SUPPLEMENT TO CHAPTER I.

' Value added by manufacture ' represents that part of the value of the product which is created in the factory and is computed by deducting from the gross ex-factory value of the product; the value of fuels and materials used, work done for the factory by other concerns and depreciation of fixed assets. Therefore, while studying Capital -output ratios, as the base is shifted from the 'value of the product' to 'value added'; certain changes in the trend of these ratios for various industries are noticeable. Along side table 1.10, the following table needs to be studied to throw more light on the items of cost and their effect on the Capital-output ratio.

TABLE 1.10 (a)

Materials; Fuels and Work Given Out as
Percentage of Value of Product
1950

INDUSTRIES.	PERCENTAGES;
Wheat Flour	93.2
Rice-milling	93.9
Vegetable Oils	94.3
Matches	50.9
Cotton Textiles	66.0
Woolen Textiles	61.5
Jute Textiles	69.2

It is thus clear from Table 1.10 (a) that the cost of materials, fuels etc constituted above 90% of the gross value of output for consumption goods such as wheat flour, Rice-milling and Vegetable Oils etc. Therefore for these industries, when Capital Investment is reckoned as percentage of value added, i.e. when the base of the ratio is shifted from the 'value of product' to 'value added', the ratio appears to be going up. For Match Industry on the other hand, the material and fuels cost constituted only about 51% of the 'Value of Product'.

MATCH INDUSTRY (1950)

Total Productive Capital (Rupees)	Value of Product (Rupees)	Capital Investment as percentage of value of product.
21,766,969	65,418,084	33.3%

Compared to other industries (Table 1.9), this ratio of Capital Investment to the value of product for Match Industry is no doubt very low. Since in computing the 'Value added by manufacture' for this industry, not much deduction is made in view of low percentage of materials costs (Table 1.10 (a)); the

the shifting of the ratio from the value of product to vale added does not augment the ratio substantially. The same is true for the Textile Industries where material and fuel costs as percentage of the value of product is not relatively high.

It is extremely difficult to make an estimate of the amount of Capital which would ideally be required to carry out a programme of Industrial Development. The proportion of capital to the net product would show marked variations from industry to industry. The proportion of capital employed qill also vary according to the extent to which capitalistic methods of production are employed and technological advances are made use of. The Bombay Plan earlier had recommended a ratio of 2.4 of capital to net output. This ratio, as is seen in Table 1.10 is exceeded greatly in cases of industries such as Rice-milling, Vegetable Oils, and Electric Lamps. Wheat flour, Distilleries and Breweries and Starch industries also tend to exceed this ratio.

A good deal of information regarding relationship between Capital per Capita and value added per Capita are revealed on a study of tables 1.11 and 1.12. The correlation

correlation between these two series however is not very high. For the year under consideration, Match Industry had lowest Capital per Capita (Rs 1700) and Soap industry, the highest (Rs 13,326). In other words, Soap Industry had about 8 times Capital per Capita as compared to Matches. Studying this in relation ro Value added per capita (Table 1.12), it will be seen that the later ratio was Rs 2464 for Matches and Rs 5677 for Soap. Thus Soap Industry inspite of its 8 times Capital per Capita as compared to Matches would yield only 2½ times net product per capita. This could to some extent be explained by the high proportion of cost of materials; fuels etc in case of Soap Industry.

Table 1.4 (P.15) reveals that wage-payments averaged 48% of the value added. In industries such as Glass and glass-ware, Ceramics, Cotton and Jute Textiles, Sewing machines, General Engineering and Electrical Engineering, this ratio was very high. In food group particularly this ratio was low and consequently the overhead costs for food items formed quite a high percentage of value added.

In the following table; value added by manufacture and aggregate employees earnings for a few important industries for the year 1950 are shown as percentage of investment in plant and machinery.

TABLE 1.10 (b).

