capital held by a business enterprise in AP is lower and the same may destabilize the production with regular or irregular interruptions. However, the examined trend of growth in working capital at all India, AP and Gujarat can be stated as satisfactory which also mildly increased along with the fixed capital of the manufacturing units as seen earlier during the study period.

4.10 AP's percentage share of working capital vis-à-vis national level stood around 5 percent to 7 percent where as Gujarat's percentage share vis-à-vis national level stood around 12 percent to 18 percent during the study period. During 2005-06, AP's percentage share of working capital vis-à-vis national level was recorded as low as 2.90 percent thereafter it mildly started increasing (see figure 11). However, it is important to note that a better management of working capital investment both at the national and at the states level is desired to keep the pace of production and unwarranted interruption of production there by increasing the level of efficiency.

Total Workers

4.11 Total number of workers defined by ASI includes "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".

4.12 Comparing the pattern of total workers involved in the production process at national level it can be observed that especially from 2004-05 onwards there is a drastic raise in the level of employment (see figure 12) before which some fluctuations were observed during 2000-01to 2003-04. Similarly, the total work force in both the selected states also increased drastically from 2004-05 onwards (see figure 13).

4.13 The important point to note is that from 2000-01 to 2006-07, the total work force in AP was significantly higher compared to Gujarat. However, from 2007-08, the growth of total work force in Gujarat was mildly higher compared to the state of AP indicating a secular decline in the level of employment in AP. Overall, in comparison with national level and AP, the state of Gujarat has shown a reasonably better pattern of growth in the total workforce by registering a growth of around 71.51 percent during the period of study as against the national growth of 59.20 percent and AP's growth of 44.84 percent.

4.14 From 2000-01to 2006-07 AP's share of total workforce compared to Gujarat's share vis-à-vis national level was high which thereafter declined and the state of Gujarat's share mildly increased (see figure 14). Over all, the state of AP consistently accounted for nearly, 9 percent to 12 percent of total workforce of the country during the study period thereby providing potential employment to the working class of the economy (see figure 14). Gujarat's percentage share of total workforce vis-à-vis India was recorded between 9 percent to 10 percent during the study period.

Total Input

4.15 According to ASI, total input consists of expenditure incurred on total fuels and materials consumed as well as expenditure incurred on overheads like cost of contract and commission work done by others on materials supplied by the factory, cost of materials consumed for repair and maintenance of factory's fixed assets including cost of repairs and maintenance work done by others to the factory's fixed assets, inward freight and transport charges, rates and taxes (excluding income tax), postage, telephone and telex expenses, insurance charges, banking charges, cost of printing and stationery and purchase value of goods sold in the same condition as purchased.

4.16 It is evident from the figures 15 and 16 that the total input (cost of production) has a positive slope, rising continuously during the study period both at the national level and at the selected states level. However, it is observed from figure 16 that the total input cost is substantially higher in Gujarat compared to AP during the study period. At the national level, the total input cost has recorded a growth of 26.88 percent where as a growth of 49.09 percent and 30.49 percent has been registered in case of AP and Gujarat manufacturing firms respectively during 2010-11 as compared to the corresponding previous year. Though the total input cost is higher in Gujarat, the growth of total input cost is higher in AP. Thus, the rise in the cost of inputs both at national and states level suggests that the overall expenditure of the manufacturing units have been rising which needs immediate attention of the management. However, a trade-off between the growth of input cost with that of growth of output can be drawn if and only if the proportionate growth of output is more than the proportionate growth of input cost in which case the raised input cost can be absorbed by the gains from the increased output.

Total Output

4.17 Total output represents the value of the all products and by products manufactured by a unit. As can be observed from the figures 17 and 18, the total output has steadily increased both at national level, AP and Gujarat level in the last decade. At the national

level, the total output has recorded a growth of 25.51 percent where as a growth of 47.83 percent and 28.16 percent has been registered in case of AP and Gujarat manufacturing firms respectively during 2010-11 as compared to the corresponding last year.

4.18 Though the value of total output is higher in Gujarat, the growth of total output is higher in AP. However, as observed earlier the growth in the input cost is much higher than the growth of output both at all India and at the selected states level which requires the attention of management to check the current distortion.

4.19 During the study period, AP's and Gujarat's percentage share of total output vis-à-vis at all-India level on an average respectively stood around 6.5 percent and 16.5 percent of the total output. Gujarat's contribution therefore, can be regarded as a significant share of contribution in the total output of the country (see figure 19).

Depreciation

4.20 Depreciation is the consumption cost of fixed assets which results due to wear and tear and obsolescence during the working life of the fixed capital. Since depreciation is also a cost of production, a proper mechanism is required by the manufacturing units to see that depreciation costs are not high in any particular year. During the last decade, it is evident that the depreciation cost has been steadily raising both at all India and at the selected states level (see figures 20 and 21).

4.21 For instance, during 2010-11 as compared to the corresponding previous year, the depreciation cost has increased to an extent of 14.79 percent at all India level and in case of Gujarat, the increase was around 10.16 percent which is less than the national level. However, with respect to AP, during the same period, the depreciation cost has mildly increased to only about 1.43 percent. This suggests that, there is an urgent need to bring down the depreciation cost both at national and states level in order to improve the overall profits of the manufacturing firms.

Net Value Added

4.22 Net value added of a manufacturing firm is the difference between the value of output and the total value of input cost plus depreciation. The net value added is the actual contribution of factors of production and is also considered as the component which makes up the domestic product of an economy (Pani, 2007). Thus, this measure of variable shows the relative contribution of the industrial sector to the states domestic product. Figures 22 and 23 illustrate that the net value added at national and states level has been steadily increasing implying that the relative contribution of the industrial sector to the states domestic product has been significantly rising in the last decade.

4.23 As far as Gujarat's contribution to the nation's total net value added is concerned, on an average it stood around 13 percent (see figure 24) during the study period where as AP's contribution to the nation's total net value added is concerned, on an average it contributed only about 6 percent. Thus, the contribution of Gujarat's industrial sector to the national domestic product is significant and as observed, Gujarat's net value added is consistently rising which illustrates the relative importance of Gujarat's industrial sector vis-à-vis at national level.

Gross Fixed Capital Formation (GFCF)

4.24 GFCF is defined as the new additions to the existing fixed capital and generally includes investments in plant and machinery, furniture and fixtures and land and building. Investment in fixed assets is considered as long-term investment which is the earning asset of a manufacturing unit that determines the overall level of output at any particular point of time.

4.25 GFCF, at all India level shows a very mild fall with fluctuations, particularly during 2002-03 (see figure 25). However, from 2002-03 onwards GFCF has increased steadily during the study period. GFCF in case of AP has increased steadily during the study period where as in case of Gujarat it has been fluctuating. Particularly, during 2001-02 the GFCF in Gujarat steeply raised before it fell sharply to an extent of 77.72 percent by the end of 2002-03.

4.26 Thereafter, since 2003-04 the GFCF in Gujarat has grown with fluctuations. As evidenced from figure 26, the GFCF of Gujarat is higher than that of AP. This suggests that there has been improved investment in fixed capital in the state of Gujarat compared to AP in the last decade or so.

4.27 On an average during the last decade the percentage share of Gujarat's GFCF vis-à-vis all India significantly stood around 16 percent where as AP's average percentage share of GFCF vis-à-vis national level was about 6 percent (see figure 27). However, AP's percentage share of GFCF vis-à-vis national level is seen marginally increasing over the period of time.

V. Analysis of the Structural Ratios and Technical Coefficients: A Comparison[7]

5.1 With the help of structural ratios and technical coefficients, one can assess the overall performance of the industrial sector. In the following section an attempt is made to assess the industrial performance of India in general and AP and Gujarat in particular by comparing structural ratios and technical coefficients. Structural ratios such as, workers per factory, fixed capital per factory, real output per worker and net real value added per worker (both output and value added have been deflated) have been used to examine the structural performance of the manufacturing units. To examine the technical coefficients, ratios like fixed capital to gross output (capital output ratio) and net value added to gross output have been utilized.

Real Output per Worker

5.2 Real output per worker is one of the partial measures of efficiency and is also known as partial factor productivity. It is known as a measure of partial factor productivity because output is a function of factors of production viz., land, labour, capital and organization whose proportion in the overall production is determined by the concerning

[7] The framework used here for analysis is similar to that of (Pani, 2007)

technology set. This structural ratio gives information about the production capability of workers alone and thus throws light on their contribution in the overall production process.

5.3 Figure 28 shows that the real output per worker, at all India level and at selected states level has a positive slope during the period of the study. This implies that, both at the national and states level the average labour productivity is increasing and the labour force of India is positively contributing in the overall production of manufacturing units. However, the average level of labour productivity of Gujarat is higher than the average level of labour productivity at national level. The average level of labour productivity of AP is lower than the national average level of labour productivity (see figure 28).

Real Value Added per Worker

5.4 Similarly, the ratio of real value added per worker also depicts the average productivity of labour and is also one of the partial measures of productivity. Figure 29 shows that net real value added per worker, both at all India and states level also show a similar increasing trend which was witnessed earlier in real output per worker ratio. This suggests that in India, AP and Gujarat the productivity of labour force involved in the manufacturing process is positively contributing to the overall production process. However, as observed in both the cases AP's average labour productivity is below the national average where as Gujarat's average labour productivity is above the national average which is a matter of concern for AP and perhaps needs attention.

Workers per Factory

5.5 The ratio of number of workers per factory measures not only the size of the manufacturing firm but also reflects the concentration of workers in the factory which ultimately influences the productivity of the factory. Figure 30, depicts that the average factory size at national level in terms of employment reflected by the ratio of number of workers per factory has mildly increased during 2000-01 to 2009-10 before falling back by about 19 percent in 2010-11corresponding to previous year[8]. The ratio of number of workers per factory in AP and Gujarat has shown a trend of fluctuations of raising and falling during the study period. During 2010-11, with respect to AP, the average factory size in terms of employment reflected by the ratio of number of workers per factory fell to an extent of 24 percent corresponding to the previous year where as in case of Gujarat the ratio declined to an extent of 18 percent corresponding to the previous year. The important point to observe is that both the selected states average factory size as well as India's average factory size more or less remained similar with little deviations during some years.

Fixed Capital per Factory

5.6 This ratio measures the average factory size in relation to the investments in fixed assets of the manufacturing unit. Figure 31, shows that the average factory size in terms of

[8] This decline can be attributed to the change in the methodology adopted for estimating the number of factories for ASI 2010-11 which has resulted in the steep increase in number of factories.

investments in fixed capital has been mildly increasing since 2000-01 onwards, both at national and selected states level with little fluctuations here and there. However, at the end of 2010-11 the ratio of fixed capital per factory declined drastically[9] in all the three cases. Importantly, it can also be observed that the average factory size in Gujarat is higher compared to AP and all India level, implying that the average level of investment in fixed assets in Gujarat is higher where as AP is lying below the national average indicating a declining investment in fixed assets.

Value Added to Output

5.7 As mentioned earlier, net value added is the difference between the value of output and the value of input cost plus depreciation of a manufacturing firm. Thus, the ratio of value added to output is one of the important technical coefficients that depict the cost structure of a manufacturing unit. If a particular manufacturing firm is able to manufacture one or more of its products under its single roof then it can reduce the overall production cost substantially. This not only improves the productivity of the firm but also improves the competitiveness of the firm in the market. In figure 32, it is seen that the net value added to output has remained more or less constant with some fluctuations during some years both at national and at the selected states level during the study period. This implies an increasing share of inputs cost in the total value of output which needs to be corrected. Importantly, figure 32 indicates that the state of Gujarat is really doing well compared to AP and national level as the share of inputs cost in the total value of output seems to be less thereby reducing the cost of manufacturing and increasing productivity.

Capital Output Ratio

5.8 Capital output ratio is the ratio of fixed capital to output which illustrates the relationship between the amount of units of capital required to produce a certain given level of output of a manufacturing unit. If a manufacturing firm has a high capital output ratio, it requires a large amount of capital units to produce a given level of output during any specified period and vice-versa. The capital output ratio has been steadily declining both at all India and at the selected states level suggesting the substitution of labour intensive techniques for capital incentive techniques (see figure 33).

5.9 However, during the early stages 2000's, the capital output ratio of Gujarat was well above the national average as well as AP suggesting that the manufacturing units in Gujarat were using more capital than labour in the production process in contrast to all India level and AP (see figure 33).

VI. Major Findings

6.1 Some of the major findings from the analysis of the structural parameters are listed below:

- The number of factories registered in AP, Gujarat and at all India level has marginally increased.

[9] ibid

- The number of factories operating under Sections 2(m)(i) and 2(m)(ii) of the Factories Act, 1948 in AP are considerably high compared to Gujarat.
- AP's percentage share of number of factories vis-à-vis all India, stood between 10 percent to 12 percent where as Gujarat's percentage share of number of factories vis-à-vis all India, stood between 9 percent to 10 percent.
- The year on year growth of the fixed capital, at the national as well as at the selected states level has been observed to be increasing during the study period.
- The level of fixed capital of Gujarat is found significantly higher than AP.
- AP's percentage share of fixed capital vis-à-vis national level stood around 6 percent to 9 percent where as Gujarat's percentage share vis-à-vis national level stood around 16 percent to 20 percent.
- The working capital at the national and at the selected states level has year on year mildly increased.
- The level of working capital of Gujarat is significantly higher than AP.
- AP's percentage share of working capital vis-à-vis national level stood around 5 percent to 7 percent where as Gujarat's percentage share vis-à-vis national level stood around 12 percent to 18 percent during the study period.
- From 2004-05 onwards there was a drastic raise in the level of employment at national level, AP and Gujarat.
- From 2000-01 to 2006-07, the total work force in AP was significantly higher compared to Gujarat. However, from 2007-08, the growth of total work force in Gujarat was mildly higher compared to the state of AP.
- AP consistently accounted for nearly, 9 percent to 12 percent of total workforce where as Gujarat's percentage share of total workforce was recorded between 9 percent to 10 percent during the study period.
- Total output and input registered a positive growth during period of study.
- AP's and Gujarat's percentage share of total output vis-à-vis at all-India level on an average respectively stood around 6.5 percent and 16.5 percent of the total output.
- The net value added at national and states level has been steadily increasing.
- Gujarat's contribution to the nation's total net value added on an average stood around 13 percent where as AP's contribution stood only about 6 percent.
- GFCF, at all India and selected states level showed a mixed trend of rise and fall during the study period.

6.2 Some of the Major findings from the analysis of the Structural Ratios and Technical Coefficients are reported below:

- The ratio of real output per worker, at all India level and at selected states level has raised implying that at all India and states level the average labour productivity is increasing.

- The average level of labour productivity of Gujarat is higher than the average level of labour productivity of India and AP.
- The ratio of net real value added per worker, both at all India and states level has also increased.
- The ratio of number of workers per factory has mildly increased during 2000-01 to 2009-10.
- The ratio of number of workers per factory in AP and Gujarat has shown a trend of fluctuations of raising and falling during the study period.
- The ratio of fixed capital per factory has mildly increased since 2000-01 onwards at national and selected states level with little fluctuations.
- The average factory size in Gujarat is higher compared to AP and all India level, implying that the average level of investment in fixed assets in Gujarat is higher.
- The ratio of value added to output has remained more or less constant with some fluctuations during some years both at national and at the selected states level during the study period.
- The capital output ratio has been steadily declining both at all India and at the selected states level suggesting the substitution of labour intensive techniques for capital incentive techniques.

VII. Concluding Observations and Remarks

7.1 In the present paper, an attempt was made to examine the industrial structure and performance at all India, AP and Gujarat level using the ASI data published by CSO from 2000-01 to 2010-11. First, to study the structural changes at national and selected states level variables like the number of factories, fixed capital, working capital, total number of workers, net value added, gross fixed capital formation, total input, total output and depreciation were employed. An attempt was also made to study the relative share of AP and Gujarat vis-à-vis all India for most of the structural variables. Second, to examine the industrial performance at all India, AP and Gujarat level structural ratios such as workers per factory, fixed capital per factory, gross output per worker and net value added per worker and technical coefficients like fixed capital to gross output (capital output ratio) and net value added to gross output were used.

7.2 The analysis of structural parameters showed that the number of factories registered in AP, Gujarat and at all India level has marginally increased. Some of the key variables like fixed capital, working capital, total output and net value added both at selected states and national level were seen increasing. The evidence suggested that from 2004-05 onwards there was a drastic raise in the level of employment at national level, AP and Gujarat. GFCF at national and selected states level showed a mixed trend of rise and fall during the study period.

7.3 The study found that the number of factories operating under Sections 2(m)(i) and 2(m)(ii) of the Factories Act, 1948 in AP were considerably high compared to Gujarat where AP's percentage share of number of factories vis-à-vis all India, stood between 10

percent to 12 percent where as Gujarat's percentage share of number of factories vis-à-vis all India, was found to be between 9 percent to 10 percent. It was also noted that the level of fixed capital in Gujarat was significantly higher than AP where Gujarat contributed around 16 percent to 20 percent. The level of working capital of Gujarat (about 12 percent to 18 percent) is was also found to be significantly higher than AP (around 5 percent to 7 percent). AP's and Gujarat's percentage share of total workforce was very much similar to the national average. Gujarat's percentage share of total output and contribution to the nation's total net value added was found to be significantly higher compared to AP.

7.4 The analysis of structural ratios revealed that the ratio of output per worker at national and selected states level has risen during the last decade of the study implying that both at all India and states level the average productivity of labour has been increasing. The average level of labour productivity of Gujarat was found to be higher than the average level of labour productivity of India and AP. The ratio of net value added per worker, at all India and states level was also found to be increasing.

