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Size Structure of Agro-Industry: A Linkage Analysis

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INTRODUCTION

An attempt is made in this paper to explain the size structure of agro-industry of India. The study does not explain the relative importance of different size-classes of agro-industries in terms of variations in partial productivities (labour, capital, etc.), economies to scale advantages, in the differences in technical efficiencies of different size-groups, etc. It tries to explain to what extent different factors favouring/disfavouring different size-classes can be used to explain the size structure of agro-industry at a single point of time.

There are several reasons for undertaking this kind of analysis. First, the most disaggregated data base on unorganised sector is available only at three-digit level. Data at three-digit level comprise various heterogeneous group of industries with divergent production and technological characteristics. Further, the quality of data base is not very reliable being based on sample survey. Thus the factor productivity estimates, returns to scale factors, technical efficiencies, etc., cannot be relied much to explain the existing size structure of agro-industry. Secondly, even if such estimations allow us to identify certain size-class of industries with inherent technological/productivity advantages over other size-class of industries, actual size distribution of industries may be quite different. Locational disadvantages in procuring inputs and in selling of output, small size of market and different infrastructural disadvantages may not allow particular size-class of industries to play its conceived role. Lastly, in this kind of scenario, it may be worthwhile to find the role played by market and input use linkages in determining size structure of agro-industry.

FACTORS AFFECTING SIZE STRUCTURE OF INDUSTRY

In a discussion about factors affecting size structure of industry one cannot but start with Staley and Morse (1965). In their pioneering study they identified eight types of factors favouring small-scale industries. They placed them in three distinct categories: (1) locational advantages for enterprises processing dispersed raw materials, having limited local market and with relatively high transport costs; (2) process advantages where manufacturing operations can be separated, handicrafts and operations requiring simple assembly, mixing or finishing operations; and (3) the market advantage factors for enterprises with differentiated product having low scale economies and selling in small total market. Ho (1980) tried to classify Korean and Taiwanese industries under these three categories of advantages and found that locational and process advantages are most important for prevalence of small-scale industries. A further study of Korean economy over the years by him revealed that in course of development, the comparative advantages of small industries in locational factors (mainly transport cost) was giving way to process factor advantages. In the case of both Korea and Taiwan he did not find market advantage factor to be important.

Sundaram and Tendulkar (1988) discovered high differential of value added per worker

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not only between rural household and census sector but also between rural and urban segment of household industry at identical two-digit level in 12 out of 14 meaningful comparative cases for the year 1974-75. They gave several possible reasons (not empirically shown) for coexistence of different segments with sizeable shares in the same two-digit code. Firstly, different segments specialise in different product lines which do not get revealed in aggregated two-digit code. Secondly, there could be product differentiation across different segments. However, this market advantage factor was not observed even in the case of Taiwan and Korea. Thirdly, geographical segregation of product market and large transport cost which can be termed as locational advantages to small-scale sector. Fourthly, government policy favouring small-scale sector by controlling raw material supply, by imposing differential excise duties, providing scarce domestic/imported input at exclusive prices, etc. Little *et al.* (1988) presented a different view. They found considerable differences in the employment size structure of six Indian states (namely, Bihar, Haryana, Madhya Pradesh, Punjab, Uttar Pradesh and West Bengal) even though they are subject to the same macro-economic and industrial policies. They, like Dhar and Lydall (1961), found considerable dearth of medium sized establishments (50-499 workers) in India as compared to Korea, Taiwan and United States. But it was less so in Haryana and Punjab which could not be accounted by industrial mix favouring small units. They reasoned that Punjab and Haryana's rapid agricultural growth may be an important factor. In contrast, Papola (1987) did not observe any relation between agricultural growth and level and growth of rural industries output and value added. He observed that in faster growing areas households engaged in rural industries even on traditional varieties carried on their activities as sole occupation and they even used hired labour to a higher extent. This signifies gradual transformation of informal sector to formal sector. The major limitation of the above-mentioned studies on India is that none of them, unlike Ho, has empirically examined the nature and significance of various factors in explaining size distribution of industries.

Austin (1981) categorised agro-industries into three stages on the basis of degree of processing. He mentioned that higher degree of processing is accompanied by higher capital investment, technological complexity and management requirement and it is characterised by higher value added. Following him, Srivastava (1989) divided Indian agro-industry into manual-mechanical, mechanical, mechanical-chemical and chemical signifying higher degree of processing in that order. He observed some movement of agro-industries from mechanical-based to chemical based processing but still mechanical-based processing dominates. Therefore, India's agro-industry is characterised by low value added which in turn means higher direct backward linkages[1] and small payments to the primary factors of production. However, measurement of backward linkages does not give any idea about efficiency in utilisation of input resources. Singh and Vyasulu (1990) observed that in census sector (more than 49 workers in factory sector) primary processing still dominates. Panchamukhi (1975) observed that in under-developed economy like India there exists high rank correlation between direct backward linkages and total linkages. He further estimated the correlation coefficients between total linkages and share of specific sectors in total number of factories for factory sector for the year 1968 and found that larger the linkage, the smaller the number of factories in relation to total. He viewed that productive activity with few large firms might imply economies to large-scale production/efficiency in input use. Therefore, one can examine whether high backward linkage, given the dominance of