Industry	Value added by manufacture.	Employees earnings.
	expressed as percentages of investment in Plant and machinery.	
Cotton Textiles	273.2	196.7
Woolen Textiles	527.4	209.3
Jute Textiles	289.6	159.8
Rice-milling	47.4	73.5
Chemicals	235.9	65.2
Soap	355.9	85.6
Sugar	257.6	81.3
Matches	1033.8	529.0

Value added by manufacture has more or less a definite relation with investment in fixed capital. For the Census of manufactures, investment in fixed capital includes investment in land and buildings,

buildings, plant and machinery and other items. Investment in plant and machinery is by far the most important of these three. For a given industry of a given size, technological requirements call for more or less a definite size of investment in plant and machinery. This is however not the case with respect to investment in land and buildings. According to the situation of the factory, the investment required in land and buildings may differ even for a firm of a given size in the same industry. Therefore, it is advisable to express value added by manufacture as a percentage of more stable components of fixed capital in an industry of a given size. It is easy to adopt this figure to the total investment in fixed capital in a given industry as soon as location of a factory is decided.

Value added by manufacture is roughly the sum total of two items, industrial employees earnings and the earnings of Capital. From the point of view of national planning of investment it is useful to know the value added by manufacture as a percentage of investment in fixed capital. For the purpose of investment planning for full employment, it is also necessary to know employees earnings as a percentage

percentage of investment in fixed capital. The difference of these percentages will broadly indicate the earnings of Capital as a percentagee of investment in plant and machinery. This information will help investment planning by the business community. As will be seen from Table 1.10 (b), this percentage is not very high for Textile industries. It is fairly high for industries such as Matches, Sugar, Soap and Chemicals. Earnings of Capital as percentage of investment in plant and machinery was practically nil for rice-milling industry.

FURTHER SUPPLEMENT TO CHAPTER II.

At page 1 of the Supplement to Chapter II, Dutt's article in Sankhya Vol. 15, Part 4 was referred to wherein certain weightage was given to female and child workers. It has already been pointed out that Dutta had estimated the average number of workers on the basis of 365 working days which however reduced the weightage of the number of equivalent male workers. We adopted Dutt's method for the year 1950 and calculation were made on the basis of 260 days which was the average number of working days in all industries reported in the Census of Manufacturing Industries for the year under consideration. It was perhaps for this reason our coefficients of L & C in the production equation differed from Dutt's coefficients. If slight modifications such as this could alter the coefficient perceptibly; it is perhaps necessary to pause and decide whether any useful purpose could be served in fitting a production function of Cobb-Douglas type to data on Indian manufacturing.

As Phelps Brown in his article in Quarterly Journal of Economics, Nov'57 has pointed out; the P, L & C as given by Census of Manufactures for an array of industries are likely to be so much correlated with one another that little reliance can be placed in the coefficients of a Cobb-Douglas function fitted to them. We have also at Page 6 of the Supplement adopted the method used by Phelps- Brown and have attempted to consider the association with one another of the deviation that remain after the common element of P, L & C is removed. But here also, the net value added associated with differences in relative factor intake will be in great part simply the counterpart of the costs of these intakes reckoned at prevailing factor prices.

We have earlier shown that omission of a few observations considerably changed the coefficients of L & C in the Production function. The instability of these coefficients specially for Indian manufacturing suggest that the industrial pattern in India has not perhaps reached a stage of maturity when a Production function of Cobb-Douglas type could be freely used. The evidence of maturity probably lies in the decrease decreased in the rate of growth of heavy industries and of building activity. It also involves slowing down of the rate of growth of the total quantity of production, of employment and usually of population. It also will involve rising relative importance in consumer goods. This stage however has not yet been reached in India.

Production functions were fitted to the Cross-Sectional data for the years 1947 to 1952. The average values of K & J (i.e the coefficients of the Cobb--Douglas equation $P= h\ L^{k}\ C^{j}$) for these years were respectively 0.34 & 0.66 associated with standard errors of the magnitude 0.17 & 0.18. Although 2/3rd of these six pairs of values of k & j seem to lie within average $\pm$ 1 standard error range, it will be appreciated that the standard errors are no doubt high, and therefore the coefficients are likely to be subject to instability and much reliance could not be placed on these coefficients.