7.5 The ratio of number of workers per factory was found fluctuating by raising and falling during the study period. Also, the ratio of fixed capital per factory was found to be mildly increasing especially since 2000-01 onwards at national and selected states level signifying that the average factory size in terms of investments in fixed capital has also mildly increased. It was noted that the average factory size in Gujarat was higher compared to AP and all India level implying that the average level of investment in fixed assets in Gujarat is higher. Finally, it was evident from the technical coefficient of capital output ratio, which was seen to be steadily declining at all India, AP and Gujarat level suggesting the substitution of labour intensive techniques for capital incentive techniques.

7.6 On the whole the analysis revealed that the industrial sector of Gujarat is significantly contributing to the national average compared to AP though the state of AP is also considerably contributing to the national average.

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Table 1: Selected States-wise Growth Rate of Net State Domestic Product in Industry

Selected States	Average (2000-01 to 2003-04)	Average (2004-05 to 2008-09)
Andhra Pradesh	5.62	6.61
Bihar	-4.77	5.80
Gujarat	3.95	12.65
Karnataka	8.84	8.32
Madhya Pradesh	-4.40	6.73
Maharashtra	1.35	9.24
Orissa	6.34	17.53
Tamil Nadu	1.97	7.25
India	5.63	8.54

Source: Planning Commission, Government of India, 2012

Table 2: Sectoral Composition of India's GDP

Year	Agriculture	Industry	Services
1950-51	53.1	16.6	30.3
1960-61	48.7	20.5	30.8
1970-71	42.3	24.0	33.8
1980-81	36.1	25.9	38.0
1990-91	29.6	27.7	42.7
2000-01	22.3	27.3	50.4
2010-11QE	14.5	27.8	57.7
2011-12AE	13.9	27	59.0

Source: Economic Survey, Government of India, 2012.
Notes: QE indicate quick estimates and AE indicate advanced estimates.

Table 3: Sectoral Composition of GSDP in AP and Gujarat (At Constant Prices)

Year	Primary Sector		Secondary Sector		Tertiary Sector	
	AP	Gujarat	AP	Gujarat	AP	Gujarat
2004-05	25.07	16.08	24.28	40.00	50.65	43.92
2005-06	24.28	17.22	24.39	39.89	51.33	42.89
2006-07	22.27	15.77	25.80	40.27	51.93	43.96
2007-08	23.34	15.45	25.53	40.20	51.13	44.35
2008-09	22.00	13.43	25.59	40.10	52.40	46.47
2009-10	21.09	11.98	25.23	43.70	53.67	44.31
2010-11	20.64	13.19	24.74	42.36	54.63	44.45
2011-12	19.29	12.92	24.71	41.07	56.00	46.01

Source: Authors calculations based on the data collected from CSO and RBI database.

Figure 1: Percentage Growth of GSDP of AP and Gujarat at factor cost vis-à-vis All India

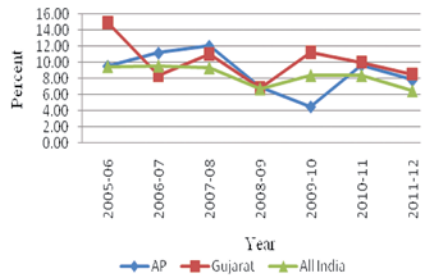


Figure 2: Percentage Share of GSDP of AP and Gujarat at factor cost vis-à-vis All India

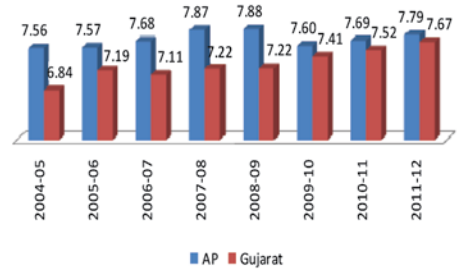


Figure 3: Factory Sector (All India)

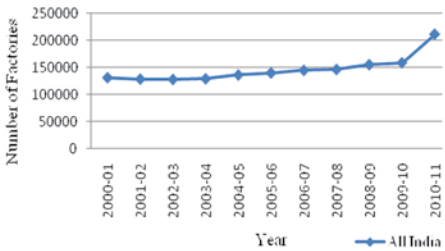


Figure 4: Factory Sector (AP and Gujarat)

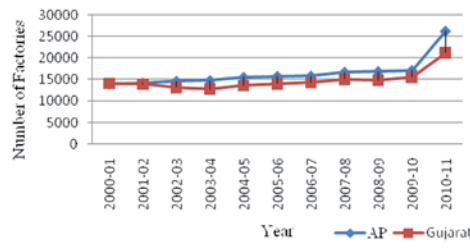


Figure 5: AP and Gujarat Percentage Share vis-à-vis All India: Factory Sector

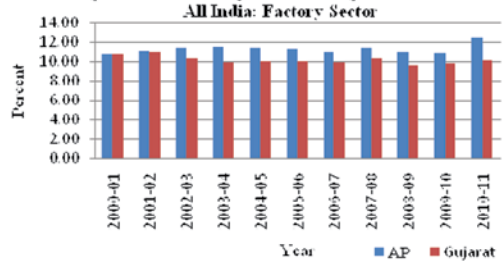


Figure 6: Fixed Capital (All India)

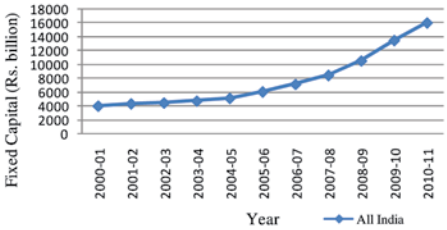


Figure 7: Fixed Capital (AP and Gujarat)

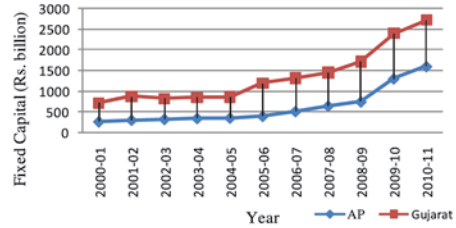


Figure 8: AP and Gujarat Percentage Share vis-à-vis All India: Fixed Capital

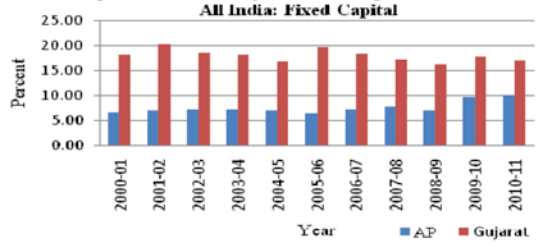


Figure 9: Working Capital (All India)

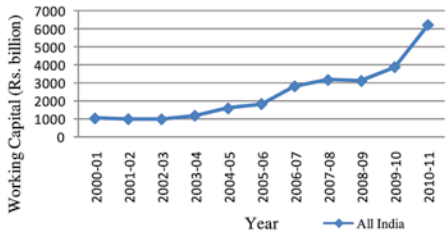


Figure 10: Working Capital (AP and Gujarat)

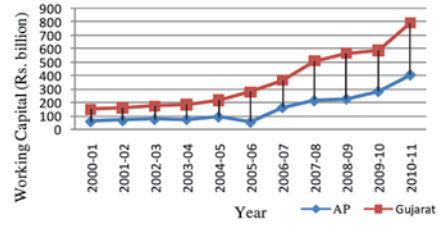


Figure 11: AP and Gujarat Percentage Share vis-à-vis All India: Working Capital

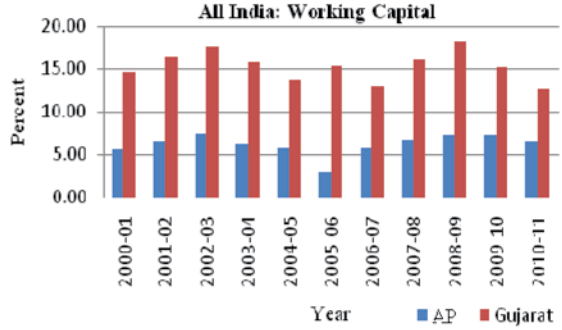


Figure 12: Total Workers (All India)

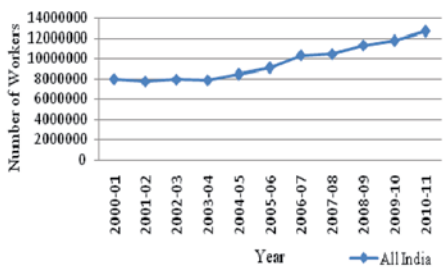


Figure 13: Total Workers (AP and Gujarat)

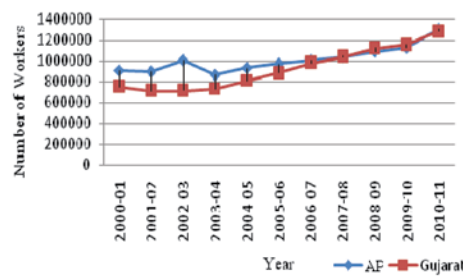


Figure 14: AP and Gujarat Percentage Share vis-à-vis All India: Total Workers

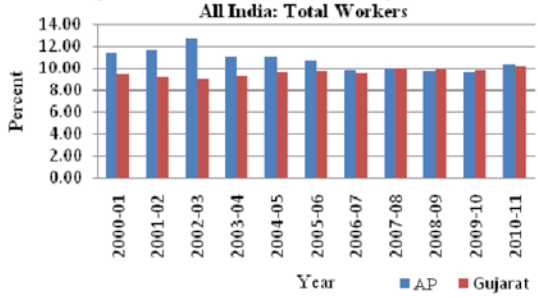


Figure 15: Total Input (All India)

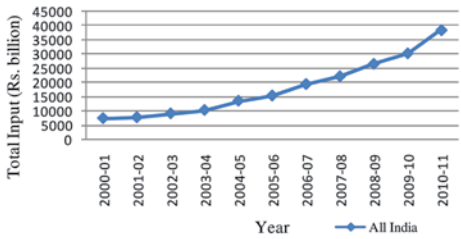


Figure 16: Total Input (AP and Gujarat)

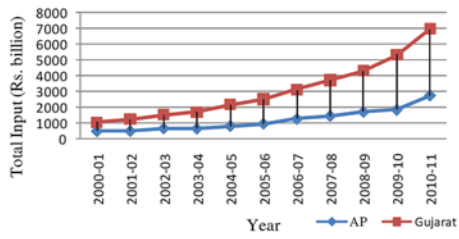


Figure 17: Total Output (All India)

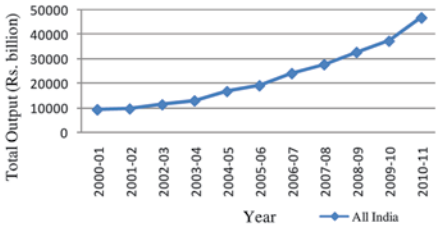


Figure 18: Total Output (AP and Gujarat)

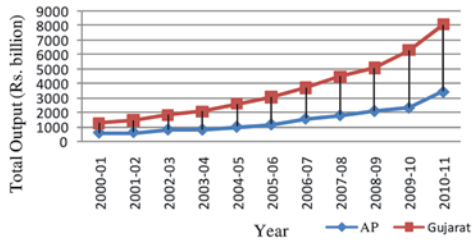


Figure 19: AP and Gujarat Percentage Share vis-à-vis All India: Total Output

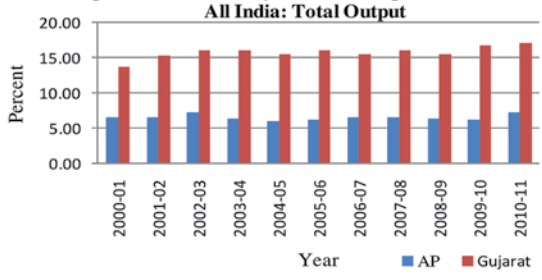


Figure 20: Depreciation (All India)

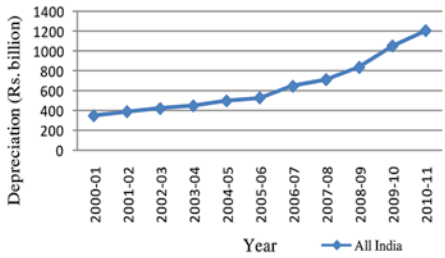


Figure 21: Depreciation (AP and Gujarat)

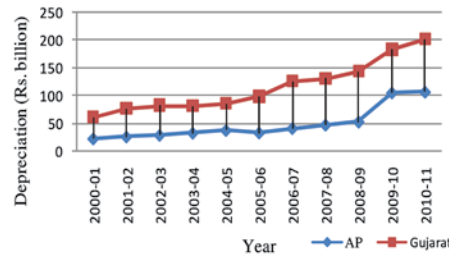


Figure 22: Net Value Added (All India)

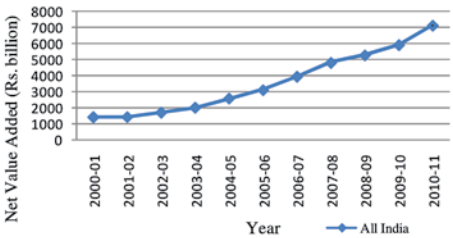


Figure 23: Net Value Added (AP and Gujarat)

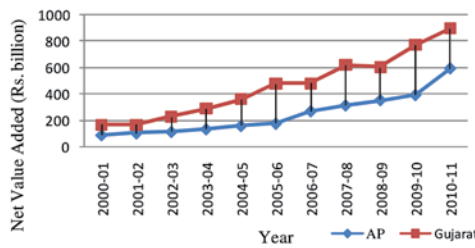


Figure 24: AP and Gujarat Percentage Share vis-à-vis All India: Net Value Added

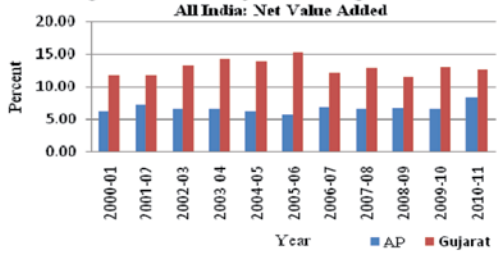


Figure 25: GFCF (All India)

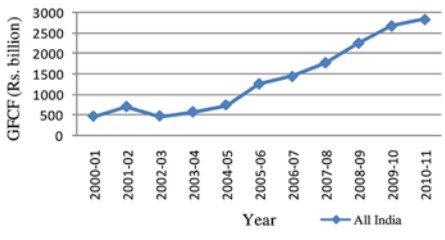


Figure 26: GFCF (AP and Gujarat)

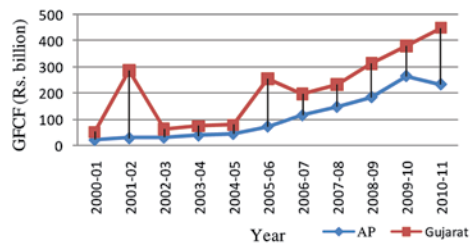


Figure 27: AP and Gujarat Percentage Share vis-à-vis All India: GFCF

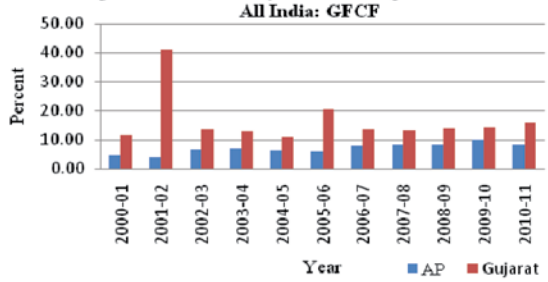


Figure 28: Real Output per Worker : AP, Gujarat and All India

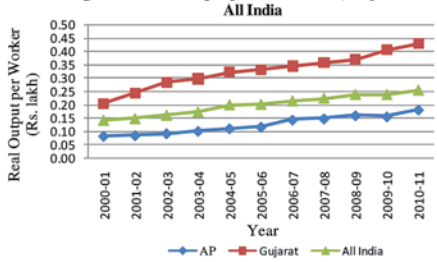


Figure 29: Real Value added per Worker : AP, Gujarat and All India

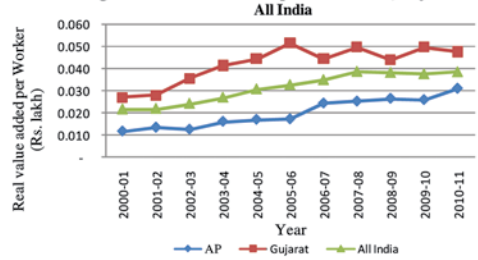


Figure 30: Workers per Factory: AP, Gujarat and All India

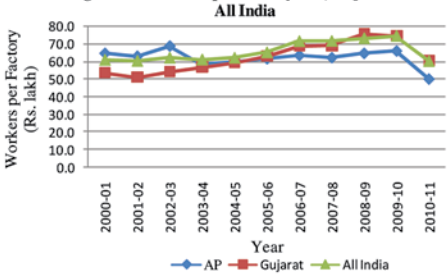


Figure 31: Fixed Capital per Factory : AP, Gujarat and All India

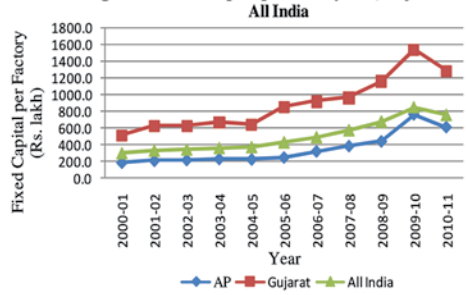


Figure 32: Value Added per Output: AP, Gujarat and All India

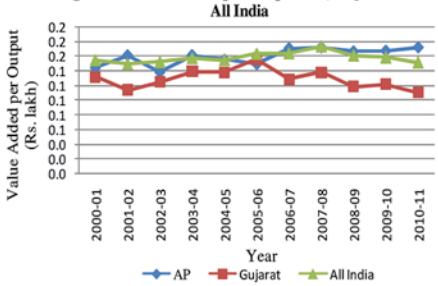
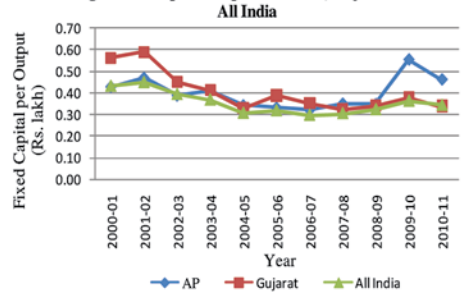


Figure 33: Capital Output Ratio: AP, Gujarat and All India



SECTION II

- International Recommendations for Industrial Statistics 2008
- Annual Growth of MVA for BRICS Countries : Table 1
- Annual Growth of MVA for SAARC Countries : Table 2
- Share of MVA in GDP for BRICS Countries : Table 3
- Share of MVA in GDP for SAARC Countries : Table 4
- Percentage Distribution of Workers in Manufacturing Sector : Table 5
- Annual Survey of Industries - A Note

International Recommendations for Industrial Statistics 2008

[Excerpts from United Nations (2009), "International Recommendations for Industrial Statistics 2008", Statistical Papers, Series M No. 90, Statistics Division, Department of Economic and Social Affairs, United Nations, New York.]