primary processing even in census sector, is advantageous to larger size-group of industries. Apart from this, raw materials are usually the major cost component in agro-industries which are characterised by seasonality, perishability and variability (Austin, 1981). In such circumstances, concentrated availability of raw materials has distinct scale advantages to larger size-group of industries in terms of prices, transportation and storage. Conversely, dispersed availability of raw materials may entail greater cost in terms of procurement and transportation for larger size-groups as they require procurement of higher volume of raw materials. Another locational factor, size of market is also important. Small sized market dispersed over wide region is likely to be difficult for larger firms to serve on account of high transport and marketing cost. Hence backward linkages, raw material concentration (reflecting whether raw material can be procured easily) and size of market could be used as important factors in explaining size structure of agro-industry.

DATA BASE

Let us begin with data base of past studies on all segments of Indian industry. Sundaram and Tendulkar (1988) analysed the size structure of Indian manufacturing sector for the year 1974-75. Their study was constrained by inadequacy of data of industries in unorganised sectors employing five or more workers at two-digit level. They combined population census of 1971 and census of small industrial units of 1972 to build the data base of this segment of the industry. Saluja (1988) rightly pointed out that the 33rd Round of the National Sample Survey (NSS) for the year 1978-79 collected data for larger establishment segment in unorganised sector, known as directory manufacturing establishment (DE) for the first time. Thus it facilitated the availability of data base for the whole segment of unorganised sector. But the 33rd Round of the NSS did not provide data separately for own account enterprises (OAE)[2] and non-directory establishments (NDE).[3] The 40th Round of the NSS, undertaken in 1984-85, for the first time, made available the whole gamut of unorganised sector's data in three size-classes, namely, OAE, NDE and DE.[4] This study is a cross-sectional analysis of agro-industry of India for the year 1984-85. The data base of agro-industry is at three-digit level. For organised sector, the data are collected from Annual Survey of Industries (ASI) for the year 1984-85. Since ASI has discontinued in presenting data separately for census and sample sector after 1982-83, the data for organised sector are available only for factory sector (FAC). The data base of DE is published in separate volume and called as 'Directory Establishment Survey, 1984-85'. The data of OAE and NDE are published under 40th Round Report of NSSO (National Sample Survey Organisation). For three-digit level, the data base of OAE and NDE is given only for each state and union territory in rural and urban areas separately. Only after totalling up rural and urban areas' data for all states and all union territories, one is able to arrive at all-India figures. Therefore, we have four size-groups of agro-industry: three for unorganised sector, namely, OAE, NDE and DE and only one for organised sector, namely, factory sector (FAC) as a whole. For this study, five characteristics of agro-industry are chosen. They are number of enterprises, fixed asset, gross output, gross value added and total employment.[5]

Agro-industry's backward linkage calculations are based on input-output transaction matrix of Indian economy for the year 1983-84. It is commodity × industry absorption matrix of 115 × 115 sectors. For calculating size of market we have taken sales figures which are total output minus change in stocks. These data are taken from final demand matrix of 115

sector input-output matrix of India for the year 1983-84. The size of each agro-industry's market is estimated as its share to total agro-industry's sales.

For this analysis, data on certain characteristics are presented in percentage share of each size-group to total for each industrial group. It is shown in 21 agro-industry sector to match the sectoral classification of 115 x 115 input-output matrix of Indian economy for the year 1983-84. The procedure for conversion of NIC (National Industrial Classification) code at three-digit level into input-output transaction code is presented in Table I.

TABLE I. CONVERSION OF NIC CODE TO INPUT-OUTPUT CODE

Code in input-output transaction matrix (1)	Code in NIC, 1970 (2)
33	206
34	207
35	210
36	211
37	212 + 213
38	200 to 205 + 208 + 209 + 214 to 217 + 219
39	220 to 224
40	225 to 229
41	233 + 234 + 235
42	230 to 232 + 236 + 239
43	240 to 244
44	245 + 246
46	250 to 253 + 259
47	263
48	264 + 266
49	260 + 261 + 262 + 265 + 267 + 268 + 269
50	276 + 277
51	270 to 275 + 279
52	280 to 283
54	291
55	290 + 292 to 296 + 299

METHODOLOGY

Backward Linkages

The backward production linkage of any sector is the amount of input needed to produce a unit of output of that particular sector in input-output framework. The column sum of input coefficient matrix is direct backward linkage, $u_j = \sum a_{ij}$ where $a_{ij} = \sum X_{ij}/X_j$ and X_{ij} = amount of i-th sector's output consumed for producing X_j unit of j-th sector's output. But direct linkage is based on first layer of intersectoral relationships. The elements of Leontief's inverse captures the sum total effect of the infinite layers of production process. Thus direct and indirect (DID) backward linkage is defined as $TU_j = \sum A^*_{ij}$ where A^*_{ij} are the elements of $(I-A)^{-1}$ and A is the matrix of input coefficients. It shows the increase in the output of entire economy required to meet the requirements of a unit increase in the final demand of sector j.