Whether or not P,L & C are highly correlated, the puppose of our study has been to derive estimating equations. Some authors contend that it is irrelevent

irrelevent if the ~~available~~ series have systematic parts which are perfectly correlated. They think that the estimating equation should be derived in a manner consistent with its intended use. At Pages 40-43; We have shown the relative difference between the computed product (P') on the basis of the estimating equation and the actual product P. The actual product P, in more than 90% of the industries lay within P' $\pm$ 2 s.e range. This indicated that the actual values in general were surprisingly close to what they should be according to the formula. This closeness of the two series, P & P' stand on our way of ~~totally~~ rejecting the reliability of the production formula.

A STUDY OF THE MANUFACTURING INDUSTRIES AND OF THE EMPLOYED POPULATION OF INDIA

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A THESIS SUBMITTED IN FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY IN THE
FACULTY OF SCIENCE OF THE UNIVERSITY
OF GLASGOW.

S U M M A R Y

A cross sectional analysis of Indian manufacturing for the year 1950, based on the data provided by the fifth Census of Manufactures revealed that manufacturing was highly concentrated in the two states, West Bengal and Bombay which together carried about 60 per cent of the total manufacturing activities. Within the industries, the textiles shared about 45 per cent of the total capital investment. Among manufacturing costs the item under 'Materials, Fuels and Work given out' comprised the largest single element, constituting in the aggregate about 71 per cent of the gross output. The wages, salaries and overhead costs have also been computed as percentages of the 'Value of the Product' as well as the 'Value added'. Since the 'Value added' is a non-duplicating item (cost of materials being excluded), its relationship to other relevant factors of production is considered useful. Relative to the value of the Product, the capital investment in manufacturing industries varied widely. Capital investment as percentage of 'Value added' was significantly low for the match industry. This was because the match industry was the least mechanized of all. Total productive capital per capita was highly correlated to the 'Value added' per capita among the industries. /

industries.

The implications of the production function $P = h, L^k C^j$, as established by Douglas and Cobb, are studied in Chapter II. Values of the parameters h, k and j were obtained for Indian manufacturing using the data provided by the Census of Manufactures (1947 to 1952). The production equations so obtained suggest a low labour elasticity of output and a high capital elasticity of output for nearly all the years under consideration. The sum of the exponents j and k was in all cases about 1, in spite of the fact that no a-priori restriction had been imposed. The accuracy of the production function was later tested by comparing the theoretical and observed values of log P. The form of this production equation was also studied in relation to the manufacturing industries in the United Kingdom for the years 1948 and 1949, on the basis of the data provided by the Census of Production, 1950, 1949 and 1948, Summary tables. The function for U.K. revealed a high labour elasticity of output. However, for the textile industries, the production function for both India and the United Kingdom showed a high coefficient for Capital.

In Chapter III, the trend in employment in relation to the volume of production in Indian manufacturing during the short period 1946 to 1951 is investigated. It was only since 1946, /

1946, that the Directorate of Industrial Statistics have been supplying adequate data on the manufacturing activities in India. Although the period under consideration is too short, yet some features are indeed note-worthy. In the composition of employment, it will be seen that during the period, the wage-earners lost some ground to salaried and other workers. Owing to relatively slow increase in employment as compared to the increase in output during this period, there has been a steady decline in the general index of employment per unit of product. From 1947 onward, the number of workers employed in making a unit of product seem to have declined in many industries. The bicycle and sewing machine industries which were conspicuous for their increases in both output and employment were characterized by sharp reduction in employment per unit of product. The part played by the Capital investment and other relevant factors are discussed in the text. We have also attempted to measure the change in efficiency in production taking into consideration the factors, labour and Capital.