With a view to establishing a uniform pattern for the measurement of economic activities on a comparable basis, international recommendations have been formulated by the United Nations for the collection of statistics on a number of economic activities. The international recommendations for industrial statistics were first formulated in 1953 and revised from time to time, the last revision having been undertaken in 1983. The United Nations Statistical Commission at its thirty-seventh session in 2006 had endorsed the proposal for a revision of the international recommendations for industrial statistics (IRIS) that would reflect the latest developments in the economic environment and statistical methodology.

A. Economic activity

1.1. In general, the term "economic activity" is understood as referring to a process, that is to say, to the combination of actions carried out by a certain entity that uses labour, capital, goods and services to produce specific products (goods and services). An activity is characterized by (*a*) an input of resources; (*b*) a production process; and (*c*) an output of products. By convention, a single activity is understood as a process resulting in a homogeneous type of product. It is recognized that one activity may consist of one simple process or may cover a whole range of sub processes, each of which might be classified in a different activity category. For statistical purposes, an entity engaged in a given activity may be treated as either simple or complex. A simple entity is not subdivided into parts to which activities are attributed, while a complex entity is, by definition, composed of several sub entities, each of which is seen as performing a specific activity. An entity engaged in more than one economic activity may produce more than one product. Such an entity may be subdivided into parts, each performing separate activities that produce separate products, if either bookkeeping records allow or there exist some statistical methods developed for the purpose of separation; each part of the entity may in this case also serve as a statistical unit.

B. Integrated nature of economic activities

1.2. It is important to point out that the system of economic activities in any economy is highly integrated and cannot be easily decomposed for the purpose of surveying only, so the industrial activities of all units of production in the economy are first fully enumerated and clearly classified by type of activities. An enterprise that is a manufacturer may also have subunits with their own account of production costs that involve other activities such as financial activities or wholesale and retail trade. For example, a manufacturer may have a network to sell its own products and a separate unit that provides loans at a rate lower than the market interest rate in order to stimulate the sale of its product. In such a case, manufacturing statistics should exclude the financial activities and distributive trade services, and the units producing these services should be classified and covered in financial

and trade statistics. Similarly, a farming household may engage in agricultural production and also in a manufacturing activity that produces goods such as bricks, furniture, etc., that should be classified as manufacturing. In order to ensure that economic activities are not underreported or misclassified, all units in the economy must be first registered and classified properly before surveys are carried out. For units that are difficult to enumerate, such as household and small-scale economic units, a proper procedure must be articulated so that all economic activities are fully covered and properly classified in an integrated manner.

C. Scope and structure of the industrial sector

1.3. In general, industrial statistics are statistics reflecting the characteristics and economic activities of units engaged in a class of industrial activities that are defined in terms of the International Standard Industrial Classification of All Economic Activities, Revision 4 (ISIC, Rev.4). The term "industry" thus refers to a class of ISIC that encompasses all economic activities including agriculture and services-producing activities within an economy and is therefore much broader than the term "industry" as it is popularly understood, which refers sometimes to manufacturing activities alone and sometimes to a more extended list of activities which may also include construction and mining.

1.4. The recommendations made on industrial statistics are relevant to a limited set of economic activities undertaken by all resident units in the reporting country that are active primarily in the following areas:

(*a*) Mining and quarrying (sect. B of ISIC, Rev.4);

(*b*) Manufacturing (sect. C of ISIC, Rev.4);

(*c*) Electricity, gas, steam and air-conditioning supply (sect. D of ISIC, Rev.4);

(*d*) Water supply; sewerage, waste management and remediation activities (sect. E of ISIC, Rev.4).

1.5. Industrial activities in international waters, such as the operation of petroleum and natural gas wells, should be included if these activities are subject to the laws, regulations and control of the country concerned.

1.6. The main recommendations may also be applicable to other areas of economic statistics, particularly non-financial services.

1.7. A brief description of the coverage of economic activities within the scope of the industrial sector is given below.

D. General description of economic activities

1. Mining and quarrying (sect. B of ISIC, Rev.4)

1.8. This includes the activities relating to extraction of minerals occurring naturally as solids (coal and ores), liquids (petroleum) or gases (natural gas). Extraction can be achieved by different methods such as underground or surface mining, well operation, seabed mining,

etc. Also included are supplementary activities aimed at preparing the crude materials for marketing, for example, crushing, grinding, cleaning, drying, sorting, concentrating ores, liquefaction of natural gas and agglomeration of solid fuels. These operations are often carried out by the units that extracted the resource and/or others located nearby.

1.9. Processing of extracted materials; crushing, grinding or otherwise treating certain earths, rocks and minerals not carried out in conjunction with mining and quarrying; usage of the extracted materials without a further transformation for construction purposes; and geophysical, geologic and seismic surveying activities are not included here.

2. Manufacturing (sect. C of ISIC, Rev.4)

1.10. This includes the physical or chemical transformation of materials, substances or components into new products, although such a definition cannot be used as the single universal criterion for determining what constitutes manufacturing (see the remark below on processing of waste). The materials, substances or components transformed are raw materials that are products of agriculture, forestry, fishing, mining or quarrying or products of other manufacturing activities. Substantial alteration, renovation or reconstruction of goods is generally considered to be manufacturing.

1.11. Units engaged in manufacturing are often described as plants, factories or mills and characteristically use power-driven machines and materials-handling equipment. However, units that transform materials or substances into new products by hand or in the worker's home and those engaged in selling to the general public products made on the same premises from which they are sold, such as bakeries and custom tailors, are also included in this section. Manufacturing units may process materials or may contract with other units to process their materials for them. Both types of units are included in manufacturing.

1.12. The output of a manufacturing process may be finished in the sense that it is ready for utilization or consumption, or it may be semi-finished in the sense that it is to become an input for further manufacturing. For example, the output of alumina refining is the input used in the primary production of aluminium; primary aluminium is the input to aluminium wire-drawing; and aluminium wire is the input for the manufacture of fabricated wire products.

1.13. Assembly of the component parts of manufactured products is considered manufacturing. This includes the assembly of manufactured products from either self-produced or purchased components.

1.14. The recovery of waste (the processing of waste into secondary raw materials), though it may involve physical or chemical transformations, is not considered to be a part of manufacturing. However, the manufacture of new final products (as opposed to secondary raw materials), even if the processes involved use waste as an input, is classified in manufacturing. For example, the production of silver from film waste is considered to be a manufacturing process.

1.15. Specialized maintenance and repair of industrial, commercial and similar machinery and equipment are included in manufacturing. However, the repair of computers and personal and household goods and the repair of motor vehicles are not included in this section.

1.16. The boundaries between manufacturing and other activities can be somewhat blurry. As a general rule, the activities in the manufacturing section involve the transformation of materials into new products. Their output is a new product. However, the definition of what constitutes a new product can be somewhat subjective. As a point of clarification, the following activities are considered manufacturing in ISIC:

— Milk pasteurizing and bottling
— Fresh fish processing (oyster shucking, fish filleting), not done on a fishing boat
— Printing and related activities
— Ready-mixed concrete production
— Leather converting
— Wood preserving
— Electroplating, plating, metal heat treating, and polishing
— Rebuilding or remanufacturing of machinery
— Tyre retreading

1.17. Conversely, there are activities that, although they sometimes involve transformation processes, are classified in other sections of ISIC; in other words, they are not classified as manufacturing. They include:

— Logging, classified in section A (Agriculture, forestry and fishing)
— Beneficiating of agricultural products, classified in section A (Agriculture, forestry and fishing)
— Beneficiating of ores and other minerals, classified in section B (Mining and quarrying)
— Construction of structures and fabricating operations performed at the site of construction, classified in section F (Construction)
— Activities of breaking bulk and redistribution in smaller lots, including packaging, repackaging, or bottling products, such as liquors or chemicals; sorting of scrap; mixing paints to customer order; and cutting metals to customer order, producing a modified version of the same product, classified to section G (Wholesale and retail trade; repair of motor vehicles and motorcycles)

3. Electricity, gas, steam and air-conditioning supply (sect. D of ISIC, Rev.4)

1.18. Economic activities included under this section are the activity of providing electric power, natural gas, steam, hot water and the like through a permanent infrastructure (network) of lines, mains and pipes. The dimension of the network is not decisive; also included is the distribution of electricity, gas, steam, hot water and the like in industrial parks or residential buildings. This section therefore includes the operation of electric and gas utilities, which generate, control and distribute electric power or gas. Also included is the provision of steam and air-conditioning supply. This section excludes the operation of water and sewerage utilities and (typically long distance) transport of gas through pipelines.

4. Water supply; sewerage, waste management and remediation activities (sect. E of ISIC, Rev.4)

1.19. This section includes activities related to the management (including collection, treatment and disposal) of various forms of waste, such as solid or non-solid industrial or household waste, as well as contaminated sites. The output of the waste or sewage treatment process can either be disposed of or become an input into other production processes. Activities of water supply are also grouped in this section, since they are often carried out in connection with, or by units also engaged in, the treatment of sewage.

E. Outsourcing: the boundary between manufacturing and wholesaling

1.20. The term "outsourcing" of production has been used to refer to a situation where the principal production unit (the principal) contracts another production unit (the contractor) to carry out specific functions constituting the whole or a part of the principal's activity in producing a good or a service. It should be noted that the activity classification of the contractor is not affected by the fact that the activity has been outsourced, but the activity classification of the principal is very much affected by the nature and extent of the outsourcing.

1.21. The trend of outsourcing manufacturing activities has been growing recently. It is imperative, therefore, that the criteria for the classification of the principal that is outsourcing its economic activity be clarified to ensure international consistency in respect of its classification. It is recommended that the criteria for classification of the principal to manufacturing be based on the principal's sole ownership of the physical input materials.

1.22. Outsourcing can assume three forms, namely (*a*) outsourcing of support functions, (*b*) outsourcing of parts of the production process and (*c*) outsourcing of the complete production process. In each of these cases, the principal and the contractor may be located within the same economic territory or in different economic territories. The actual location does not affect the classification of either of these units. The classification rules for these cases are discussed below.

1. Outsourcing of support functions

1.23. In this case, the principal carries out the core production process (of a good or a service) but outsources certain support functions, such as accounting or computer services, to the contractor. In such a case, the principal remains classified to the same ISIC class that represents the core production process. The contractor is classified to the specific support activity that it is carrying out, for example, ISIC class 6920 (Accounting, bookkeeping and auditing activities; tax consultancy) or class 6202 (Computer consultancy and computer facilities management activities).

2. Outsourcing of parts of the production process

1.24. The principal outsources a part of the production process (of a good or a service), but not the whole process, to the contractor. The principal owns the (material) inputs to be

transformed by the contractor and thereby has ownership over the final outputs. In such a case, the principal is to be classified as if it were carrying out the complete production process. The contractor is classified according to the portion of the production process that it is undertaking. In case of the transformation of a good, the contractor is classified in the same or a separate ISIC category. Also, in the case of the outsourcing of a service, the activities of the principal and the contractor might not be classified in the same ISIC category.

3. Outsourcing of the complete production process

1.25. Two specific cases have to be considered when the principal outsources the complete production process to the contractor, namely:

(*a*) Outsourcing of service producing activities including construction, in which case, both the principal and the contractor are classified as if they were carrying out the complete service activity;

(*b*) Outsourcing of manufacturing activities to the contractor, whereby the principal does not physically transform the goods at the location of its unit, in which case the following activity classifications apply:

(i) A principal that owns the material inputs and thereby has economic ownership of the outputs, but has the production carried out by others, is classified to section C (Manufacturing) of ISIC Rev.4, specifically to the classification category that corresponds to the complete (outsourced) manufacturing activity;

(ii) A principal that has the production carried out by others, but does not own the material inputs, should be classified to section G (Wholesale and retail trade; repair of motor vehicles and motorcycles) of ISIC Rev.4, specifically to the classification category that corresponds to the activity represented by the type of sale (for example, wholesale or retail sale) and type of good sold. In this case, it should also be determined whether the principal carries out other activities, such as design or research and development. If, indeed, other production activities are undertaken by the principal, the usual rules for identifying the principal activity of the principal should be applied;

(iii) The contractor in such a case is classified to section C (Manufacturing) of ISIC Rev.4, specifically to the classification category that corresponds to the manufacturing activity performed by the contractor.

F. Coverage of industrial activities

1.26. The field of industrial statistics could be covered in terms of activities or of establishments. It is desirable, of course, that all industrial activities be covered, including the minor industrial activities of establishments that are predominantly non-industrial, and some countries aim at such coverage. However, a difficulty usually arises from the fact that separate statistics for the industrial part of an establishment engaged in mixed

activities may not be available because of the nature of the accounting data kept. In practice, therefore, most countries prefer to divide the industrial from the non-industrial in terms of establishments, that is to say, by distinguishing between establishments that are predominantly industrial and those that are predominantly non-industrial, rather than attempt to cover industrial activities wherever they are carried on. An establishment that conducts several activities but is not organized to be treated as two or more statistical units is classified wholly in or wholly out of the industrial sector and the data reported for the establishment cover its secondary activities as well as its principal activities. This is consistent with the general principle of classifying establishments according to their principal activity.

1.27. In conformity with the 2008 SNA production boundary, all units engaged in economic activities should be covered in the collection of industrial statistics. This embraces units of all sizes and types of ownership including government and household units and sub-units embedded in other activities such as manufacturing by the general government sector.

1.28. Small-scale mining and quarrying, manufacturing and water supply activities engaged in by households must also be covered. Also included are activities of units that exist outside a household but have no established fixed industrial premises. Goods produced by households by engaging in industrial activities for own consumption should also be covered.

1.29. Departments, establishments and similar units in general government should be included if they are mainly engaged in producing goods and services, and identifiable by accounting records kept by the government, even though some of the units may not be operated for profit or may not dispose of their output in the market. Such units may produce goods and services that, because of government policy, are sold at prices set below the costs of production.

1.30. Government units may furnish goods and services to the government itself of a kind often provided by privately owned establishments. Examples are ammunition factories, navy dockyards, and printing and publishing services. It is sometimes difficult to isolate the production activities of these units, since they are embedded in the general government and are not established independently of the departments they serve. However, efforts should be made to encompass the activities when they constitute a substantial part of the total national output of an industry and maintain accounts on cost of production and fixed assets used in the production process.

1.31. The actual enumeration of the establishments engaged in the various activities will vary in practice according to the frequency with which the data are required, the difficulty of obtaining them, the existence of alternative sources and the resources available to the statistical authorities. The coverage recommended may be attained through a complete enumeration of the relevant establishments or by using sampling techniques. The method of enumeration chosen will depend on the circumstances in each country. Since circumstances differ, it is not possible to make international recommendations on this issue.

G. Scope of the industrial sector in terms of the Central Product Classification (CPC)

1.32. The Central Product Classification, Version 2 (CPC, Ver.2) constitutes a comprehensive classification of all goods and services. It presents categories for all products that can be the object of domestic or international transactions or that can be entered into stocks. It includes products that are an output of economic activity, including transportable goods, non-transportable goods and services. It serves as an instrument for assembling and tabulating all kinds of statistics requiring product detail. Such statistics may cover production, intermediate and final consumption, and capital formation, etc. They may refer to commodity flows, stocks or balances and may be compiled in the context of supply and use tables, balance of payments and other analytical presentations. This provides a basis for recompiling basic statistics from their original classifications into a standard classification for analytical use.

1.33. All goods produced through industrial activities are classified in section 1 (Ores and minerals; electricity, gas and water), section 2 (Food products, beverages and tobacco; textiles, apparel and leather products), section 3 (Other transportable goods, except metal products, machinery and equipment) and section 4 (Metal products, machinery and equipment). The relevant services are classified in group 862 (Support services to mining), group 863 (Support services to electricity, gas and water distribution), division 87 (Maintenance, repair and installation (except construction) services, except group 872 (Repair services of other goods), and divisions 88 (Manufacturing services on physical inputs owned by others) and 89 (Other manufacturing services; publishing, printing and reproduction services; materials recovery services). It is recommended that CPC, Ver.2 (or the national versions developed by countries that are fully compatible with CPC), should be used for reporting industrial statistics.