Raw Material Concentration Index

Estimation of raw material concentration indices is undertaken in two stages. In the first

stage, output concentration indices of various agricultural sectors are calculated. In the next stage, these output concentration indices are weighted by their proportional contribution to the respective agro-industry's total material output. Output concentration indices are based on output data of 22 major states of India for the year 1983-84 for 22 agricultural sectors as specified in 115 sector input-output matrix. Only output figures of other livestock products (code 20) are collected separately for raw wool, raw silk and livestock population to calculate three separate concentration indices as they are required for three separate agro-industries, namely, woollen textiles, silk textiles and footwear and other leather products respectively.

Agricultural Output Concentration Index

Agricultural output concentration index used in this study is Herfindahl index (HL_i).[6] It is calculated as $\sum_{i=1}^{N} pi^2$ where $pi = O_i/\Sigma O_i$ denotes proportion of output in different states. Herfindahl index takes the value of 1 when there is complete specialisation and it approaches zero as N gets large. That is, if diversification is perfect, such that $O_i = (1/N)^* \Sigma O_i$ and $N \rightarrow \infty$, then $\Sigma pi^2 = 1/N \rightarrow O$. Raw material concentration index (RCON) of each agro-industry is obtained as follows:

$RCON = \Sigma (HL_i^* wi)$, where HL_i is the Herfindahl index of agricultural sector i and w_i is the share of input of sector i to total output of specific agro-industry (a_j). It is output weighted. They are presented in Table II.

TABLE II. HERFINDAHL INDICES OF DIFFERENT AGRICULTURAL SECTORS

Industrial code	Description of the code (1)	Agricultural output concentration index (2)
1.	Paddy	0.0906
2.	Wheat	0.2008
3.	Jowar	0.2225
4.	Bajra	0.2350
5.	Maize	0.1022
6.	Gram	0.2136
7.	Pulses	0.1084
8.	Sugarcane	0.2454
9.	Groundnut	0.1725
10.	Jute	0.4410
11.	Cotton	0.1373
12.	Tea	0.3833
13.	Coffee	0.5872
14.	Rubber	0.8605
15.	Coconut	0.3132
16.	Tobacco	0.2958
17.	Other crops	0.0913
18.	Milk and milk products	0.0873
20.	Other livestock products	
	(i) Raw wool	0.2137
	(ii) Raw silk	0.3179
	(iii) Livestock population	0.0817**
21.	Forestry and logging	0.1355*
22.	Fishing	0.1306*

Note: All these figures are Herfindahl indices calculated across 22 states for the year 1983-84. It is the summation of square of each state's share to 22 states.

* Signifies figures in value terms.

** Signifies figures in numbers.

The rest of the figures is in quantity.

ROLE OF DIFFERENT SIZE-CLASSES IN AGRO-INDUSTRY

This analysis is based on 21 groups of agro-industries and only two characteristics are considered, namely, gross value added and total employment. The detailed percentage distribution of size structure of agro-industries in terms of five characteristics are presented in Table III. In Table III (A) we present selected items from Table III.