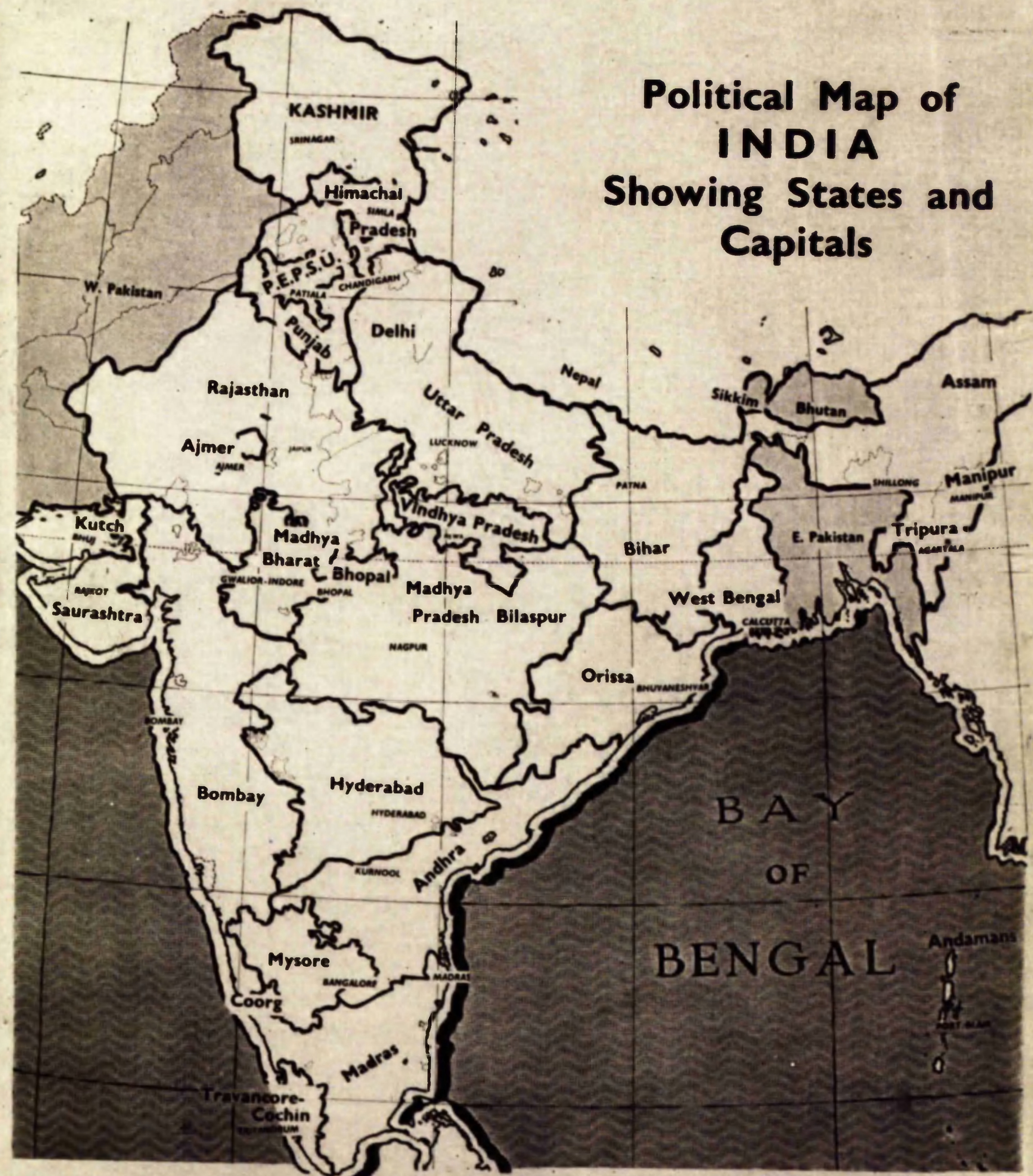
Chapter IV deals with a study of relationship between Primary, Secondary and Tertiary employed populations in India based on the information provided by the 1931 and 1951 Census tables. Our analysis revealed that the tertiary population is more dependent on the secondary activities rather than the primary ones. In countries like U.K. and U.S.A., where

farming /

farming is a mechanized operation, the tertiary employment depends equally on the employment in farming as much as it does on manufacturing.