Table-1: Annual Growth of MVA, 2000-2011 and Per-capita MVA, 2011[a/]

BRICS Countries	Total MVA						Per-capita MVA						
	Growth Rate (Percentage)		Index (2005=100)				Growth Rate (Percentage)		Index (2005=100)				Value (US dollars
	2000-05	2005-11	2008	2009	2010 [b/]	2011 [c/]	2000-05	2005-11	2008	2009	2010 [b/]	2011 [c/]	2011 [c/]
Brazil	3.2	1.6	110	100	110	112	1.9	0.7	107	96	105	106	779
Russian Federation	6.5	0.0	112	96	103	108	6.9	0.1	113	96	104	109	909
India	6.6	8.5	132	144	155	166	5.0	6.9	126	136	144	153	158
China	10.7	11.7	144	162	177	195	10.1	11.2	142	159	172	189	1063
South Africa	2.7	0.9	115	103	108	111	1.3	0.0	111	98	103	105	897

a/ At constant 2005 prices.
b/ Provisional.
c/Estimate.

Note : MVA : Manufacturing Value Added

Sources: UNIDO, 2013

Table-2: Annual Growth of MVA, 2000-2011 and Per-capita MVA, 2011 [a/]

SAARC Countries	Total MVA						Per-capita MVA						
	Growth Rate (Percentage)		Index (2005=100)				Growth Rate (Percentage)		Index (2005=100)				Value (US dollars
	2000-05	2005-11	2008	2009	2010 [b/]	2011 [c/]	2000-05	2005-11	2008	2009	2010 [b/]	2011 [c/]	2011 [c/]
Afghanistan	13.7	6.8	115	127	144	152	9.4	4.1	107	115	127	130	49
Bangladesh	6.7	7.8	130	139	148	160	5.0	6.7	126	133	140	149	101
Bhutan	5.8	10.3	151	162	170	179	2.8	8.3	142	149	155	160	142
India	6.6	8.5	132	144	155	166	5.0	6.9	126	136	144	153	158
Maldives	8.6	-2.0	115	97	93	97	7.0	-3.3	110	92	86	89	189
Nepal	0.1	1.1	104	103	106	109	-2.1	-0.8	98	95	96	97	22
Pakistan	9.5	4.0	123	119	125	131	7.5	2.2	117	111	115	117	142
Sri Lanka	2.9	5.8	118	122	131	143	1.7	4.8	114	117	124	135	324

a/ At constant 2005 prices.
b/ Provisional.
c/Estimate.

Note : MVA : Manufacturing Value Added

Sources: UNIDO, 2013

Table-3: Share of MVA in GDP for BRICS Countries in Selected Years (Percentage)

BRICS Countries	At constant 2005 prices						At current prices					
	2000	2005	2008	2009	2010[a/]	2011[b/]	2005	2006	2007	2008	2009	2010[a/]
Brazil	15.4	15.5	14.7	13.5	13.8	13.6	15.5	14.1	13.3	14.2	14.4	13.9
Russian Federation	15.7	15.7	14.2	13.2	13.7	13.7	15.7	15.3	15.1	14.9	12.7	14.1
India	14.3	14.1	14.9	15.1	14.8	14.9	14.1	14.8	14.7	14.5	14.0	13.6
China	31.6	32.5	33.3	34.2	33.8	34.2	32.5	32.9	32.9	32.7	32.3	29.6
South Africa	17.1	16.5	16.4	14.9	15.2	15.2	16.5	15.5	15.1	15.0	13.7	13.2

a/ Provisional
b/ Estimate.

Note : MVA : Manufacturing Value Added

Sources: UNIDO, 2013

Table-4: Share of MVA in GDP for SAARC Countries in Selected Years (Percentage)

SAARC Countries	At constant 2005 prices						At current prices					
	2000	2005	2008	2009	2010[a/]	2011[b/]	2005	2006	2007	2008	2009	2010[a/]
Afghanistan	17.5	15.2	13.7	12.6	13.1	13.1	15.2	16.2	17.8	15.3	11.3	11.4
Bangladesh	14.8	15.9	17.1	17.3	17.4	17.6	15.9	16.2	17.2	17.2	17.3	17.3
Bhutan	7.6	7.1	8.2	8.2	8.1	8.1	7.1	7.6	8.2	8.4	8.2	8.2
India	14.3	14.1	14.9	15.1	14.8	14.9	14.1	14.8	14.7	14.5	14.0	13.6
Maldives	5.8	6.3	4.9	4.3	3.9	3.9	6.3	5.6	5.2	4.6	3.9	3.5
Nepal	8.7	7.6	7.0	6.6	6.5	6.4	7.6	7.3	7.2	7.0	6.6	5.9
Pakistan	13.9	17.5	18.9	17.6	17.8	18.0	17.5	18.0	18.1	19.0	16.3	16.0
Sri Lanka	20.9	19.5	18.9	18.8	18.7	19.0	19.5	19.2	18.5	18.0	18.1	18.0

a/ Provisional
b/ Estimate.

Note : MVA : Manufacturing Value Added

Sources: UNIDO, 2013

Table-5: Percentage Distribution of Workers Aged 15 years & above in Manufacturing Sector according to Usual Principal Status Approach for each States/UT

Sl. No.	Name of State/UT	Rural (%)			Urban (%)			Total (%)		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	Andhra Pradesh	6.5	6.9	6.7	14.7	18.0	15.5	8.8	8.5	8.7
2	Arunachal Pradesh	3.0	5.3	3.8	4.4	2.4	4.0	3.3	5.0	3.8
3	Assam	5.4	7.3	5.7	9.2	14.1	9.9	5.8	8.0	6.1
4	Bihar	5.3	5.5	5.3	6.2	4.1	6.1	5.3	5.5	5.4
5	Chhattisgarh	3.9	3.4	3.7	21.7	19.8	21.3	7.4	4.9	6.6
6	Delhi	17.4	27.9	18.3	22.0	12.1	20.9	21.6	13.2	20.7
7	Goa	20.8	21.4	20.9	11.7	7.9	10.8	16.8	15.2	16.5
8	Gujarat	10.8	4.3	9.6	34.4	23.8	33.3	19.5	8.6	17.8
9	Haryana	6.6	1.7	6.1	21.4	16.8	20.8	11.0	6.6	10.5
10	Himachal Pradesh	6.7	1.6	4.7	22.2	7.5	19.3	8.5	1.9	6.1
11	Jammu & Kashmir	8.9	22.7	10.3	11.1	18.7	12.1	9.5	21.4	10.7
12	Jharkhand	7.6	6.1	7.3	14.6	9.7	14.1	9.0	6.6	8.6
13	Karnataka	5.2	9.3	6.4	18.8	26.8	20.6	9.6	14.1	10.8
14	Kerala	10.9	13.5	11.6	15.3	17.3	15.8	12.2	14.6	12.8
15	Madhya Pradesh	3.6	2.8	3.4	12.3	17.2	13.0	5.6	4.8	5.4
16	Maharashtra	5.0	2.0	4.0	17.2	14.3	16.6	9.6	4.8	8.2
17	Manipur	5.5	31.3	11.8	4.3	61.1	17.3	5.1	39.6	13.4
18	Meghalaya	3.2	1.5	2.5	2.1	2.9	2.4	3.0	1.8	2.5
19	Mizoram	2.9	4.0	3.3	2.7	9.1	5.3	2.8	6.6	4.3
20	Nagaland	1.9	1.5	1.8	3.6	6.5	4.5	2.2	2.5	2.3
21	Odisha	9.0	8.6	8.9	10.7	10.1	10.6	9.3	8.7	9.1
22	Punjab	5.4	5.6	5.4	17.9	13.5	17.3	10.3	9.1	10.2
23	Rajasthan	6.6	3.3	6.0	19.1	22.4	19.4	9.6	6.1	9.0
24	Sikkim	1.7	0.7	1.4	2.1	-	1.6	1.7	0.6	1.4
25	Tamil Nadu	14.1	11.8	13.3	19.2	25.5	20.7	16.2	16.0	16.2
26	Tripura	8.7	15.5	9.8	19.4	-	14.7	10.4	12.0	10.7
27	Uttarakhand	9.2	2.2	7.9	24.0	15.1	23.0	12.9	4.2	11.4
28	Uttar Pradesh	8.7	10.1	8.8	20.1	23.4	20.3	11.0	12.5	11.1
29	West Bengal	13.1	26.3	15.3	20.9	24.8	21.4	15.0	26.1	16.7
30	A & N Islands	2.4	-	1.8	5.9	-	4.4	3.9	-	3.0
31	Chandigarh	17.2	-	16.0	5.9	3.6	5.5	8.0	3.3	7.3
32	Dadra & Nagar Haveli	10.7	9.2	10.4	52.1	-	46.5	25.2	7.3	22.2
33	Daman & Diu	28.6	-	28.0	64.9	-	60.3	55.5	-	52.2
34	Lakshadweep	3.9	13.0	4.7	0.8	-	0.7	2.4	5.4	2.7
35	Puducherry	15.8	15.7	15.8	9.3	18.2	10.8	11.2	17.1	12.4
	All India	**7.7**	**7.5**	**7.7**	**18.8**	**19.6**	**18.9**	**10.6**	**9.9**	**10.5**

Sources: Govt. of India (2013), Report on Third Annual Employment & Unemployment Survey: 2012-13, Vol. II

Note: '-' implies that no sample case is reported under such category.

Annual Survey of Industries – A Note

Annual Survey of Industries (ASI) is the main survey conducted by Central Statistics Office (CSO) Industrial Statistics Wing (ISW). ASI is the principal source of industrial statistics in India. ASI, an annual event, not only facilitates suitable data collection based on appropriate sampling techniques but also ensures timely dissemination of statistical information to asses and evaluate the dynamics in composition, growth and structure of organized manufacturing sector.

1.1 Scope

The Annual Survey of Industries (ASI) has been conducted since 1959 under the authority of the Collection of Statistics Act, 1953. From ASI 2010-11, the survey is conducted under the authority of the Collection of Statistics Act, 2008. In accordance with the provisions of the Collection of Statistics (Central) Rules, 2011 framed under the Act, it had been designed to obtain comprehensive and detailed data with the objectives of estimating the contribution of manufacturing industries as a whole to the national income by type of industry, systematic study of the structure of the industry by type of industry, occasional analysis of the various factors influencing industries in the country to facilitate the construction of comprehensive, factual and systematic bases for formulation of policy.

1.2 Coverage

1.2.1 Coverage of the Annual Survey of Industries extends to the entire Factory Sector comprising industrial units (called factories) registered under the Sections 2(m)(i) and 2(m)(ii) of the Factories Act, 1948, wherein a 'Factory', which is the primary statistical unit of enumeration for the ASI, is defined as:

'Any premises' including the precincts thereof:

(i) Wherein 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,

(ii) Wherein 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, but does not include a mine subject to the operation of the Mines Act, 1952, or a railway running shed.

The 'manufacturing process' referred to above has been defined [vide Section 2(k)] in the Factories Act, 1948 as:

'Any process' for:

(i) making , altering, ornamenting, finishing, packing, oiling, washing, cleaning, breaking up, demolishing or otherwise treating or adapting any article or substance with a view to its use, sale, transport, delivery or disposal; or,

(ii) pumping oil, water or sewage ; or,

(iii) generating , transforming or transmitting power; or,

(iv) composing types for printing by letter press, lithography, photogravure or other similar process or book binding; or,

(v) constructing, reconstructing, repairing, refitting, finishing or breaking up shipsor vessels; or,

(vi) preserving or storing any article in cold storage.

1.2.2 In addition to Sections 2(m)(i) & 2(m)(ii) of the Factories Act, 1948, bidi & cigar units, employing 10 or more workers with the aid of power and 20 or more workers without the aid of power and registered under the Bidi & Cigar Workers (Conditions of Employment) Act, 1966 are also covered in ASI.

1.2.3 Although the scope of the ASI was extended to all registered manufacturing establishments in the country, establishments under the control of the Defence Ministry, oil storage and distribution units, restaurants and cafes and technical training institutions not producing anything for sale or exchange were kept outside the coverage of the ASI. The Collection of Statistics Act, 1953, being not applicable to Jammu & Kashmir, factories in that state used to be covered under ASI on a voluntary basis till a similar State Act, called the Jammu & Kashmir Collection of Statistics Act, 1961 was enacted and the Collection of Statistics Rules, 1964 was framed there under making thereby the collection of statistics under the ASI also statutory in that state. Since 2009-2010 the geographical coverage of the Annual Survey of Industries has been extended to the entire country.

1.3 Reference Period & Survey Period

ASI data of a factory corresponds to the production of a specified time. This is called reference period. In most cases, it is Financial year (March-April) and is taken as the reference period. For ASI 2010-2011, data collected from respective establishment relate to their accounting year ended on any day between 1st April 2010 and 31st March, 2011. However, survey period of ASI denotes the time when the ASI data is actually collected by NSSO, FOD. Survey period is generally from October to April following the reference period. Thus for ASI 2010-2011, the survey period is from October, 2011 to April, 2012.

Selected findings based on ASI data are presented below:

Table 1: Value of Principal Characteristics during ASI 2006-07 to 2010-11

Characteristics	Unit	*ASI Year*				
		2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Factories in Operation	Number	144710	146385	155321	158877	172177
Fixed Capital	Rs Lakhs	71513139	84513209	105596614	135218367	160700652
Invested Capital	Rs Lakhs	107150382	128012553	153517773	193305395	239358002
Workers	Number	7880536	8198110	8776745	9157802	9901970
Total Persons Engaged	Number	10328434	10452535	11327485	11792055	12694853
Wages to Worker	Rs Lakhs	4429135	5103023	5977184	6894071	8564552
Total Emoluments	Rs Lakhs	8875099	10544284	12944123	14700696	18329574
Input	Rs Lakhs	194836758	222295282	266148638	303585334	385108361
Output	Rs Lakhs	240854764	277570904	327279786	373303593	467621696
GVA	Rs Lakhs	46018006	55275622	61131148	69718259	82513336
Depreciation	Rs Lakhs	6445480	7116354	8354590	10506872	12055754
NVA	Rs Lakhs	39572526	48159268	52776558	59211387	70457581
Rent Paid	Rs Lakhs	640399	750549	975778	1200490	1349336
Interest Paid	Rs Lakhs	4131128	5148688	6868048	7331793	8802079
Income	Rs Lakhs	34800999	42260031	44932732	50679104	60306166
Profit	Rs Lakhs	24142496	29757600	30166927	33293065	39016161

Table 2: Observed Growth Rate in Last Five Year

Characteristics	Percentage Growth				
	2006-07 over 2005-06	2007-08 over 2006-07	2008-09 over 2007-08	2009-10 over 2008-09	2010-11 over 2009-10
Factories in Operation	3.25	1.16	6.10	2.29	8.37
Fixed Capital	17.83	18.18	24.95	28.05	18.85
Invested Capital	18.85	19.47	19.92	25.92	23.82
Workers	10.43	4.03	7.06	4.34	8.13
Total Persons Engaged	13.35	1.20	8.37	4.10	7.66
Wages to Worker	17.60	15.21	17.13	15.34	24.23
Total Emoluments	19.92	18.81	22.76	13.57	24.69
Input	26.22	14.09	19.73	14.07	26.85
Output	26.21	15.24	17.91	14.06	25.27
GVA	26.18	20.12	10.59	14.05	18.35
Depreciation	22.00	10.41	17.40	25.76	14.74
NVA	26.89	21.70	9.59	12.19	18.99
Rent Paid	20.84	17.20	30.01	23.03	12.40
Interest Paid	23.69	24.63	33.39	6.75	20.05
Income	27.40	21.43	6.32	12.79	19.00
Profit	30.88	23.26	1.38	10.36	17.19

Table 3: Estimate of Structural Ratios and Technical Co-efficients during ASI 2006-07 to 2010-11

Structural Ratios	Unit	2006-07	2007-08	2008-09	2009-10	2010-11
Fixed Capital per Factory	Rs Lakhs	494	577	680	851	933
Gross Output per Factory	Rs Lakhs	1664	1896	2107	2350	2716
Net Value Added per Factory	Rs Lakhs	273	327	340	373	409
Workers per Factory	Number	54	56	57	58	58
Employee per Factory	Number	71	71	73	74	74
Fixed Capital per Employee	Rupees	692391	808543	932216	1146690	1265872
Output per Employee	Rupees	2331958	2655537	2889254	3165721	3683553
Output per Worker	Rupees	3056325	3385791	3728943	4076345	4722512
Net Value Added per Employee	Rupees	383142	458282	465916	502130	555009
Net Value Added per Worker	Rupees	502155	587444	601323	646568	711551
Emoluments per Employee	Rupees	85929	100878	114272	124666	144386
Wages per Worker	Rupees	56203	62246	68103	75281	86493
Technical Coefficients						
Fixed Capital to Net Value Added		1.81	1.76	2	2.28	2.28
Fixed Capital to Output		0.3	0.3	0.32	0.36	0.34
Net Value Added to Output		0.16	0.17	0.16	0.16	0.15
Output to Input		1.24	1.25	1.23	1.23	1.21
Emoluments to Net value Added		0.22	0.22	0.25	0.25	0.26