TABLE III. PERCENTAGE DISTRIBUTION OF SIZE STRUCTURE OF AGRO-INDUSTRIES FOR THE YEAR 1984-85

Industrial code (1)	Description of the code (2)	Number of enterprises (3)	Fixed assets (4)	Gross output (5)	Gross value added (6)	Total employment (7)
Own Account Enterprise (OAE)						
33	Sugar	15.4900	0.0030	0.0022	0.0047	0.1003
34	Khandsari, bora	61.8595	14.2756	9.9231	16.3787	26.4922
35	Hydrogenated oil	92.6737	0.7589	0.0727	0.7446	12.7467
36	Edible oil other than vanaspati	74.4702	21.7512	2.7020	9.4867	46.4551
37	Tea and coffee processing	48.7357	2.6940	1.1764	1.8138	3.6682
38	Miscellaneous food products	71.3935	50.5118	22.3476	36.3074	69.7943
39	Beverages	90.2348	16.8742	12.3182	19.3532	69.9528
40	Tobacco products	93.9595	66.4598	16.8371	41.7067	72.7871
41	Khadi, cotton textile in handloom	94.8726	89.1762	55.8722	74.7755	88.6715
42	Cotton textiles	56.7536	4.2629	0.9346	2.1868	13.0792
43	Woollen textiles	96.8801	36.1179	9.5178	18.0221	82.2349
44	Silk textiles	72.8310	35.1953	20.7199	34.7665	51.7440
46	Jute, hemp, mesta textiles	95.4699	4.1701	4.3393	5.3829	28.9004
47	Carpet weaving	67.3024	42.2080	29.8101	35.7168	58.4781
48	Readymade garments	85.1115	89.8502	38.6176	50.8451	67.4602
49	Miscellaneous textile products	93.1581	77.9024	19.3968	32.1681	77.3415
50	Furniture and fixtures	92.3993	83.5945	45.2171	53.7291	83.1909
51	Other wood and wood products	93.4656	86.1828	44.5730	65.2725	84.3821
52	Paper, paper products and newspaper	81.9984	0.8407	1.7815	2.7799	33.4910
54	Leather footwear	92.4443	75.3896	49.6477	55.6574	77.1091
55	Other leather and leather products	79.8668	67.5011	15.0548	21.7987	52.0138
Non-Directory Establishments (NDE)						
33	Sugar	46.6807	0.0429	0.1826	0.2407	0.6227
34	Khandsari, bora	17.5910	23.9123	5.7433	6.6131	9.7866
35	Hydrogenated oil	2.7368	0.2409	0.0071	0.0477	0.6652
36	Edible oil other than vanaspati	20.7979	31.7065	12.6540	31.8746	25.0956
37	Tea and coffee processing	25.8657	1.7397	2.3175	3.4764	4.2425
38	Miscellaneous food products	26.1225	33.6846	12.3300	24.5124	16.6554
39	Beverages	8.9613	15.4576	4.1064	5.9881	13.7415
40	Tobacco products	4.0912	14.7592	4.9201	5.9607	5.9488
41	Khadi, cotton textile in handloom	3.6654	8.1858	7.5890	6.1927	4.0086
42	Cotton textiles	30.0837	4.8039	5.9454	8.8944	10.5982

(Contd.)

TABLE III *(Contd.)*

Industrial code (1)	Description of the code (2)	Number of enterprises (3)	Fixed assets (4)	Gross output (5)	Gross value added (6)	Total employment (7)
43	Woollen textiles	1.9942	1.4127	1.4137	2.9764	2.3975
44	Silk textiles	17.4143	14.2786	11.0501	14.2802	15.4100
46	Jute, hemp, mesta textiles	3.2048	0.4655	0.6018	0.4844	2.1020
47	Carpet weaving	28.0998	34.3883	21.6339	31.6421	20.4294
48	Readymade garments	13.7288	8.6833	22.5403	29.2910	24.3072
49	Miscellaneous textile products	4.5527	16.4101	8.7841	13.3785	7.5003
50	Furniture and fixtures	6.5675	13.4727	25.6921	20.7797	10.3965
51	Other wood and wood products	5.4695	8.2653	16.3705	15.7035	8.4171
52	Paper, paper products and newspaper	8.0647	0.3322	1.2275	2.4637	4.6937
54	Leather footwear	5.9474	18.9776	9.1997	9.7155	10.7691
55	Other leather and leather products	16.9515	4.2590	6.1518	13.2962	18.8707
Directory Establishments (DE)						
33	Sugar	4.3203	0.0020	0.0112	0.0344	0.0774
34	Khandsari, bora	19.6035	29.7862	40.9869	52.1637	47.0484
35	Hydrogenated oil	0.2947	0.0658	0.0074	0.0256	0.3067
36	Edible oil other than vanaspati	2.7263	7.7023	15.7047	16.1958	9.4467
37	Tea and coffee processing	7.1992	3.9174	3.2267	0.9700	6.3540
38	Miscellaneous food products	1.8417	2.9748	13.6560	10.1476	5.0039
39	Beverages	0.5908	3.6000	2.3345	3.8387	3.4239
40	Tobacco products	1.3823	4.6786	13.2121	9.0740	8.6233
41	Khadi, cotton textile in handloom	1.4530	2.2490	32.5353	16.7970	7.1020
42	Cotton textiles	10.3665	4.5834	6.4754	7.2134	16.8265
43	Woollen textiles	0.8284	5.1795	5.9063	5.2291	3.9842
44	Silk textiles	9.5008	22.2165	59.8411	45.4590	30.0802
46	Jute, hemp, mesta textiles	0.9815	1.0640	3.1144	1.1126	1.3947
47	Carpet weaving	4.5632	10.6181	32.2583	23.5456	19.6911
48	Readymade garments	1.1144	0.6475	15.1557	11.7824	6.6616
49	Miscellaneous textile products	2.0853	1.7217	20.9916	18.7862	12.3578
50	Furniture and fixtures	0.9990	2.0566	24.4766	23.5760	5.8809
51	Other wood and wood products	0.9122	2.7704	20.5451	9.7034	5.2199
52	Paper, paper products and newspaper	7.3121	2.0762	6.9525	6.7256	12.8069
54	Leather footwear	1.5661	0.9630	14.6551	17.5664	7.5535
55	Other leather and leather products	2.3760	1.9166	12.0107	13.7249	10.7440
Factory Sector						
33	Sugar	33.5090	99.9521	99.8040	99.7202	99.1996
34	Khandsari, bora	0.9460	32.0259	43.3468	24.8445	16.6728
35	Hydrogenated oil	4.2947	98.9344	99.9128	99.1820	86.2814
36	Edible oil other than vanaspati	2.0056	38.8400	68.9393	42.4430	19.0026

(Contd.)