An attempt has also been made to measure the contributions of the 'earning dependents' and 'secondary occupations' in the agricultural sector in relation to the self-supporters. We estimate the share of earning dependents and secondary occupations to be $\frac{1}{4}$ and $\frac{1}{8}$ respectively as compared to 1 for the self-supporters.

CONTENTS



Political Map of
INDIA
Showing States and
Capitals
KASHMIR
SRINAGAR
Himachal
SIMLA
Pradesh
P.E.P.S.U.
PATIALA
CHANDIGARH
Punjab
W. Pakistan
Delhi
Nepal
Sikkim
Bhutan
Assam
Rajasthan
Uttar Pradesh
LUCKNOW
Ajmer
AJMER
JAIPUR
PATNA
SHILLONG
Manipur
MANIPUR
Kutch
BHUJ
Madhya
Bharat
Vindhya Pradesh
Bihar
E. Pakistan
Tripura
AGARTALA
GWALIOR-INDORE
Bhopal
BHOPAL
Madhya
Pradesh
Bilaspur
West Bengal
CALCUTTA
RAJKOT
Saurashtra
NAGPUR
Orissa
BHUVANESHWAR
BOMBAY
Bombay
Hyderabad
HYDERABAD
BAY
OF
BENGAL
KURNOOL
Andhra
Mysore
BANGALORE
MADRAS
Andamans
PORT BLAIR
Coorg
Madras
Travancore-
Cochin
TRIVANDRUM

CHAPTER I

THE STRUCTURE OF MANUFACTURING PRODUCTION IN INDIA

A CROSS-SECTIONAL STUDY: YEAR 1950

Manufacturing comprises a major division of the productive system. The manufacturing system can be studied in several ways. Changes in manufacturing activity may be analysed by noting the changes in output and productive factors during certain successive periods. This method no doubt gives measure of the success in manufacturing but it hardly speaks anything about the manufacturing process itself. By this method, we do not get a clear picture of the distribution of various types of manufacturing activity, or the proportions in which productive factors are used in the manufacture of different types of goods. A great deal of information on such matters is revealed by an examination of figures relating to the manufacturing industries for a given period. We shall call this a cross-section study of manufacturing activity. A cross-section study intends to describe the manufacturing operations at some given time. Accordingly a cross-section study is descriptive, and suggests a static analysis of an admittedly dynamic economy.

We have chosen the year 1950 for this cross-section study of manufactures in India. The general index of Production for the year was 105.0 (base 1946 = 100).

We now attempt to study the distribution and inter-relation of various manufacturing activities on the basis of the data provided by the Fifth Census of Indian Manufactures (1950).

At /

At the outset, we should analyse the Geographic distribution of manufacture and population during the year 1950 in India. The following table gives the percentage distribution of Value* added by manufacture, Average Number of persons employed and Total Productive Capital invested in various States in India.

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* For definitions of the terms, please refer to Appendix (ii).

TABLE 1·1

INDIA 1950

Geog. Divn.	Value added by manufacture as per cent of the total	Persons employed as per cent of the total	Productive capital employed as per cent of the total
1. W. Bengal	27.06	30.10	24.64
2. Bombay	36.88	32.92	34.58
3. Madras	9.16	10.89	10.03
4. U.P.	9.04	9.85	9.63
5. Bihar	10.78	6.79	10.49
6. Punjab	1.34	1.69	1.83
7. M.P.	2.12	3.17	3.01
8. Orissa	0.56	0.67	0.96
9. Assam	0.36	0.39	0.56
10. Delhi	1.51	1.48	1.45
11. Ajmer	0.14	0.38	0.21
12. Vindya Pradesh	0.00	0.02	0.03
13. Travancore Cochin	0.18	0.39	0.45
14. Pepsu	0.55	0.58	0.92
15. Himachal Pradesh	0.03	0.06	0.01
16. Rajasthan	0.28	0.62	1.04
TOTAL	100	100	100

	Total Value added by manufacture (Rs)	No. of persons employed	Productive capital employed (Rs)
INDIA 1950	2839,285,673	1,632,483	6145,286,220

As is apparent from the table (1·1), manufacturing is highly concentrated in W. Bengal and Bombay. These two States together carry about 60 per cent of the total manufacturing activities in India. The largest contribution for Bombay's manufacturing comes from the textile industries particularly cotton textiles. In the year 1950, about Rs 1353 millions were invested in cotton textiles for Bombay State alone. This amounts to 67 per cent of the total capital invested in cotton textiles throughout India. The major manufacturing industries in W. Bengal are jute textiles and Iron and Steel Industry.