Figure 1: Technical coefficients during 2006-07 to 2010-11: All -India

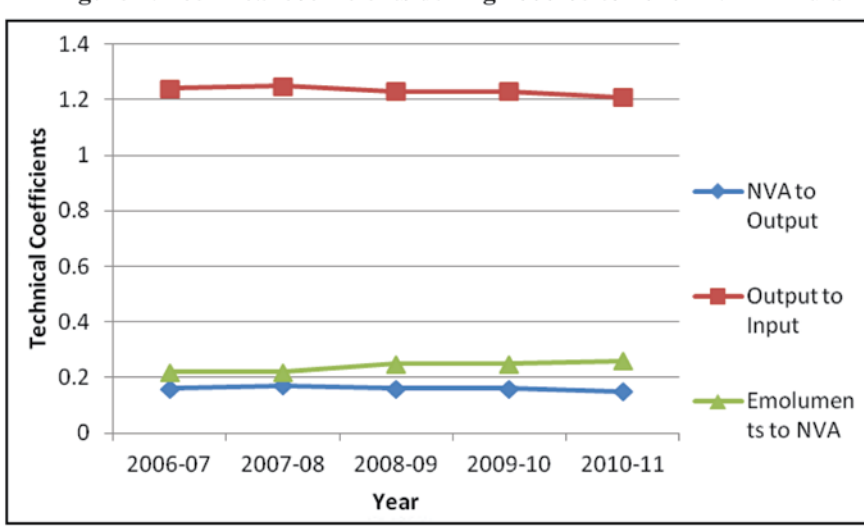


Figure 2: Annual Growth Rates (%) of Selected Characteristics for Different Years over Previous Year: All -India

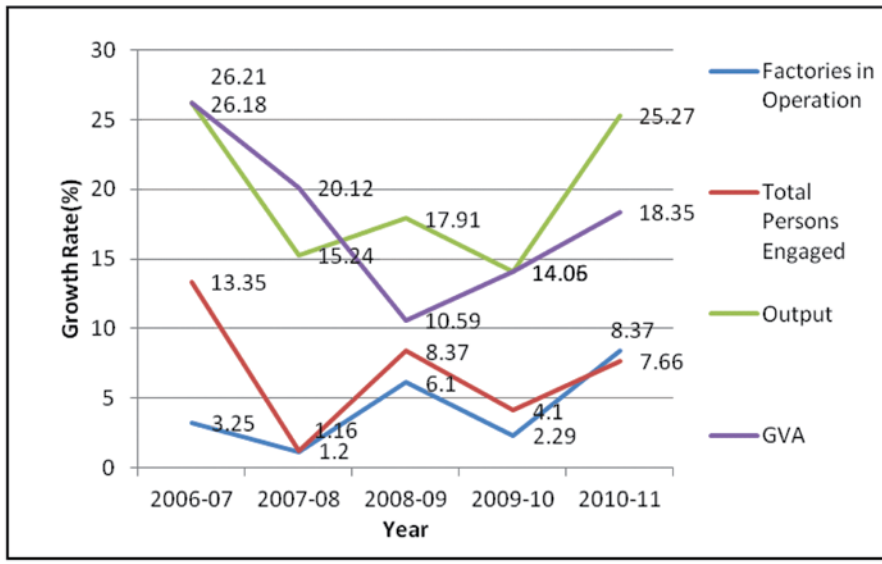


Figure 3: Percentage Share of Major Industries in Total Number of Persons Engaged in the Factory Sector based on ASI 2010-11: All -India

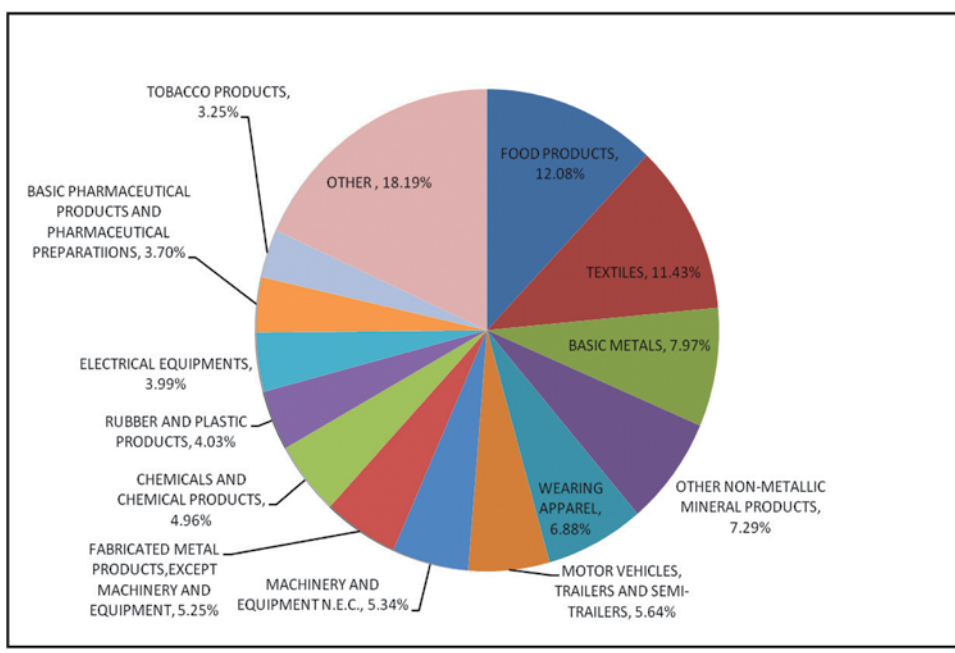


Figure 4: Percentage Share of Major Industries in Aggregate GVA by the Factory Sector based on ASI 2010-11: All –India

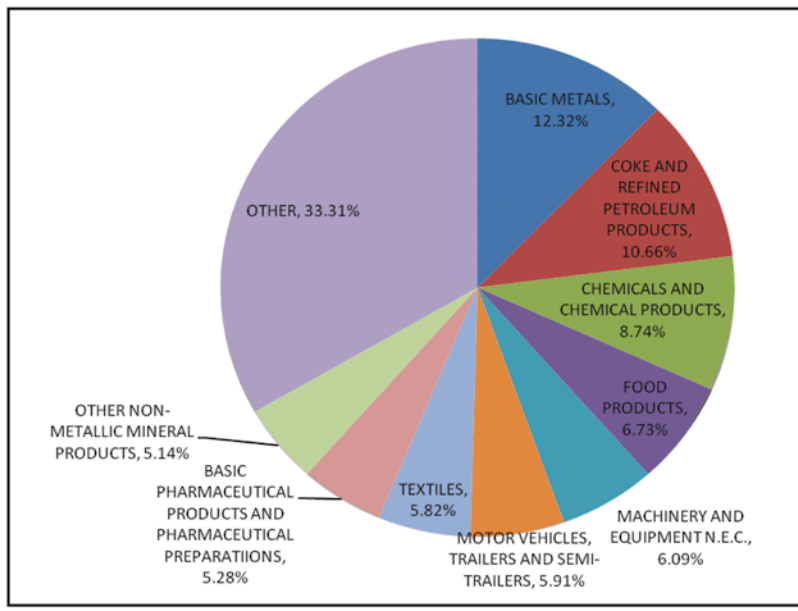


Figure 5: Total Number of Persons Engaged in the Factory Sector by State/UT based on ASI 2010-11

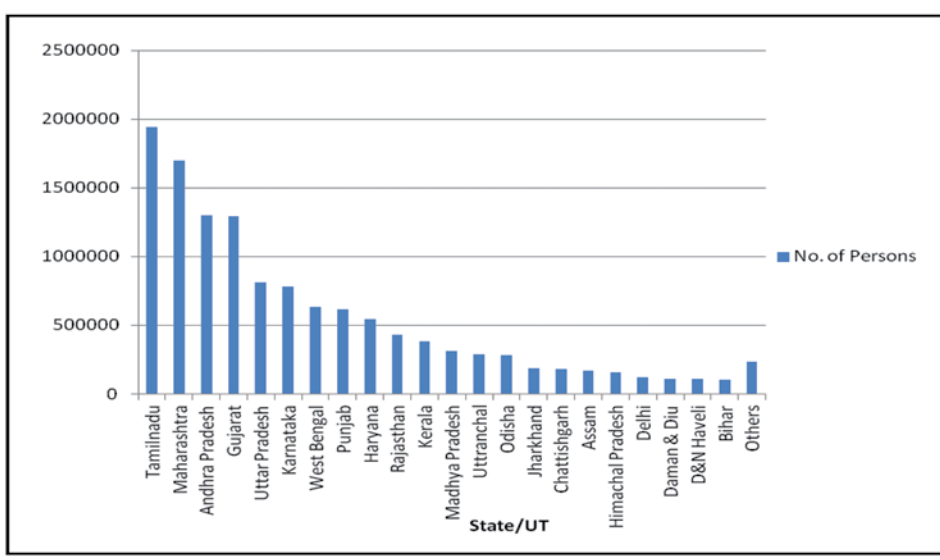


Figure 6: Distribution of Factories in Operation by Employment Range based on ASI 2010-11: All –India

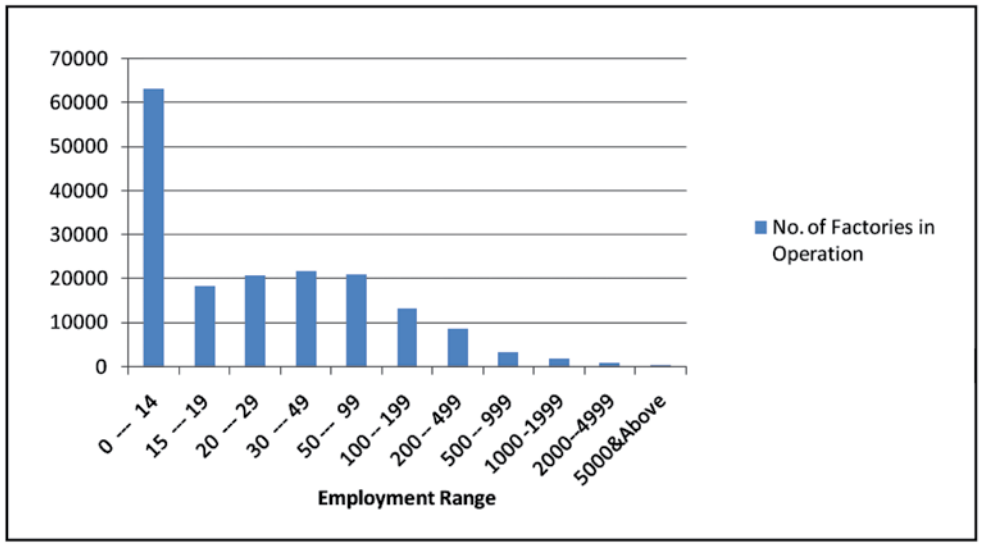


Figure 7: Percentage Distribution of Factories in Operation by Employment Range based on ASI 2010-11: All -India

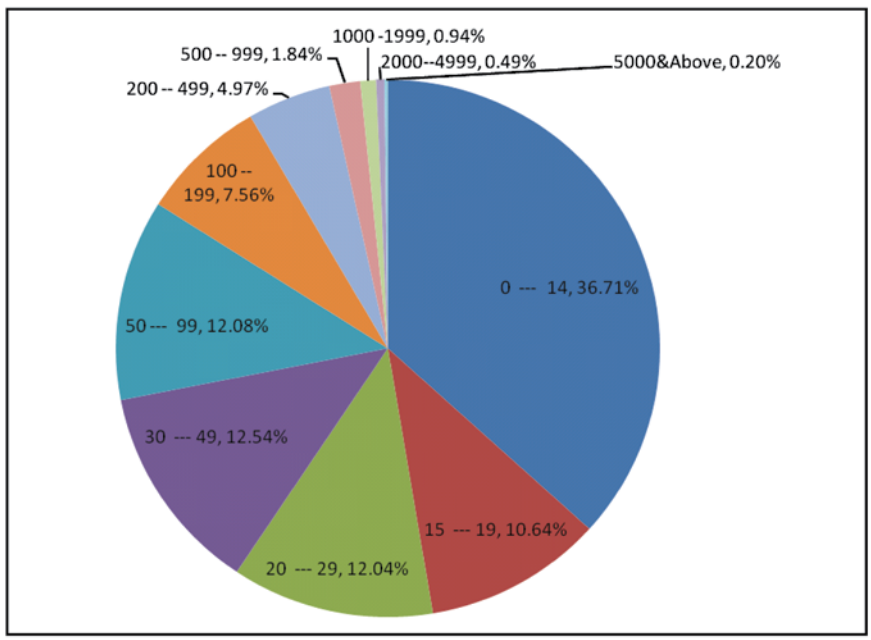


Table 4: Structural Ratios by NIC-2008 (2-digit) based on ASI 2010-11

NIC -08	Description	Fixed Capital per Factory (Rs. Lakh)	Gross Output per Factory (Rs. Lakh)	Net Value Added per Factory (Rs. Lakh)	Workers per Factory (Number)	Employee per Factory (Number)	Net Value Added per Employee (Rupees)	Emoluments per Employee (Rupees)	Wages per Worker (Rupees)
01	Crop and Animal Production, Hunting and Related Servuce Activities	129	1830	121	30	37	328179	50938	35531
08	Other Mining and Quarrying	164	147	63	61	69	91570	54409	42281
10	Food Products	352	1891	165	42	53	309380	92451	62196
11	Beverages	1290	2566	516	66	85	607066	131836	83478
12	Tobacco Products	90	923	312	136	143	217798	41248	32437
13	Textiles	825	2067	288	94	110	261611	96663	71641
14	Wearing Apparel	275	1223	220	119	139	157674	92943	65020
15	Leather and Related Products	206	1024	151	82	96	157073	83930	61854
16	Wood and of Products of Wood and Cork, Except Furniture; Articles of Straw and Plaiting Material	127	449	32	18	23	140922	85237	58338
17	Paper and Paper Products	693	1168	170	38	49	349273	132705	86944
18	Printing and Reproduction of Recorded Media	368	818	209	28	43	481007	178813	91755
19	Coke and Refined Petroleum Products	12777	56408	6451	71	95	6797849	413069	268384
20	Chemicals and Chemical Products	1350	3823	651	51	68	952590	199050	106553
21	Basic Pharmaceutical Products and Pharmaceutical Preparations	1413	3430	990	73	119	833167	216481	103065
22	Rubber and Plastic Products	493	1621	306	42	54	570895	126784	80051
23	Other Non-Metallic Mineral Products	557	746	175	38	47	370877	98329	62035
24	Basic Metals	3677	6836	887	81	107	831177	202996	125321
25	Fabricated Metal Products, Except Machinery and Equipment	380	1300	269	44	56	481699	146481	95414
26	Computer, Electronic and Optical Products	1124	5298	937	79	112	838924	254320	112537
27	Electrical Equipments	663	3279	554	62	84	661154	194215	104621
28	Machinery and Equipment N.E.C.	521	2232	459	46	68	673330	224065	113255
29	Motor Vehicles, Trailers and Semi-Trailers	2230	6850	877	127	163	537375	205825	123371
30	Other Transport Equipment	1192	5462	1113	105	130	854598	176778	115216
31	Furniture	216	993	198	37	48	410249	160221	92832
32	Other Manufacturing	371	4254	389	83	106	367855	140998	93451
33	Repair and Installation of Machinery and Equipment	472	1942	511	64	86	594340	222042	146582
38	Waste Collection, Treatment and Disposal Activities; Materials Recovery	285	2738	179	43	53	337546	86758	62000
58	Publishing Activities	1742	2738	1140	59	122	934287	321316	169919
	OTHER INDUSTRIES	2125	2576	426	27	42	1003477	138763	85937
	ALL INDUSTRIES	**933**	**2716**	**409**	**58**	**74**	**555009**	**144386**	**86493**

Table 5 : Principal Characteristics by Size of Employment (Only for Manufacturing Sector) for ASI 2010-11

Employment Range	Factories in Operation	Fixed Capital	Working Capital	Productive Capital	Invested Capital	Workers	Total Persons Engaged	Wages to Workers
	Number	Rs. Lakhs	Rs. Lakhs	Rs. Lakhs	Rs. Lakhs	Number	Number	Rs. Lakhs
0 — 14	59276	4017818	372066	4389885	6184294	332729	476534	209855
15 — 19	17138	1176460	996241	2172702	2228632	207610	287820	118083
20 — 29	19310	2529822	1853288	4383111	4529261	337563	461038	206839
30 — 49	19948	4056812	3146335	7203147	7176022	575558	761464	351893
50 — 99	19261	8689642	6703482	15393124	14488708	1032024	1321333	668105
100 — 199	12380	10528015	7379697	17907712	17579110	1304879	1639492	881407
200 — 499	8250	23099367	12093633	35192999	36973305	1809781	2295258	1507964
500 — 999	3108	19965340	7136163	27101502	31810531	1268628	1617729	1236790
1000 -1999	1605	23092169	6049478	29141647	33711924	1029150	1283496	1067304
2000—4999	835	22005557	6422659	28428216	31059422	912080	1147207	1049139
5000&Above	346	25412614	7189681	32602296	34008664	789625	964129	1058478
Total	**161458**	**144573616**	**59342722**	**203916338**	**219749873**	**9599627**	**12255500**	**8355858**

Table 5 (contd.): Principal Characteristics by Size of Employment (Only for Manufacturing Sector) for ASI 2010-11

Employment Range	Total Emoluments Rs. Lakhs	Input Rs. Lakhs	Output Rs. Lakhs	Gross Value Added Rs. Lakhs	Depreciation Rs. Lakhs	Net Value Added Rs. Lakhs	Rent Paid Rs. Lakhs	Interest Paid Rs. Lakhs
0 — 14	414981	9955290	11450889	1495599	276081	1219518	40755	267531
15 — 19	254064	5921174	6825048	903874	130499	773375	18693	142759
20 — 29	436036	11096192	12393433	1297241	229687	1067554	33925	249795
30 — 49	767162	17535172	20347252	2812080	403275	2408805	77809	426620
50 — 99	1427160	31582966	37246345	5663379	795807	4867572	115858	743775
100 — 199	1887439	36432808	43395772	6962964	959899	6003064	147509	926612
200 — 499	3242496	59034885	73120370	14085485	1838086	12247399	233765	1523379
500 — 999	2692894	48990652	63905798	14915146	1567067	13348079	183275	1348657
1000 -1999	2290355	46718545	56227543	9508998	1559104	7949894	136124	1124555
2000—4999	2238715	51532140	61808281	10276142	1762364	8513777	127410	992856
5000&Above	2178685	45747122	55914415	10167293	1655588	8511705	94161	515251
Total	**17829986**	**364546945**	**442635146**	**78088201**	**11177459**	**66910742**	**1209283**	**8261790**