TABLE III *(Concld.)*

Industrial code (1)	Description of the code (2)	Number of enterprises (3)	Fixed assets (4)	Gross output (5)	Gross value added (6)	Total employment (7)
37	Tea and coffee processing	18.1994	91.6489	93.2795	93.7398	85.7353
38	Miscellaneous food products	0.6422	12.8288	51.6663	29.0325	8.5464
39	Beverages	0.2131	64.0683	81.2409	70.8199	12.8818
40	Tobacco products	0.5670	14.1023	65.0307	43.2586	12.6409
41	Khadi, cotton textile in handloom	0.0089	0.3891	4.0035	2.2348	0.2179
42	Cotton textiles	2.7962	86.3498	86.6446	81.7053	59.4960
43	Woollen textiles	0.2973	57.2900	83.1622	73.7724	11.3835
44	Silk textiles	0.2539	28.3097	8.3889	5.4943	2.7657
46	Jute, hemp, mesta textiles	0.3438	94.3004	91.9445	93.0202	67.6029
47	Carpet weaving	0.0347	12.7856	16.2977	9.0955	1.4015
48	Readymade garments	0.0454	0.8189	23.6863	8.0816	1.5711
49	Miscellaneous textile products	0.2040	3.9657	50.8275	35.6671	2.8004
50	Furniture and fixtures	0.0343	0.8762	4.6142	1.9152	0.5317
51	Other wood and wood products	0.1527	2.7815	18.5114	9.3205	1.9809
52	Paper, paper products and newspaper	2.6248	96.7509	90.0385	88.0308	49.0084
54	Leather footwear	0.0422	4.6698	26.4975	17.0607	4.5683
55	Other leather and leather products	0.8057	26.3233	66.7827	51.1803	18.3715

TABLE III (A). PERCENTAGE SHARE OF DIFFERENT SIZE-GROUPS IN SELECTED INDUSTRY CODES

Industrial code (1)	Description of the code (2)	Different size-groups: Share in value added (3)	Different size-groups: Share in employment (4)
Industry groups where OAE is dominant			
41	Khadi, cotton textile in handloom	74.78	88.67
48	Readymade garments	50.85	67.46
50	Furniture and fixtures	53.73	83.19
51	Other wood and wood products	65.27	84.38
54	Leather footwear	55.66	77.11
Industry groups where NDE is significant			
36	Edible oil other than vanaspati	31.87	25.10
47	Carpet weaving	31.64	20.43
48	Ready made garments	29.29	24.31
Industry groups where DE is significant			
34	Khandsari, bora	52.16	47.08
44	Silk textiles	45.46	30.08
Industry groups where FAC is dominant			
33	Sugar	99.72	99.20
35	Hydrogenated oil	99.18	86.28
37	Tea and coffee processing	93.74	85.74
42	Cotton textiles	81.71	59.50
46	Jute, hemp, mesta textiles	93.02	67.60

From this table certain findings emerge:

(i) In five industry groups (41, 48, 50, 51 and 54), OAE's share in value added is more than half and that of employment exceeds two-thirds.

(ii) NDE is not dominant in any industry group. Its share in both value added and employment terms is significant (i.e., more than 20 per cent) only in three industry groups (namely, 36, 47 and 48).

(iii) DE is significant (share > 20 per cent) in two industry groups, 34 and 44. It dominates all other size-groups in both value added and employment terms in industry group 34, whereas in industry group 44, it dominates only in value added term.

(iv) Factory sector's (FAC) share is more than half in both value added and employment terms in five industry groups (33, 35, 37, 42 and 46), out of which in four industry groups its share in both value added and employment terms exceeds more than two-thirds (33, 35, 37 and 46).

This clearly reflects that agro-industry is dominated more or less by the smallest size-group (OAE) or by the largest size-group (FAC). The unregistered establishment sector (NDE and DE) has not turned out to be vibrant as far as size structure of agro-industries goes.

INPUT SOURCE-BASED CLASSIFICATION OF AGRO-INDUSTRY

Concentrated availability of a specific raw material is important only in cases where an agro-industry buys some significant amount of that raw material for its own production. The source of main raw material input of an agro-industry is either from the agricultural sector or from agro-industry. The magnitude of agro-industry's transaction can be traced from agricultural-agro-industry intersectoral transaction matrix. We have taken input coefficient having values 0.05 to be the cut-off point in classifying agro-industries into different categories. On the basis of this criteria agro-industries can be put into four categories:

(i) $a_{ij} >= 0.05$ for one or more agricultural sector i and $a_{ij} < 0.05$ for all agro-industry sector i.