Among the major Geographical divisions, a discrepancy is revealed in the distribution of percentages in Bihar. Bihar with its share of total Capital Investment of 10.49 per cent and 10.78 per cent of the value added has relatively quite low share i.e. 6.79, in employment. This however speaks to the credit of Bihar's industrial economy that in spite of its low share of employment it could attain quite a satisfactory level in production. The main industry in Bihar is Iron and Steel which normally employs comparatively less labour.

Value of Product and elements of cost

Manufacturing operations in 1950 as reported by the Directorate of Industrial Statistics, India, were conducted in 6.605 factories in various States in India. The total value of the products manufactured, as measured by the sales of these concerns /

concerns was Rs 10,280 millions. The increase in value at the manufacturing stage as measured by the value of product less cost of materials purchased (i.e. value added by manufacture) was Rs 2,839 million. Value of fuels consumed alone for the year 1950 amounted to Rs 356 million. Materials, fuels consumed and depreciation in total amounted to Rs 7,441 million. Salaries and Wages paid to workers was Rs 1,722 million.

Number of Wage-earners and Salaried employees

The average number of wage-earners employed in manufacturing in the year 1950 was 1,468,334. The number of salaried workers was 164,149. The total number of persons employed in manufacturing was thus 1,632,483. The salaried employees on the average constituted about 11 per cent of the number of wage-earners.

In the analysis of labour effort in manufacturing operations, account should be taken of varying hours worked by different groups of employees. The aggregate number of man-hours worked directly for factories have been worked out for individual industries. Although from the point of view of social study, the individual workman is considered important, yet aggregate hours of work is more significant in measuring the extent to which physical energies are devoted to manufacturing operations. The total man-hours worked during the year 1950 for the /

the manufacturing operations in India was 3043,740,404. This however refers to the working hours of the wage-earners alone.

Capital Investment

Capital Investment constitutes fixed as well as working capital. Fixed Capital comprises investment in land, buildings, plants, machinery and miscellaneous assets such as furniture, fixtures, fittings, railway sidings, automobiles, patents and trade names, etc.

Working Capital comprises stocks of raw materials, finished and semi-finished products, cash in hand and at the bank, excluding fixed deposits and current credits. Total Productive Capital employed in the manufacturing industries for the year 1950 was Rs 6,145 million. Working Capital amounted to Rs 3564 million and fixed capital was Rs 2581 million.

TABLE 1·2

DISTRIBUTION OF PRODUCTIVE RESOURCES AMONG VARIOUS MANUFACTURED GOODS

CENSUS OF MANUFACTURES 1950

Industries	Per cent total capital employed	Per cent total persons employed	Per cent value added by manufacture
1. Wheat Flour	0.8	0.34	0.45
2. Rice Milling	2.1	3.03	0.84
3. Biscuit-making	0.5	0.41	0.78
4. Fruit & Veg. Processing	0.2	0.10	0.15
5. Sugar	8.4	7.71	8.3
6. Distilleries & Breweries	0.6	0.30	0.33
7. Starch	0.1	0.08	0.05
8. Veg. Oils	7.5	3.56	2.3
9. Paints & Varnishes	0.7	0.30	0.72
10. Soap	1.4	0.39	1.27
11. Tanning	0.6	0.53	0.54
12. Cement	2.3	1.01	1.93
13. Glass & Glassware	0.7	1.34	0.63
14. Ceramics	0.6	1.13	0.74
15. Plywood & Teachests	0.3	0.22	0.21
16. Paper & Paperboard	2.4	1.36	1.73
17. Matches	0.3	0.78	1.11
18. Cotton Textiles	33.01	39.51	36.7
19. Woollen Textiles	1.0	0.94	1.5
20. Jute Textiles	11.2	18.74	15.5
21. Chemicals	4.1	2.11	3.41
22. Al. Cu & Brass	2.9	1.68	2.15
23. Iron and Steel	8.41	4.68	8.9
24. Bicycles	0.2	0.18	0.33
25. Sewing Machines	0.15	0.12	0.16
26. Electric lamps	0.25	0.09	0.13
27. Elect. Fans	0.44	0.35	0.41
28. Gen. Eng. & Elect. Eng.	8.7	8.88	8.5
	100	100	100
	Total capital employed Rs	Total No. of persons employed	Total value added Rs
India 1950	6145,286,220	1,632,483	2839,285,673