Table 6: Principal Characteristics by Net Value Added *based on ASI 2010-11*

NVA Range (Rs. Lakhs)	Factories in Operation Number	Fixed Capital Rs. Lakhs	Productive Capital Rs. Lakhs	Invested Capital Rs. Lakhs	Workers Number	Total Persons Engaged Number	Wages to Workers Rs. Lakhs	Total Emoluments Rs. Lakhs
Upto 2.5	19768	20997086	22137606	29080153	697572	921734	560218	1277009
2.5 — 5	9541	175248	289709	281709	58847	78618	21002	31251
5 —— 10	16764	358457	640041	678126	137704	204314	55435	86171
10 —— 20	25915	866381	1565013	1597982	349890	448016	147176	237642
20 —— 50	34650	2593892	4139472	4457706	813271	1002660	387447	644534
50 ——100	19226	2754451	4721008	5107220	659215	838415	382173	703914
100——200	15260	4567187	7686749	8094817	822784	1043583	518320	1007101
200——500	13847	9464225	15352758	15525856	1252076	1581400	885020	1769246
500——1000	6945	8558968	13814743	14482181	1007002	1298072	771887	1619046
1000—5000	7405	24674340	36393605	40220439	2141564	2696789	1889337	3970406
5000& above	2855	85690417	115996232	119831812	1962045	2581252	2946537	6983252
Total	**172177**	**160700652**	**222736937**	**239358002**	**9901970**	**12694853**	**8564552**	**18329574**

Table 6 (contd.): Principal Characteristics by Net Value Added *based on ASI 2010-11*

NVA Range (Rs. Lakhs)	Input Rs. Lakhs	Output Rs. Lakhs	Gross Value Added Rs. Lakhs	Depreciation Rs. Lakhs	Net Value Added Rs. Lakhs	Rent Paid Rs. Lakhs	Interest Paid Rs. Lakhs
Upto 2.5	37169238	32001919	-5167319	1396774	-6564093	96381	1390205
2.5 — 5	427597	480562	52965	17080	35885	2101	11866
5 —— 10	1264751	1424833	160082	36245	123838	6050	28230
10 —— 20	3306824	3778151	471327	92212	379114	14715	88817
20 —— 50	10233136	11583820	1350685	252496	1098189	37594	256542
50 ——100	13278134	14914787	1636653	282014	1354639	44431	314588
100——200	20426170	22984575	2558405	442083	2116322	63441	463442
200——500	33686024	38690390	5004366	825350	4179016	119283	843009
500——1000	29886723	35098331	5211608	783076	4428532	112919	779893
1000—5000	66715293	81763361	15048068	1987173	13060895	306095	1716677
5000& above	168714470	224900965	56186495	5941252	50245243	546325	2908810
Total	**385108361**	**467621696**	**82513336**	**12055754**	**70457581**	**1349336**	**8802079**

Table 7: Principal Characteristics by Net Value Added based on ASI 2010-11 (Percentage Distribution)

NVA Range (Rs. Lakhs)	Factories in Operation	Fixed Capital	Productive Capital	Invested Capital	Workers	Total Persons Engaged	Wages to Workers	Total Emoluments
Upto 2.5	11.48	13.07	9.94	12.15	7.04	7.26	6.54	6.97
2.5 — 5	5.54	0.11	0.13	0.12	0.59	0.62	0.25	0.17
5 —— 10	9.74	0.22	0.29	0.28	1.39	1.61	0.65	0.47
10 —— 20	15.05	0.54	0.70	0.67	3.53	3.53	1.72	1.30
20 —— 50	20.12	1.61	1.86	1.86	8.21	7.90	4.52	3.52
50 ——100	11.17	1.71	2.12	2.13	6.66	6.60	4.46	3.84
100——200	8.86	2.84	3.45	3.38	8.31	8.22	6.05	5.49
200——500	8.04	5.89	6.89	6.49	12.64	12.46	10.33	9.65
500——1000	4.03	5.33	6.20	6.05	10.17	10.23	9.01	8.83
1000—5000	4.30	15.35	16.34	16.80	21.63	21.24	22.06	21.66
5000& above	1.66	53.32	52.08	50.06	19.81	20.33	34.40	38.10
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 7 (Contd.): Principal Characteristics by Net Value Added *based on ASI 2010-11* (Percentage Distribution)

NVA Range (Rs. Lakhs)	Input	Output	Gross Value Added	Depreciation	Net Value Added	Rent Paid	Interest Paid
Upto 2.5	9.65	6.84	-6.26	11.59	-9.32	7.14	15.79
2.5 — 5	0.11	0.10	0.06	0.14	0.05	0.16	0.13
5 —— 10	0.33	0.30	0.19	0.30	0.18	0.45	0.32
10 —— 20	0.86	0.81	0.57	0.76	0.54	1.09	1.01
20 —— 50	2.66	2.48	1.64	2.09	1.56	2.79	2.91
50 ——100	3.45	3.19	1.98	2.34	1.92	3.29	3.57
100——200	5.30	4.92	3.10	3.67	3.00	4.70	5.27
200——500	8.75	8.27	6.06	6.85	5.93	8.84	9.58
500——1000	7.76	7.51	6.32	6.50	6.29	8.37	8.86
1000—5000	17.32	17.48	18.24	16.48	18.54	22.68	19.50
5000& above	43.81	48.09	68.09	49.28	71.31	40.49	33.05
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 8: Share of Seven Major Industries in Output and GVA in States/UTs based on ASI 2010-11(Arranged in Descending Order of Output)

State/UT	NIC-2008	Description	Output		GVA	
			Actual (Rs. Lakhs)	Per-centage	Actual (Rs. Lakhs)	Per-centage
Jammu & Kashmir		TOTAL	1902392	100.00	306854	100.00
		TOTAL OF 7 INDUSTRIES	1656253	87.06	259036	84.42
	20	CHEMICALS AND CHEMICAL PRODUCTS	603313	31.71	108621	35.40
	24	BASIC METALS	376842	19.81	30859	10.06
	Ot	OTHER INDUSTRIES	209643	11.02	3772	1.23
	22	RUBBER AND PLASTIC PRODUCTS	143650	7.55	30078	9.80
	21	BASIC PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL PREPARATIONS	130869	6.88	64435	21.00
	10	FOOD PRODUCTS	96785	5.09	6284	2.05
	27	ELECTRICAL EQUIPMENTS	95151	5.00	14987	4.88
Himachal Pradesh		TOTAL	7184348	100.00	2063797	100.00
		TOTAL OF 7 INDUSTRIES	5253630	73.11	1400661	67.86
	21	BASIC PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL PREPARATIONS	1401221	19.50	533767	25.86
	20	CHEMICALS AND CHEMICAL PRODUCTS	1090580	15.18	341717	16.56
	27	ELECTRICAL EQUIPMENTS	924042	12.86	169034	8.19
	24	BASIC METALS	547730	7.62	22032	1.07
	23	OTHER NON-METALLIC MINERAL PRODUCTS	473729	6.59	208339	10.09
	13	TEXTILES	473017	6.58	69607	3.37
	26	COMPUTER,ELECTRONIC AND OPTICAL PRODUCTS	343311	4.78	56165	2.72
Punjab		TOTAL	14866258	100.00	2330016	100.00
		TOTAL OF 7 INDUSTRIES	10705963	72.03	1598987	68.62
	13	TEXTILES	3028656	20.37	804893	34.54
	10	FOOD PRODUCTS	2309846	15.54	137998	5.92
	24	BASIC METALS	2072453	13.94	129982	5.58
	30	OTHER TRANSPORT EQUIPMENT	1051862	7.08	126013	5.41
	28	MACHINERY & EQUIPMENT N.E.C.	840943	5.66	176889	7.59
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	726334	4.89	120281	5.16
	14	WEARING APPAREL	675869	4.55	102931	4.42
Chandigarh (U.T.)		TOTAL	580940	100.00	79045	100.00
		TOTAL OF 7 INDUSTRIES	518880	89.32	69875	88.40
	Ot	OTHER INDUSTRIES	332704	57.27	32476	41.09
	24	BASIC METALS	76264	13.13	6851	8.67
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	47913	8.25	7130	9.02
	32	OTHER MANUFACTURING	22010	3.79	10226	12.94
	58	PUBLISHING ACTIVITIES	16934	2.91	11170	14.13
	10	FOOD PRODUCTS	12887	2.22	1300	1.64
	27	ELECTRICAL EQUIPMENTS	10168	1.75	722	0.91
Uttrakhand		TOTAL	10583763	100.00	2913308	100.00
		TOTAL OF 7 INDUSTRIES	6842062	64.65	1927655	66.18

Table 8 (Contd.) : Share of Seven Major Industries in Output and GVA in States/ UTs based on ASI 2010-11(Arranged in Descending Order of Output)

State/UT	NIC-2008	Description	Output		GVA	
			Actual (Rs. Lakhs)	Per centage	Actual (Rs. Lakhs)	Per centage
	10	FOOD PRODUCTS	1172948	11.08	587816	20.18
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	1065387	10.07	227562	7.81
	28	MACHINERY & EQUIPMENT N.E.C.	968301	9.15	275552	9.46
	22	RUBBER AND PLASTIC PRODUCTS	954439	9.02	245776	8.44
	27	ELECTRICAL EQUIPMENTS	943918	8.92	211528	7.26
	30	OTHER TRANSPORT EQUIPMENT	929597	8.78	187215	6.43
	20	CHEMICALS AND CHEMICAL PRODUCTS	807472	7.63	192206	6.60
Haryana		TOTAL	21526888	100.00	2994007	100.00
		TOTAL OF 7 INDUSTRIES	17124393	79.54	2087257	69.72
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	6484346	30.12	538819	18.00
	10	FOOD PRODUCTS	2695192	12.52	272728	9.11
	30	OTHER TRANSPORT EQUIPMENT	2662635	12.37	482894	16.13
	24	BASIC METALS	2080538	9.66	135313	4.52
	28	MACHINERY & EQUIPMENT N.E.C.	1521922	7.07	334501	11.17
	14	WEARING APPAREL	843852	3.92	152099	5.08
	27	ELECTRICAL EQUIPMENTS	835908	3.88	170903	5.71
Delhi		TOTAL	4868702	100.00	632782	100.00
		TOTAL OF 7 INDUSTRIES	3715624	76.31	389547	61.55
	10	FOOD PRODUCTS	1360946	27.95	131484	20.78
	Ot	OTHER INDUSTRIES	906194	18.61	62733	9.91
	14	WEARING APPAREL	477504	9.81	95259	15.05
	27	ELECTRICAL EQUIPMENTS	430021	8.83	44997	7.11
	13	TEXTILES	223377	4.59	10645	1.68
	28	MACHINERY & EQUIPMENT N.E.C.	162592	3.34	35606	5.63
	15	LEATHER & RELATED PRODUCTS	154990	3.18	8823	1.39
Rajasthan		TOTAL	15004752	100.00	2183082	100.00
		TOTAL OF 7 INDUSTRIES	10953347	73.01	1486432	68.09
	24	BASIC METALS	2371524	15.81	310108	14.21
	10	FOOD PRODUCTS	2174200	14.49	44422	2.03
	23	OTHER NON-METALLIC MINERAL PRODUCTS	1865706	12.43	565710	25.91
	13	TEXTILES	1810972	12.07	255257	11.69
	20	CHEMICALS AND CHEMICAL PRODUCTS	1180427	7.87	101501	4.65
	Ot	OTHER INDUSTRIES	911939	6.08	46616	2.14
	22	RUBBER AND PLASTIC PRODUCTS	638579	4.26	162818	7.46
Uttar Pradesh		TOTAL	29221560	100.00	5132623	100.00
		TOTAL OF 7 INDUSTRIES	19743026	67.57	3194158	62.22
	10	FOOD PRODUCTS	5778638	19.78	681347	13.27
	19	COKE AND REFINED PETROLEUM PRODUCTS	3545580	12.13	382932	7.46
	26	COMPUTER, ELECTRONIC AND OPTICAL PRODUCTS	3354875	11.48	676060	13.17
	24	BASIC METALS	2320029	7.94	391131	7.62
	20	CHEMICALS AND CHEMICAL PRODUCTS	1898520	6.50	431233	8.40

Table 8 (Contd.) : Share of Seven Major Industries in Output and GVA in States/ UTs based on ASI 2010-11(Arranged in Descending Order of Output)

State/UT	NIC-2008	Description	Output		GVA	
			Actual (Rs. Lakhs)	Per centage	Actual (Rs. Lakhs)	Per centage
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	1592196	5.45	439543	8.56
	27	ELECTRICAL EQUIPMENTS	1253188	4.29	191912	3.74
Bihar		TOTAL	3605131	100.00	484284	100.00
		TOTAL OF 7 INDUSTRIES	3441686	95.48	426599	88.08
	19	COKE AND REFINED PETROLEUM PRODUCTS	2403143	66.66	255316	52.72
	10	FOOD PRODUCTS	364000	10.10	11344	2.34
	ot	OTHER INDUSTRIES	182629	5.07	7455	1.54
	24	BASIC METALS	179953	4.99	13996	2.89
	12	TOBACCO PRODUCTS	140781	3.91	88055	18.18
	23	OTHER NON-METALLIC MINERAL PRODUCTS	101355	2.81	39442	8.14
	11	BEVERAGES	69825	1.94	10991	2.27
Sikkim		TOTAL	445997	100.00	285155	100.00
		TOTAL OF 7 INDUSTRIES	441630	99.04	284161	99.66
	21	BASIC PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL PREPARATIONS	355306	79.67	259084	90.86
	20	CHEMICALS AND CHEMICAL PRODUCTS	51727	11.60	12565	4.41
	10	FOOD PRODUCTS	12154	2.73	3536	1.24
	11	BEVERAGES	9188	2.06	2098	0.74
	12	TOBACCO PRODUCTS	6096	1.37	5713	2.00
	22	RUBBER AND PLASTIC PRODUCTS	4176	0.94	833	0.29
	17	PAPER AND PAPER PRODUCTS	2983	0.67	332	0.12
Nagaland		TOTAL	46960	100.00	5588	100.00
		TOTAL OF 7 INDUSTRIES	46904	99.88	5558	99.46
	16	WOOD AND OF PRODUCTS OF WOOD AND CORK, EXCEPT FURNITURE; ARTICLES OF STRAW AND PLAITING MATERIAL	40749	86.77	4301	76.97
	10	FOOD PRODUCTS	4490	9.56	473	8.46
	23	OTHER NON-METALLIC MINERAL PRODUCTS	1158	2.47	737	13.19
	ot	OTHER INDUSTRIES	246	0.52	56	1.00
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	109	0.23	-108	-1.93
	18	PRINTING AND REPRODUCTION OF RECORDED MEDIA	87	0.19	69	1.23
	22	RUBBER AND PLASTIC PRODUCTS	65	0.14	30	0.54
Manipur		TOTAL	27451	100.00	4364	100.00
		TOTAL OF 7 INDUSTRIES	27211	99.13	4284	98.16
	10	FOOD PRODUCTS	14736	53.68	961	22.02
	23	OTHER NON-METALLIC MINERAL PRODUCTS	6884	25.08	2606	59.72
	24	BASIC METALS	4587	16.71	602	13.79
	ot	OTHER INDUSTRIES	569	2.07	69	1.58

Table 8 (Contd.) : Share of Seven Major Industries in Output and GVA in States/ UTs based on ASI 2010-11(Arranged in Descending Order of Output)

State/UT	NIC-2008	Description	Output		GVA	
			Actual (Rs. Lakhs)	Per centage	Actual (Rs. Lakhs)	Per centage
	19	COKE AND REFINED PETROLEUM PRODUCTS	211	0.77	4	0.09
	22	RUBBER AND PLASTIC PRODUCTS	123	0.45	21	0.48
	11	BEVERAGES	101	0.37	21	0.48
Tripura		TOTAL	143076	100.00	39607	100.00
		TOTAL OF 7 INDUSTRIES	132935	92.91	39006	98.49
	23	OTHER NON-METALLIC MINERAL PRODUCTS	28176	19.69	12227	30.87
	ot	OTHER INDUSTRIES	24152	16.88	1626	4.11
	10	FOOD PRODUCTS	19888	13.90	3946	9.96
	24	BASIC METALS	18441	12.89	3330	8.41
	12	TOBACCO PRODUCTS	14857	10.38	10233	25.84
	22	RUBBER AND PLASTIC PRODUCTS	13976	9.77	1054	2.66
	20	CHEMICALS AND CHEMICAL PRODUCTS	13445	9.40	6590	16.64
Meghalaya		TOTAL	287476	100.00	82912	100.00
		TOTAL OF 7 INDUSTRIES	273591	95.17	80221	96.76
	23	OTHER NON-METALLIC MINERAL PRODUCTS	162326	56.47	63802	76.95
	24	BASIC METALS	77266	26.88	10450	12.60
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	9368	3.26	779	0.94
	20	CHEMICALS AND CHEMICAL PRODUCTS	7680	2.67	2851	3.44
	10	FOOD PRODUCTS	6219	2.16	933	1.13
	19	COKE AND REFINED PETROLEUM PRODUCTS	5774	2.01	852	1.03
	11	BEVERAGES	4958	1.72	554	0.67
Assam		TOTAL	4236700	100.00	766187	100.00
		TOTAL OF 7 INDUSTRIES	3943026	93.07	729513	95.20
	19	COKE AND REFINED PETROLEUM PRODUCTS	2167235	51.15	370547	48.36
	10	FOOD PRODUCTS	910385	21.49	180855	23.60
	20	CHEMICALS AND CHEMICAL PRODUCTS	256921	6.06	58631	7.65
	ot	OTHER INDUSTRIES	221640	5.23	10890	1.42
	23	OTHER NON-METALLIC MINERAL PRODUCTS	163411	3.86	77247	10.08
	24	BASIC METALS	158715	3.75	20207	2.64
	12	TOBACCO PRODUCTS	64719	1.53	11136	1.45
West Bengal		TOTAL	20611103	100.00	2513266	100.00
		TOTAL OF 7 INDUSTRIES	16366430	79.41	1660516	66.08
	24	BASIC METALS	6130001	29.74	309530	12.32
	19	COKE AND REFINED PETROLEUM PRODUCTS	2729712	13.24	181101	7.21
	10	FOOD PRODUCTS	2438168	11.83	274455	10.92
	20	CHEMICALS AND CHEMICAL PRODUCTS	2249716	10.92	361775	14.39
	13	TEXTILES	1171532	5.68	227664	9.06