(ii) $a_{ij} >= 0.05$ for one or more agro-industry sector i and $a_{ij} < 0.05$ for all agricultural sectors.

(iii) $a_{ij} >= 0.05$ for at least one agricultural sector i as well as one agro-industry sector and agricultural sector is the largest input supplier.

(iv) $a_{ij} >= 0.05$ for at least one agro-industry sector i as well as one agricultural sector and agro-industry is the largest input supplier.

They are named as (i) Mainly agricultural input purchasing industry; (ii) Mainly agro-industry input purchasing industry; (iii) Primarily agricultural input and secondarily agro-industry input purchasing industry and (iv) Primarily agro-industry and secondarily agricultural input purchasing industry.

Only beverages (code 39) is the agro-industry which does not even buy 5 per cent of input from at least one agricultural or agro-industry and therefore cannot be categorised. Table IV presents the overall picture. Columns (4) and (6) provide the input coefficient of main input supplying agricultural and agro-industry sectors respectively with main input

supplying industry code in parenthesis. Columns (5) and (7) provide the share of agricultural and agro-industry to total material inputs of agro-industry. Column (3) is total material input share to output (the direct backward production linkage). Column (8) presents the raw material concentration index.

TABLE IV. CLASSIFICATION OF AGRO-INDUSTRIES ON THE BASIS OF MAIN INPUT SOURCE

Industrial code	Description of the code	Material intensity (MI/OP)	Agricultural input source	Agricultural input to total material input	Agro-industry input source	Agro-industry input to total material input	Raw material concentration index
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(i) Mainly Agricultural Input							
33	Sugar	0.8020	0.5626 (8)	0.7057		0.0218	0.1385
34	Khandsari, bora	0.7259	0.4496 (8)	0.6267		0.0736	0.1111
36	Edible oil other than vanaspati	0.9600	0.4551 (9) 0.3299 (17)	0.8390		0.0367	0.1140
38	Miscellaneous food products	0.8197	0.2078 (18)	0.5249		0.2258	0.0481
51	Other wood and wood products	0.6928	0.4975 (21)	0.7189		0.0698	0.0674
(ii) Mainly Agro-Industry Input							
35	Hydrogenated oil	0.8608		0.0410	0.4318(36)	0.5247	0.0040
41	Khadi, cotton textile in handloom	0.3914		0.0049	0.2163(42)	0.6839	0.0003
47	Carpet weaving	0.3614		0.0242	0.0710(42)	0.5301	0.0018
48	Readymade garments	0.3673		0.0020	0.0710(42)	0.5677	0.0001
49	Miscellaneous textile products	0.5871		0.0236	0.1278(42) 0.1070(49)	0.5559	0.0056
52	Paper, paper products and newspaper	0.7045		0.0695	0.2454(52)	0.3739	0.0064
54	Leather footwear	0.5118		0.0369	0.2158(55) 0.0777(56)	0.6360	0.0132

(Contd.)

TABLE IV *(Concld.)*

Industrial code	Description of the code	Material intensity (MI/OP)	Agricultural input source	Agricultural input to total material input	Agro-industry input source	Agro-industry input to total material input	Raw material concentration index
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(iii) Primarily Agricultural Input and Secondarily Agro-Industry Input							
37	Tea and coffee processing	0.7786	0.3555 (12)	0.4902	0.1720(37)	0.2550	0.1495
40	Tobacco products	0.5412	0.1443 (16)	0.3571	0.0897(40)	0.2342	0.0472
42	Cotton textiles	0.6888	0.2066 (11)	0.3016	0.1497(42)	0.2469	0.0285
46	Jute, hemp, mesta textiles	0.6750	0.2964 (10)	0.4457	0.1004(46)	0.1858	0.1311
55	Other leather and leather products	0.7625	0.2375 (20)	0.3435	0.1666(55)	0.2566	0.0227
(iv) Primarily Agro-Industry Input and Secondarily Agricultural Input							
43	Woollen textiles	0.6631	0.0874 (20)	0.1457	0.1992(43)	0.3326	0.0223
44	Silk textiles	0.5891	0.1619 (20)	0.2765	0.2463(44)	0.4945	0.0516
50	Furniture and fixtures	0.4233	0.0954 (21)	0.2270	0.1071(51) 0.0641(50)	0.4306	0.0132
(v) Unclassified							
39	Beverages	0.5873		0.1069		0.2015	0.0109

Note: Figures in parentheses are input industry source codes.

Certain interesting observations can be made from this table:

(a) Raw material concentration index is more than 0.10 only for some industries in category (i) and in category (iii) which use agricultural input as main/primary source. All of them have material intensity (total material input to output) more than two-thirds. These industries are sugar, khandsari and bora, edible oil other than vanaspati, tea and coffee processing and jute, hemp and mesta textiles. All these cases, except for khandsari and bora (which by input use pattern should be combined with sugar industry, then the same argument can proceed for all) show clear domination of factory sector.