It will be seen from table (1·2) that for the year 1950, 45.3 per cent of the total capital was invested in the textile industries alone. The corresponding percentage of value added in the textiles was 53.7 and the percentage of persons employed 59.2. 8.4 per cent of the total capital was invested in the Iron & Steel industry, the corresponding percentage of value added and persons employed being 8.9 and 4.68 respectively. It is evident that employment is proportionately low in this Iron and Steel Sector.

Now, we attempt to classify the industries presented in the census of manufactures into categories like Consumption goods and Capital goods. It is not easy to draw a rigid line of demarcation between these groups. From the broadest point of view, all production is for consumption purposes. However, we shall try to use the less inclusive definition of consumption goods.

The terms, consumption goods and capital goods in this study should be identical, as descriptive of broad classes, with the terms consumers' goods and producers' goods used by Dr. Kuznets in the National Bureau's studies of capital formation for U.S.A. Dr. Kuznets defines his terms as follows,

"Consumers' goods - Commodities and services that whether finished or unfinished, are when finished and at their destination, used by households or large ultimate consuming /

consuming units. Example: flour, bread, raw wool, clothing, etc.

"Producers' goods - Commodities and services, whether finished or unfinished, that are when finished and at their destinations, used by business agencies in the process of production. Example: Industrial Machinery, Steel used therein."

The classification into Durable and Non-durable goods has sometimes been preferred. 'The Economic Survey of Asia and Far East' includes 'Cement, Aluminium, Iron and Steel, machinery, electric lamps, electric fans, bicycles, sewing machines, etc. among durable manufacturing industries. Textiles and Chemicals, etc. are included among non-durable manufacturing goods.

In our discussion, since the industries were few in number, we have endeavoured to calculate necessary ratios and percentages whenever required for each industry individually.

Broadly, Iron and Steel, General Eng. and Electrical Eng. and to some extent Cement, could be classified among Capital goods. So, in 1950, by far the greatest part, approximately 80 per cent of the productive activity can be associated with the manufacture of goods destined for human consumption. The other 20 per cent was devoted to making goods eventually used for capital purposes.

Inter- /

Inter-relation of Productive factors

One aspect of the structure of manufacturing concerns the relative use made of different productive elements. We now deal directly with the relative importance of productive factors. We first present measures of the relative importance of elements of manufacturing cost (Table 1:3).

Manufacturing Costs as percentage of the value of product

'Materials, Fuels and work given out' comprised the largest single element in the value of manufactured products for the year 1950. In aggregate this item constituted 70.7 per cent of the gross output. It is evident from the table 1'3, that the material costs were abnormally high in some of the industries making consumption goods, e.g. Wheat Flour, Rice Milling and Vegetable Oil. The material costs including fuels and work given out constituted about 93 to 94 per cent of the total value of the product for the industries Wheat Flour, Rice Milling and Vegetable Oils. In case of Capital goods like Machinery, Iron & Steel, Cement, etc. the percentage of material cost was relatively low.

Examination of another component of the value of the product, 'Salaries, Wages and other benefits' gives altogether a different picture. Manufacturing labour accounts for a relatively larger share of the value of the product in the case of capital goods and construction materials.