Table 8 (Contd.) : Share of Seven Major Industries in Output and GVA in States/ UTs based on ASI 2010-11(Arranged in Descending Order of Output)

State/UT	NIC-2008	Description	Output		GVA	
			Actual (Rs. Lakhs)	Per centage	Actual (Rs. Lakhs)	Per centage
	ot	OTHER INDUSTRIES	836213	4.06	135141	5.38
	28	MACHINERY & EQUIPMENT N.E.C.	811088	3.94	170850	6.80
Jharkhand		TOTAL	9720666	100.00	2259721	100.00
		TOTAL OF 7 INDUSTRIES	9345718	96.15	2198453	97.29
	24	BASIC METALS	5188750	53.38	1598320	70.73
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	1480221	15.23	142482	6.31
	ot	OTHER INDUSTRIES	1016129	10.45	150906	6.68
	19	COKE AND REFINED PETROLEUM PRODUCTS	570636	5.87	126192	5.58
	28	MACHINERY & EQUIPMENT N.E.C.	517012	5.32	-55196	-2.44
	23	OTHER NON-METALLIC MINERAL PRODUCTS	302233	3.11	105031	4.65
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	270737	2.79	130718	5.78
Odisha		TOTAL	9214154	100.00	2144365	100.00
		TOTAL OF 7 INDUSTRIES	8599503	93.32	2052922	95.73
	24	BASIC METALS	6202349	67.31	1567900	73.12
	20	CHEMICALS AND CHEMICAL PRODUCTS	864061	9.38	140600	6.56
	10	FOOD PRODUCTS	516406	5.60	91430	4.26
	23	OTHER NON-METALLIC MINERAL PRODUCTS	463005	5.02	121225	5.65
	ot	OTHER INDUSTRIES	201735	2.19	56669	2.64
	22	RUBBER AND PLASTIC PRODUCTS	201197	2.18	22528	1.05
	17	PAPER AND PAPER PRODUCTS	150750	1.64	52570	2.45
Chhattish garh		TOTAL	7954481	100.00	1546412	100.00
		TOTAL OF 7 INDUSTRIES	7641271	96.06	1494594	96.65
	24	BASIC METALS	5919375	74.42	1261242	81.56
	10	FOOD PRODUCTS	596672	7.50	42373	2.74
	23	OTHER NON-METALLIC MINERAL PRODUCTS	419576	5.27	131580	8.51
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY & EQUIPMENT	217153	2.73	27978	1.81
	30	OTHER TRANSPORT EQUIPMENT	204344	2.57	30156	1.95
	ot	OTHER INDUSTRIES	167300	2.10	27562	1.78
	19	COKE AND REFINED PETROLEUM PRODUCTS	116851	1.47	-26297	-1.70
Madhya Pradesh		TOTAL	11589804	100.00	2027989	100.00
		TOTAL OF 7 INDUSTRIES	8381236	72.32	1417993	69.92
	10	FOOD PRODUCTS	3136787	27.07	255485	12.60
	24	BASIC METALS	1169261	10.09	110650	5.46
	23	OTHER NON-METALLIC MINERAL PRODUCTS	988762	8.53	326698	16.11
	13	TEXTILES	823133	7.10	198560	9.79
	22	RUBBER AND PLASTIC PRODUCTS	788344	6.80	162713	8.02
	27	ELECTRICAL EQUIPMENTS	760884	6.57	242610	11.96
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	714065	6.16	121277	5.98

Table 8 (Contd.) : Share of Seven Major Industries in Output and GVA in States/ UTs based on ASI 2010-11(Arranged in Descending Order of Output)

State/UT	NIC-2008	Description	Output		GVA	
			Actual (Rs. Lakhs)	Per centage	Actual (Rs. Lakhs)	Per centage
Gujarat		TOTAL	80678350	100.00	10962242	100.00
		TOTAL OF 7 INDUSTRIES	64272090	79.67	8270725	75.44
	19	COKE AND REFINED PETROLEUM PRODUCTS	31256139	38.74	3230771	29.47
	20	CHEMICALS AND CHEMICAL PRODUCTS	10765309	13.34	2417220	22.05
	24	BASIC METALS	6015439	7.46	836412	7.63
	10	FOOD PRODUCTS	5409920	6.71	319943	2.92
	13	TEXTILES	4734402	5.87	662611	6.04
	28	MACHINERY & EQUIPMENT N.E.C.	3325258	4.12	568162	5.18
	ot	OTHER INDUSTRIES	2765623	3.43	235606	2.15
Daman & Diu		TOTAL	4038142	100.00	704052	100.00
		TOTAL OF 7 INDUSTRIES	3481044	86.20	557861	79.22
	27	ELECTRICAL EQUIPMENTS	1332405	33.00	182013	25.85
	22	RUBBER AND PLASTIC PRODUCTS	755705	18.71	111834	15.88
	20	CHEMICALS AND CHEMICAL PRODUCTS	544474	13.48	80645	11.45
	24	BASIC METALS	291738	7.22	19234	2.73
	13	TEXTILES	208461	5.16	50430	7.16
	21	BASIC PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL PREPARATIONS	203839	5.05	81624	11.59
	17	PAPER AND PAPER PRODUCTS	144422	3.58	32081	4.56
D&N Haveli		TOTAL	7291502	100.00	866972	100.00
		TOTAL OF 7 INDUSTRIES	6690770	91.77	733251	84.56
	13	TEXTILES	2594423	35.58	296491	34.20
	24	BASIC METALS	1435435	19.69	64884	7.48
	27	ELECTRICAL EQUIPMENTS	1037835	14.23	94072	10.85
	20	CHEMICALS AND CHEMICAL PRODUCTS	649504	8.91	83179	9.59
	22	RUBBER AND PLASTIC PRODUCTS	511933	7.02	90015	10.38
	19	COKE AND REFINED PETROLEUM PRODUCTS	316147	4.34	76069	8.77
	17	PAPER AND PAPER PRODUCTS	145493	2.00	28541	3.29
Maharashtra		TOTAL	78536268	100.00	16846750	100.00
		TOTAL OF 7 INDUSTRIES	50639936	64.48	10461748	62.10
	19	COKE AND REFINED PETROLEUM PRODUCTS	10725926	13.66	3541132	21.02
	24	BASIC METALS	8942843	11.39	1149604	6.82
	10	FOOD PRODUCTS	8456371	10.77	819206	4.86
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	6565937	8.36	928618	5.51
	28	MACHINERY & EQUIPMENT N.E.C.	5971415	7.60	1513898	8.99
	20	CHEMICALS AND CHEMICAL PRODUCTS	5750230	7.32	1419596	8.43
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	4227214	5.38	1089694	6.47
Andhra Pradesh		TOTAL	34356018	100.00	6848971	100.00
		TOTAL OF 7 INDUSTRIES	23075414	67.18	4603568	67.22

Table 8 (Contd.) : Share of Seven Major Industries in Output and GVA in States/ UTs based on ASI 2010-11(Arranged in Descending Order of Output)

State/UT	NIC-2008	Description	Output		GVA	
			Actual (Rs. Lakhs)	Per centage	Actual (Rs. Lakhs)	Per centage
	10	FOOD PRODUCTS	7172331	20.88	545796	7.97
	24	BASIC METALS	3626946	10.56	686140	10.02
	19	COKE AND REFINED PETROLEUM PRODUCTS	2847233	8.29	167146	2.44
	ot	OTHER INDUSTRIES	2743508	7.99	1639372	23.94
	21	BASIC PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL PREPARATIONS	2506106	7.29	624462	9.12
	23	OTHER NON-METALLIC MINERAL PRODUCTS	2122295	6.18	643401	9.39
	20	CHEMICALS AND CHEMICAL PRODUCTS	2056995	5.99	297251	4.34
Karnataka		TOTAL	28594965	100.00	4893279	100.00
		TOTAL OF 7 INDUSTRIES	19271359	67.39	2638260	53.93
	19	COKE AND REFINED PETROLEUM PRODUCTS	4142407	14.49	260093	5.32
	10	FOOD PRODUCTS	4068755	14.23	535630	10.95
	24	BASIC METALS	3616754	12.65	689391	14.09
	32	OTHER MANUFACTURING	2308611	8.07	45098	0.92
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	1868259	6.53	335994	6.87
	28	MACHINERY & EQUIPMENT N.E.C.	1665306	5.82	424115	8.67
	27	ELECTRICAL EQUIPMENTS	1601267	5.60	347939	7.11
Goa		TOTAL	3249409	100.00	655452	100.00
		TOTAL OF 7 INDUSTRIES	2629978	80.93	518305	79.08
	20	CHEMICALS AND CHEMICAL PRODUCTS	635274	19.55	7402	1.13
	22	RUBBER AND PLASTIC PRODUCTS	589404	18.14	87258	13.31
	21	BASIC PHARMACEUTICAL PRODUCTS & PHARMACEUTICAL PREPARATIONS	537228	16.53	227196	34.66
	24	BASIC METALS	355846	10.95	2663	0.41
	27	ELECTRICAL EQUIPMENTS	189183	5.82	25734	3.93
	10	FOOD PRODUCTS	176225	5.42	67053	10.23
	13	TEXTILES	146818	4.52	100999	15.41
Kerala		TOTAL	8205049	100.00	1004011	100.00
		TOTAL OF 7 INDUSTRIES	6854826	83.55	627866	62.52
	19	COKE AND REFINED PETROLEUM PRODUCTS	3155466	38.46	112065	11.16
	10	FOOD PRODUCTS	1303623	15.89	91597	9.12
	22	RUBBER AND PLASTIC PRODUCTS	832798	10.15	108059	10.76
	20	CHEMICALS AND CHEMICAL PRODUCTS	622249	7.58	181163	18.04
	24	BASIC METALS	333665	4.07	24746	2.46
	13	TEXTILES	331242	4.04	61713	6.15
	ot	OTHER INDUSTRIES	275783	3.36	48523	4.83
Tamilnadu		TOTAL	47212225	100.00	8546867	100.00
		TOTAL OF 7 INDUSTRIES	30725670	65.07	5265567	61.61
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	8443004	17.88	1707283	19.98

Table 8 (Contd.) : Share of Seven Major Industries in Output and GVA in States/ UTs based on ASI 2010-11(Arranged in Descending Order of Output)

State/UT	NIC-2008	Description	Output		GVA	
			Actual (Rs. Lakhs)	Per centage	Actual (Rs. Lakhs)	Per centage
	13	TEXTILES	5362370	11.36	988931	11.57
	24	BASIC METALS	4237868	8.98	539968	6.32
	10	FOOD PRODUCTS	3584774	7.59	336143	3.93
	19	COKE AND REFINED PETROLEUM PRODUCTS	3325680	7.04	172447	2.02
	28	MACHINERY & EQUIPMENT N.E.C.	2937945	6.22	629043	7.36
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	2834029	6.00	891752	10.43
Puducherry		TOTAL	1820839	100.00	387421	100.00
		TOTAL OF 7 INDUSTRIES	1419521	77.97	308951	79.75
	20	CHEMICALS AND CHEMICAL PRODUCTS	362865	19.93	75738	19.55
	26	COMPUTER, ELECTRONIC AND OPTICAL PRODUCTS	345435	18.97	141789	36.60
	24	BASIC METALS	184093	10.11	13079	3.38
	28	MACHINERY & EQUIPMENT N.E.C.	173285	9.52	25000	6.45
	10	FOOD PRODUCTS	131229	7.21	4859	1.25
	25	FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND EQUIPMENT	114482	6.29	19006	4.91
	22	RUBBER AND PLASTIC PRODUCTS	108132	5.94	29480	7.61
A& N Islands		TOTAL	16327	100.00	1957	100.00
		TOTAL OF 6 INDUSTRIES	16327	100.00	1956	99.95
	ot	OTHER INDUSTRIES	15036	92.09	1987	101.53
	10	FOOD PRODUCTS	497	3.04	-249	-12.72
	16	WOOD AND OF PRODUCTS OF WOOD AND CORK, EXCEPT FURNITURE; ARTICLES OF STRAW AND PLAITING MATERIAL	475	2.91	42	2.15
	11	BEVERAGES	169	1.04	75	3.83
	20	CHEMICALS AND CHEMICAL PRODUCTS	139	0.85	94	4.80
	18	PRINTING AND REPRODUCTION OF RECORDED MEDIA	11	0.07	7	0.36
All India		TOTAL	467621696	100.00	82513336	100.00
		TOTAL OF 7 INDUSTRIES	301827120	64.55	46425948	56.27
	19	COKE AND REFINED PETROLEUM PRODUCTS	67971759	14.54	8794603	10.66
	24	BASIC METALS	64794410	13.86	10165945	12.32
	10	FOOD PRODUCTS	54372015	11.63	5554372	6.73
	20	CHEMICALS AND CHEMICAL PRODUCTS	35229032	7.53	7213221	8.74
	29	MOTOR VEHICLES, TRAILERS AND SEMI-TRAILERS	30044070	6.42	4872796	5.91
	13	TEXTILES	27197382	5.82	4803700	5.82
	28	MACHINERY & EQUIPMENT N.E.C.	22218452	4.75	5021311	6.09

Table 9: Principal Characteristics by Major Economic Activities based on ASI 2010-11

Characteristics	Unit	Manufac turing	Electricity, Gas, Water Supply	Others	All Activities
Factories in Operation	Number	161458	585	10134	172177
Fixed Capital	Rs Lakhs	144573616	13885952	2241084	160700652
Productive Capital	Rs Lakhs	203916338	15072848	3747750	222736937
Invested Capital	Rs Lakhs	219749873	15337969	4270159	239358002
Workers	Number	9599627	35565	266777	9901970
Total Persons Engaged	Number	12255500	46499	392854	12694853
Wages to Worker	Rs Lakhs	8355858	36265	172429	8564552
Total Emoluments	Rs Lakhs	17829986	91307	408281	18329574
Input	Rs Lakhs	364546945	3690321	16871094	385108361
Output	Rs Lakhs	442635146	6598139	18388412	467621696
GVA	Rs Lakhs	78088201	2907817	1517317	82513336
Depreciation	Rs Lakhs	11177459	676121	202175	12055754
NVA	Rs Lakhs	66910742	2231696	1315143	70457581
Rent Paid	Rs Lakhs	1209283	62001	78053	1349336
Interest Paid	Rs Lakhs	8261790	286164	254125	8802079
Income	Rs Lakhs	57439670	1883532	982965	60306166
Profit	Rs Lakhs	36716469	1777514	522177	39016161

Table 10: Principal Characteristics by Major Economic Activities based on ASI 2010-11 (Percentage Distribution)

Characteristics	Unit	Manufac turing	Electricity, Gas, Water Supply	Others	All Activities
Factories in Operation	Number	93.77	0.34	5.89	100.00
Fixed Capital	Rs Lakhs	89.96	8.64	1.39	100.00
Productive Capital	Rs Lakhs	91.55	6.77	1.68	100.00
Invested Capital	Rs Lakhs	91.81	6.41	1.78	100.00
Workers	Number	96.95	0.36	2.69	100.00
Total Persons Engaged	Number	96.54	0.37	3.09	100.00
Wages to Worker	Rs Lakhs	97.56	0.42	2.01	100.00
Total Emoluments	Rs Lakhs	97.27	0.50	2.23	100.00
Input	Rs Lakhs	94.66	0.96	4.38	100.00
Output	Rs Lakhs	94.66	1.41	3.93	100.00
GVA	Rs Lakhs	94.64	3.52	1.84	100.00
Depreciation	Rs Lakhs	92.71	5.61	1.68	100.00
NVA	Rs Lakhs	94.97	3.17	1.87	100.00
Rent Paid	Rs Lakhs	89.62	4.59	5.78	100.00
Interest Paid	Rs Lakhs	93.86	3.25	2.89	100.00
Income	Rs Lakhs	95.25	3.12	1.63	100.00
Profit	Rs Lakhs	94.11	4.56	1.34	100.00

SECTION III

- Proceedings of the International Workshop on Official Economic Statistics of India

IGC-ISI-CSO Workshop on Official Economic Statistics of India

11 July, 2013

1. A one-day workshop on official Indian economic statistics was organised jointly by the Sampling and Official Statistics Unit (SOSU), Indian Statistical Institute (ISI) Kolkata, the Central Statistics Office, Industrial Statistics Wing, Government of India at ISI Kolkata on 11 July 2013. Its purpose was to initiate a dialogue between researchers using these statistics, and officials in the Indian government responsible for generating them. In the short-run, such dialogue can help researchers confronting problems with using the data, to learn more about how it was generated and resolve specific questions about how to correctly interpret it. The longer term goal is to help Indian government officials design surveys in the future that are more useful for researchers, besides consolidating existing systems and planning design of future statistical systems in a comprehensive manner.