(b) Category (ii) and category (iv) of agro-industry which buy mainly/primarily output of other agro-industries as main inputs follow certain distinct pattern. For eight agro-industries[7] in these categories, seven of them (namely, with code 35, 41, 47, 48, 49, 52 and 54) buy from agro-industries dominated by factory sector. Industry with code 50 buys mainly from code 51 where both sectors are dominated by OAE. In all these cases where factory sector dominates (code 35, 49 and 52), they purchase their main input from sectors dominated by factory sector only. It shows that factory sector plays the role of bulk-input supplier. One

can safely conclude that the phenomenon of sub-contracting is not significant in agro-industry. Rather, size-class of industries in unorganised sector add value to the input supplied largely by factory sector.

DETERMINATION OF SIZE STRUCTURE OF AGRO-INDUSTRY[6]

Regression Analysis

Two sets of regressions are estimated here to determine factors affecting size structure of agro-industries. In the first set, we have one input supply factor direct and indirect (DID) backward production linkage and on demand side we have the size of market variable represented by the share of each agro-industries sale to total agro-industries sale as independent variables determining size structure of agro-industries. We have also included one dummy variable for the category of mainly agricultural input purchasing agro-industry in the group of independent variables. The results are presented in Table V.

TABLE V. REGRESSION OF SHARE OF VARIOUS CHARACTERISTICS OF DIFFERENT SIZE-GROUPS OF AGRO-INDUSTRIES WITH RESPECT TO DIRECT AND INDIRECT LINKAGE, SIZE OF MARKET AND DUMMY VARIABLE

Independent variables	Intercept	Direct and indirect linkages	Size of market	Dummy variable (D2)	R^2	Number of observations
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own Account Enterprise (OAE) Dependent variables						
Number of enterprises	95.800*	-2.894	-1.801*	0.605	0.274	20
	(5.377)	(-0.361)	(-5.249)	(0.097)		
Fixed assets	178.100*	-60.481*	-1.596***	9.867	0.455	20
	(4.864)	(-3.477)	(-1.747)	(0.650)		
Gross output	105.150*	-38.213*	-0.982**	5.893	0.502	20
	(6.077)	(-4.981)	(-2.395)	(0.805)		
Gross value added	137.840*	-49.322*	-1.113**	10.211	0.500	20
	(6.244)	(-5.062)	(-2.221)	(0.954)		
Total employment	155.660*	-43.788*	-2.178*	15.033	0.389	20
	(7.023)	(-4.207)	(-3.755)	(1.173)		
Factory Sector (FAC) Dependent variables						
Number of enterprises	-5.885*	3.442*	0.131	-1.873	0.104	20
	(-3.978)	(3.329)	(1.337)	(-1.389)		
Fixed assets	-116.820*	72.165*	1.496	-20.541	0.383	20
	(-4.093)	(4.968)	(1.541)	(-1.099)		
Gross output	-102.850*	71.850*	1.459**	-12.329	0.485	20
	(-4.250)	(6.380)	(1.953)	(-1.027)		
Gross value added	-112.090*	73.175*	1.776	-19.955	0.455	20
	(-5.019)	(6.732)	(1.539)	(-1.378)		
Total employment	-91.320*	52.376*	1.578**	-22.303**	0.407	20
	(-3.595)	(3.914)	(2.426)	(-2.369)		

Note: *, ** and *** Significant at 1, 5 and 10 per cent level respectively.
All t-values are White's corrected t-values for heteroscedasticity.

For the second set of variables, only input-supply side factors are included in the set of independent variables. They are DID backward production linkage and raw material concentration index. Table VI provides the results of this set.

TABLE VI. REGRESSION OF SHARE OF VARIOUS CHARACTERISTICS OF DIFFERENT SIZE-GROUPS OF AGRO-INDUSTRIES WITH RESPECT TO DIRECT AND INDIRECT LINKAGE AND RAW MATERIAL CONCENTRATION INDEX

Independent variables	Intercept	Direct and indirect linkages	Raw material concentration Index	R^2	Number of observations
(1)	(2)	(3)	(4)	(5)	(6)
Own Account Enterprise (OAE) Dependent variables					
Number of enterprises	100.650* (5.377)	-6.131 (-0.722)	-124.440*** (-2.075)	0.240	20
Fixed assets	182.220* (4.958)	-59.107* (-3.411)	-266.710* (-3.585)	0.502	20
Gross output	107.480* (6.780)	-37.993** (-5.546)	-130.530* (-4.295)	0.608	20
Gross value added	139.700* (6.411)	-48.339* (-5.077)	-158.080* (-3.586)	0.594	20
Total employment	160.160* (5.556)	-43.949* (-3.185)	-235.720* (-3.493)	0.514	20
Factory Sector (FAC) Dependent variables					
Number of enterprises	-6.148* (-2.723)	2.984* (2.771)	31.898 (1.140)	0.249	20
Fixed assets	-119.300* (-3.619)	68.685* (3.951)	273.870* (2.632)	0.484	20
Gross output	-105.910* (-4.818)	70.698* (6.905)	208.800* (3.279)	0.564	20
Gross value added	-113.530* (-4.816)	69.820* (5.770)	216.630* (2.395)	0.518	20
Total employment†	-93.205* (-2.531)	50.241* (2.955)	197.070* (2.005)	0.454	20