2. The day-long workshop was co-sponsored by the International Growth Centre, (IGC) India Central Programme, which also helped by inviting leading economists to participate. There were around 50 participants from government bodies such as the Central Statistics Office (CSO), National Sample Survey Office (NSSO), Micro, Small and Medium Enterprises (MSME) and Council of Scientific and Industrial Research (CSIR); international organisations such as the International Monetary Fund (IMF) and World Bank; academic researchers from Boston University, Yale University, Jawaharlal Nehru University (JNU) and University of California, Berkeley; and corporate users of Indian data. A summary of the proceedings is provided below.

3. **Prasanta Pathak (Head, SOSU, ISI Kolkata)** made introductory remarks. He said that the purpose of the workshop is to identify and bridge the gap between the officials involved in data generation and the users of data. The unique event was the first of its kind and there are plans of holding such workshops at other places as well in the future. Another objective is to popularise the use of official India data so as to justify the expense and effort that goes into generating the data. **Bimal Roy (Director, ISI Kolkata)** welcomed the participants to the workshop. He said that the workshop reiterates the commitment of the institute to working with the government on projects of national importance.

Session I: Perspectives of the Data Users

4. This session was chaired by **Pronab Sen (National Statistical Commission; IGC India Central).** He noted that in the context of the Indian statistical system, user interaction has been a one way conversation, and nothing much has come out of it. The workshop is an opportunity to have a more meaningful interaction between researchers and academics where the researchers can put down the nature of the

problems that they face when using Indian statistics, and for officials to explain why data is collected in the way that it is. The complaints of data users are generally of three types: (i) Data is not appropriate for the purpose for which it has been collected on account of errors, data being out of date etc., (ii) Data is not suitable for purposes other than the ones for which it has been collected (a common complaint by academics), and (iii) Lack of data on correlates that would allow for more analytical work.

5. With respect to the first problem, there is indeed a need for dialogue. The data officials are only generating the data and have no time to analytically examine it. Hence, problems come up in using the data and it is important that these be fed back into the system so as to enable a re-engineering of the processes. The second problem is more complex; academics have a research idea in mind, and the data they require may not be compatible with what is currently being collected for those purposes. For instance, the original purpose of the National Sample Survey (NSS) consumption surveys and National Income Accounts was to feed into the consumption models of Plans. In the 60s, researchers began to use them to compute poverty and by the 80s, this became their dominant use. If there is a change in the basket, there are protests by academics that inter-temporal comparability is being destroyed. As a result, this data has now become useless for the planning model and they are too far removed from the structure of the economy. With regard to the third problem outlined above, there is no formal forum through which new research issues can come to notice. User interactions are dominated by the government and the government demands descriptive data – a lot of resources go into satisfying these demands.

6. The objective of the workshop is to assess the appropriateness of current data, and to think about how to re-jig the processes with respect to existing data, and what new data is required. In doing so, one should keep in mind that the NSS is already over-burdened and academics should think of data processes that would satisfy more than one need.

7. **Pranab Bardhan (University of California, Berkeley)** delivered the keynote address based on his experiences with Indian statistics. He focused on data quantity and quality issues. He said that Indian statistics was a reputed enterprise at one time, and an example for many other developing countries and that this reputation is now in shambles. Data issues are hurting analyses of some of the basic elements of the Indian economy – growth, poverty and inequality. For example, with respect to *growth*, he said that even though services now constitute nearly 58% of national income, there is no separate price index for services yet. Further, he also pointed out problems with the Economic Census (EC) such as undercounting, erratic frequency, lack of training of enumerators etc. In the context of manufacturing, the fact that NSS and the Annual Survey of Industries (ASI) do not follow a common sampling framework causes problems. Moreover, we do not have information on the linkages between the organised and unorganised sectors, or on the quality of employment in the informal sector. Finally, we do not factor in depreciation of natural capital in growth accounting.

8. With regard to *poverty*, he pointed out that the data problems relate to the consumption expenditure figures and appropriate price indices for the poor. There are large and increasing discrepancies between NSS estimate and that from National Accounts statistics. Non-response errors are large and increasing. The price index is not covering the self-employed poor. Non-income indicators of poverty can be estimated from the National Family Health Survey (NFHS), which has a large sample but is not panel data.

9. With regard to the analysis of *inequality*, the usual Gini coefficients are misleading, as there is no income data, except for that produced by the National Council of Applied Economic Research (NCAER) and there are some doubts about that data as well. More important than the inequality of outcome is the inequality of opportunity, which depends on inequality of land, education, locality and social status. We have very little data on educational inequality by households. Even though intergenerational mobility is crucial for understanding the dynamic nature of Indian inequality, neither the NSS nor NFHS give panel data following the same households, and neither gives the parents' job history.

10. Finally, he recommended that the National Statistical Commission be made a permanent and independent statutory body, and the various statistical units of the Ministries should report autonomously to the Commission. Immediate steps need to be taken by the whole statistics community to address issues of shortage and poor quality of staff, inadequate resources and the general low priority given to statistics in government circles.

11. Next, **T.N. Srinivasan (Yale University)** delivered a lecture on the shortcomings of Indian official statistics. He said that the blame game between data generators and users in the context of the recent Uttarakhand tragedy is a familiar story – the Meteorological Department claimed to have provided forecasts but the government said that they were not specific enough in terms of location and expected time, and hence not useful for planning and taking advance action. Generally speaking, users often complain that official data is too general from the perspective of policy making. They do not realise that given limited resources, no data-gathering agency can anticipate and cater to the specific needs of myriads of users.

12. Srinivasan raised several issues with official data in the context of CSO, National Accounts Statistics (NAS), NSS, industrial statistics, employment data, price statistics and poverty, and savings and investment statistics. In his view, there is the longstanding problem that Gross Domestic Product (GDP) in Indian NAS is estimated using a mish-mash of income, product, and expenditure approaches. The employment-based procedure of estimating parts of service sector value added, and price deflation procedures in general continue to be unsatisfactory.

13. The savings and investments statistics remain the weakest in NAS. The household sector in NAS, unlike in the NSS, is a residual that should in fact be called 'Sector other than private corporate sector and public sector'. Being residuals, the data for this misnamed sector absorbs the errors in measurement in the estimates for the

other two sectors. The notorious 'Direct Savings in the form of physical assets' of the household sector is again a residual in the commodity flow method of estimation of investment. The reports of the National Statistical Commission and the High Level Committee headed by Dr C. Rangarajan had recommended resuming the estimation of the savings and investment of households using an integrated schedule of enquiry on their income, consumption, savings and investment, as done in the 19th round of the NSS. This has not yet been implemented by NSS.

14. Srinivasan discussed two issues arising from the 'Statistical Federalism' in India. Firstly, in NSS, two independent samples – Central and the state – are canvassed, so that states can do their own analyses on issues of interest to them. However, this is turning out to be an enormous waste of resources as most states do not make use of their samples. Secondly, while the CSO is responsible for NAS estimation for the country as a whole, they only publish the aggregate State Domestic Product (SDP) data series, but do not analyse the series or assess its quality.

15. The Planning Commission, aided and abetted by NSSO, clings to the myth that only 'thick' rounds have large enough sample sizes to yield reliable estimates of poverty head count ratio for the country as a whole. They should know that only the absolute size of the sample matters for reliability and the absolute sizes of samples in 'thin' rounds, at least for the last two decades or more, are adequate to yield reliable estimates of poverty ratio.

16. Srinivasan said that the Ministry of Statistics and Programme Implementation (MoSPI) should periodically publish a comprehensive volume on historical statistics of India, including pre-independence data. In his view, this would enable more cliometric research on India.

17. He emphasised the importance of experimentation, for example, in terms of the size and shape of plots for cross-cutting experiments, choice of reference periods for household expenditure surveys, composition and length of questionnaires etc. – as done in the early years of NSS. States should be used as laboratories for this purpose, and rapid changes in Information and Communication Technology (ICT) should be exploited.

18. He concluded with a couple of suggestions: (i) Sub-round estimates of the NSS can be used to generate seasonal adjustments, and could also be integrated into the quarterly GDP estimates. A panel feature could be introduced by revisiting the same set of villages and urban blocks, if not households, of one of the independent samples for several rounds, and (ii) Price indices and other data need to take into account changes in the quality of goods and services produced and used.

19. **Dilip Mookherjee (Boston University; IGC India Central)** talked about the research and policy issues pertaining to the Small and Medium Enterprises (SME) sector, and data problems in this context. He said that there are specific problems with generation of productive employment opportunities in the manufacturing sector on account of which growth acceleration in per capita GDP has not resulted in

significant benefits for the bottom half of the population. To test possible causes in terms of governance factors or market/ technology access, data is required on firms at the firm and plant level, on an annual basis, combined with their external environment.

20. As the ASI excludes the unorganised sector entirely, the NSSO Employment/ Unemployment Surveys (EUS) are meant to represent the unorganised and organised sector employment, but they are undertaken once in five years and do not have a panel feature. Also, there are issues of inconsistency of sample frame and questionnaires with ASI. He also outlined issues with the EC such as undercounting of very small firms. The need to 'stitch' together the ASI data with NSSO or EC is important to be able to say something about the importance of small enterprises or the unorganised sector, in trying to compare productivity or examine the importance of industrial regulations relative to other factors in explaining the unusual size distribution of Indian firms.

21. In conclusion, he said that there is a need for greater dialogue between the users and generators of data so that the users can ask questions regarding the data in the short run, and provide feedback to help design future surveys in the long run.

22. **Michael Gechter (Boston University)** presented key questions from his on-going research on the effect of size-based regulations on the distribution of enterprise size. The researchers plan to use NSSO and ASI data on organised and unorganised manufacturing and raised some initial questions regarding both datasets – for instance, he asked how national estimates are produced from the NSSO surveys for comparisons with the EC. He also said that the researchers would like to find additional data sources on small and medium enterprises such as employment data from the Ministry of Labour and Employment.

23. **Sharon Buteau (IFMR Research)** spoke about the currently available MSME data and unmet requirements. She said that the mission of the Small Enterprise Finance Sector (SEFC) at IFMR is to study how financial markets can foster growth of MSMEs and the role that MSMEs play in poverty alleviation. Important research topics in the context of MSMEs are access to finance, human capital and markets. She also pointed out major data gaps for research and policy in the MSME sector. While data is available on the amount of credit given, Non-Performing Assets (NPA) etc., data is lacking on time taken for credit processing, rejections, withdrawals, and so on, cost of obtaining credit from different financial institutions, and on collateral requirements. In terms of employment, data is available on the percentage of employment in MSMEs across rural, urban and state sectors, but not on the type and quality of employment, family businesses and the MSME labour force.

Session 2: Perspectives of the Data Generators

24. This session was chaired by **V.K. Arora (CSO)** and **B.N. Goldar (JNU).** It involved presentations by officials from the CSO on the EC, ASI and Unemployment Surveys. Goldar raised a few issues, which he wanted the presenters to shed light on. These

issues included deficiencies in the sampling frame, how to make better use of the state sample data, and whether it is feasible to combine state and central statistics to get more robust estimates. He further commented on the issue of comparability of data - employment and unemployment data is collected by various agencies such as ASI, NSSO etc.; however, often the data is not easily comparable. He raised the issue of limited resources and whether new surveys may be a burden on the existing resources. Lastly, he went on to talk about the utility of panel data and whether it will be possible to have panel data in household surveys.

25. **Sunil Jain (CSO)** made a presentation on the 'Economic Census'. He spoke about the meaning and relevance of the EC, international practices, other economic censuses in Asia, the procedure followed in the sixth EC and issues relating to India. He outlined the objectives of the sixth EC, which include providing information on operational variables (activity-wise for all establishments), providing data at lower geographical levels, like tehsils and villages, and on the number of workers in the unorganised sector. He said that the initial figures for the EC are likely to be released by December 2013, the All-India report by October 2014 and the final completion of the EC will be by March 2015. Finally, he suggested that the EC should have a periodicity of five years, so that it can be used for planning purposes. Also, there should be an effort to create awareness about the EC among socio-economic ministries.

26. **Bivas Chaudhuri (CSO)** submitted a presentation on the 'Annual Survey of Industries' data. ASI is the principal source of industrial statistics in India, and is collected by the NSSO. It provides statistical information to assess and evaluate, objectively and realistically, the changes in the growth, composition and structure of the organised manufacturing sector. The survey techniques are broadly based on the recommendations of the United Nations Statistics Division (UNSD), and international comparability is possible. A legal guarantee of the confidentiality of the data is given to the factories, and any unit that refuses to furnish ASI units or provides false information can be prosecuted. He described the reference periods of surveys, schedules of enquiry, scope and coverage, frame and sampling design of the ASI, as well as the industrial and product classification. He noted that the time lag in the release of data had been reduced considerably in the past few years. Moreover, certain new initiatives had been implemented such as e-schedules and an ASI web portal that included frame updation, data collection, processing and dissemination. ASI has rich time series data spanning over 25 years. He also described how data were disseminated and how it could be obtained.

27. He highlighted a few shortcomings of the data, for example: (i) The Collection of Statistics Act prohibits disclosure of data relating to individual factories (ii) Sampling design is changing over time (iii) Industrial and product classifications are updated as per the UN recommendations, so concordance is a challenging task (iv) All estimates, especially for quantity and value figures for any particular item consumed and produced, are subject to statistical error as these are estimated on the basis of a selected sample.

28. Finally, for controlling non-sampling errors, he recommended record-based surveys, experienced field investigators, training of field investigators, close monitoring of field work, and data validation and scrutiny.

29. **B.K. Giri (CSO)** made a presentation concerning Employment and Unemployment Surveys (EUS). The major sources are the population census, EUS of NSSO, recent EUS of the Labour Bureau, and MSME, Ministry of Agriculture etc. for their respective domains. He said that there are differences in the estimates from the Population Censuses and the NSSO EUS for various reasons, and these have been addressed by the Expert Committee on Data Divergence. He also said that there are differences in the estimates from the Population Censuses and the NSSO EUS for various reasons, and that these have been addressed by the Expert Committee on Data Divergence.

30. He outlined the changes in concepts and definitions, and their impacts on the estimates. For instance, since the 61st Round of the NSS, information on voluntary participation without remuneration in the production of goods and services was added. These are not considered as economic activities in the NSS surveys. In terms of measurement, information on two subsidiary activities was collected in the 55th Round of the NSS to understand the extent of labour mobility.

31. Other issues discussed were the feasibility of providing absolute estimates in household surveys with reference to employment and unemployment indicators, usability of EUS for providing estimates of jobs, recording of data on earning from employment, additional categories for status classification, measuring informal sector employment, and definitions of decent work, green jobs and child labour.

Session III: Panel Discussion on Future Agenda for Official Data

32. The final session was chaired by **T.C.A. Anant (Ministry of Statistics and Programme Implementation, Government of India).** The users and generators of data discussed plans for the future for official data.

33. T.C.A. Anant began the discussion by highlighting the need for innovative solutions to two major problems. First, the official statistical system does not address the need for panel data to answer dynamic questions, and second, there are various constraints on the official statistical system in terms of resources, skilled manpower etc. He noted that the data already being produced is voluminous, and is stretching the scarce resources available. He further said that the panellists should suggest better synergies of available processes and ways to economising the use of existing resources, in order to be able to respond to the needs of the users of data.

34. **Manisha G. Singh (CSIR)** suggested using technology to improve data collection. For instance, GPS-enabled tablets can be given to enumerators that will show how much time they spend in the field interviewing respondents. This is something that is already being done by corporates. **Sandip Mitra (ISI Kolkata)** said that the time of data collection should be specified in NSS. Data required for behavioural

economics studies such as on aspirations should be incorporated in surveys. Also, an understanding of formal and informal sectors is very important in the Indian context and data collection should take this into account.

35. Other important points raised during the discussion by other panelists were the trade-off between resources and reliability; the quality of data; insufficient data on the rich and associated problems with capturing inequalities; lack of state-level capital stock information that is required for sub-regional growth analysis, limited utility of yearly surveys such as the consumer expenditure survey to researchers; and inability of official statistics to capture the dynamic nature of the economy. The possibility of creating pseudo-panels to capture dynamic incentives was also explored.

Concluding Remarks

36. In conclusion, Pronab Sen said that given the resources, the Indian government needs to change the way it collects statistics. He noted that the NSSO has been doing the same things in the same way – this cannot carry on going forward. There is an urgent need to consider the needs of policymakers as well as the needs of academics, which are often conflicting, and prioritise. It is important to re-visit some questions with regard to the type of data being generated. For example, why not discontinue household consumption surveys if they are not being used? We need to have a debate on the need for panel data vis-à-vis cross sectional data. He further said that this workshop was a good beginning, and we need more precise interactions on the areas of focus and the nature of surveys. However, we cannot give everyone what they ask for as the system does not permit this. The changes that are required need to be brought about in a collective manner.

37. T.C.A. Anant said that e-governance efforts are being made. Usable statistics can now be extracted. However, this is at early stages. For example, there is a partnership with the corporate affairs ministry and datasets on company returns can be mined online. There is an on-going exercise in partnership with the department of revenue for creation of an excise database. Finally, he said that there is also a need to manage expectations and keep feasibility in mind.

38. **Nachiketa Chattopadhyay (ISI Kolkata)** thanked all the participants and closed the workshop.

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