Note: *, ** and *** Significant at 1, 5 and 10 per cent level respectively.

† Signify that t-values for these regressions are not corrected for heteroscedasticity. The rest of the t-values are White's corrected t-values for heteroscedasticity.

In the first set, the effect of DID linkages on different characteristics of OAE are clearly negative and except for number of enterprises characteristic, all other characteristics are significant at 1 per cent level. The second variable, the size of market is also significantly negative in the estimation on all characteristics. The estimated coefficients of dummy variable, although insignificant, are positive in all cases. It possibly shows that the OAE size-group in the category of mainly agricultural commodity using agro-industries have some positive advantage in the procurement of raw materials. In contrast, both DID linkage and size of market variables influence positively the size share of factory sector. In the case of DID linkage, all estimated coefficients are significant whereas in the case of size of market they are significant only in gross output and total employment characteristics. Comparing the significant level of the size of market variable in OAE and FAC, it can be said that larger market is distinctly disadvantageous to OAE, but it is not uniformly favourable to FAC. Rather the linkage variable is more uniformly favourable to FAC.

In the second set of regressions, raw material concentration index replaces the size of market and dummy variable. In comparison with the first set, the overall explanatory power of regression equations for almost all characteristics in the size-group of OAE and FAC are more (as can be observed from R^2 values). Thus raw material concentration index variable

reinforces the effect of DID linkage variable in a more uniform fashion than that of the size of market variable. It can also be observed from its relatively more significant estimated coefficients for both these size-groups. Estimated coefficients of raw material concentration index are significant in all cases of OAE and FAC size-groups except for number of enterprises characteristic in FAC size-group.

CONCLUSION

It is seen in this analysis that the agro-industry is either dominated by informal sector (OAE) or by factory sector. It can be generally observed that the size-class of industries in unorganised sector add value to the primary processed agro-products supplied largely by factory sector. This paper indicates that OAE (smallest size-group in unorganised sector) is disadvantageously positioned in terms of backward linkage, raw material concentration index and size of market factors. Their ever diminishing advantages lie in dispersed raw material availability and sectors where processes are difficult to standardise (i.e., wood products and furniture). Further, raw material concentration index and direct backward linkage are positively and significantly correlated.[9] It signifies that agro-industries using larger proportion of material inputs also have added advantage in geographically concentrated availability of raw materials used in production. Whereas the advantages of factory sector lie in terms of larger market, higher linkages and concentrated availability in raw material. Specialisation of agricultural production in different regions, higher income level by expanding the size of market and better transportation facilities are likely to eat into the locational advantages which OAE still possess.

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NOTES

1. Because low value added means higher ratio of material used in the production process. Direct backward linkage is the column sum of input coefficients which in other words is the ratio of material used to output.

2. Own account enterprises (OAE) comprise enterprises which do not employ any hired worker on long-term basis with no ceiling on the number of workers employed.

3. Non-directory establishments (NDE) consist of establishments using at least one hired worker and with a ceiling of five workers or less.

4. Directory manufacturing establishments (DE) consist of establishments employing 6 to 9 workers in non-factory sector.

5. We have omitted working capital as it contains some negative numbers for certain NIC code. This characteristic, and the other five mentioned are only six available for unorganised sector. Total employment is taken as sum of full-time and part-time workers in unorganised sector. For organised sector, it is considered as total number of persons engaged.

6. The methodology of calculating Herfindahl index is discussed in Pope and Prescott (1980).

7. Industry codes 43 and 44 representing woollen and silk textiles respectively are dominated by inter-industry sales. Industry code 43 is dominated by FAC and industry code 44 is dominated by DE. Further disaggregation is required to capture the transaction among different size-groups of agro-industries in these codes. Therefore, they are excluded from the present analysis. However, percentage distribution of size structure at more disaggregated NIC three-digit level for these two codes (not presented in this paper) does not contradict the findings of this section.

8. For analysis in this part of the study, NDE and DE size-groups of industries are omitted because they did not give satisfactory results. Further, two industrial groups, Sugar (code 33) and Khandsari and bora (code 34), have been combined into one as they source their raw material from the same agricultural sector, Sugarcane (code 8).

9. The value of partial correlation coefficient is 0.5475 and it is significant at 1 per cent level.

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