TABLE 1·3

ELEMENTS OF MANUFACTURING COSTS

As percentage of gross receipts (value of Product)

Industry	Materials Fuels and work given out		Deprec-iation		Value added by Manufacture: Salaries, Wages and other benefits		Value added by Manufacture: Available for other purpose		Value added by Manufacture: Total	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
1. Wheat Flour	92.5	93.2	0.6	0.6	3.0	2.9	3.9	3.3	6.9	6.2
2. Rice Milling	94.3	93.9	0.8	0.8	3.6	3.2			4.9	5.3
3. Bisc. making	64.6	61.9	2.1	1.8	11.3	9.9			33.3	36.3
4. Fruit & Veg. Processing	61.9	64.3	3.5	2.3	13.1	11.4			34.6	33.4
5. Sugar	73.9	70.9	2.1	1.6	9.8	9.3			24.0	27.5
6. Distilleries & Breweries	52.8	56.2	5.6	5.8	21.0	22.0			41.6	38.0
7. Starch	68.6	77.6	5.1	2.3	14.2	9.4			26.3	20.1
8. Veg. Oils	92.5	94.3	1.2	1.1	3.3	2.9			6.3	4.6
9. Paints and Varnishes	60.6	64.4	1.0	1.7	8.8	11.5			38.4	33.9
10. Soap	74.8	74.5	1.3	1.4	5.2	6.3			23.9	24.1
11. Tanning	76.0	79.8	1.1	0.7	11.2	8.0			22.9	19.5
12. Cement	56.8	55.2	6.5	5.1	14.5	13.2			36.7	39.7
13. Glass and Glassware	51.3	54.1	5.7	4.9	37.8	33.4			43.0	41.0
14. Ceramics	36.6	39.7	3.3	3.3	40.8	44.7			60.1	57.0

TABLE 1·3 (Continued)

ELEMENTS OF MANUFACTURING COSTS

As percentage of gross receipts (value of Product)

Industry	Materials Fuels and work given out		Depreciation		Value added by Manufacture: Salaries, Wages and other benefits		Value added by Manufacture: Available for other purpose		Value added by Manufacture: Total	
	1949	1950	1949	1950	1949	1950	1949	1950	1949	1950
15. Plywood & Teachests	57.5	62.3	3.4	3.3	15.9	17.1			39.1	34.4
16. Paper and Paperboard	60.2	56.0	4.1	6.1	18.1	18.9			35.7	37.9
17. Matches	47.3	50.9	1.2	0.9	23.9	25.4			51.5	48.2
18. Cotton Textiles	63.0	66.0	1.0	1.2	26.0	24.4			36.0	32.8
19. Woollen Textiles	60.3	61.5	1.0	0.8	23.8	15.3			38.7	37.7
20. Jute Textiles	70.5	69.2	1.1	1.1	19.6	17.6			22.4	29.7
21. Chemicals	56.9	60.5	3.9	3.7	17.3	16.2			39.2	35.8
22. Al. Copper & Brass	76.2	75.5	2.5	2.0	12.9	11.2			21.3	22.5
23. Iron & Steel	48.1	50.6	4.1	4.3	22.5	24.4			47.3	45.1
24. Bicycles	40.8	44.9	3.3	2.5	29.7	23.6			55.9	52.6
25. Sew.Machines	32.0	39.2	5.2	2.5	39.1	46.1			62.8	58.3
26. Elec. Lamps	45.9	54.4	4.2	5.4	21.1	21.8			49.9	40.2
27. Elec. Fans	53.0	49.9	2.9	2.5	27.7	24.6			44.1	47.6
28. Gen. Eng. & Elec. Eng.	55.8	55.7	3.5	3.3	28.8	22.2			40.7	41.0
TOTAL	70.4	70.7	1.7	1.7	18.2	16.7	9.7	10.9	27.9	27.6

The percentages of 'Salaries, Wages and other benefits' to the gross output remained fairly within the range 3 to 20 per cent in the case of consumption goods particularly food items, whereas they were as high as 20 to 40 per cent in the case of Capital goods.

Depreciation charges as percentage of gross receipts were quite low for the industries, Wheat Flour, Rice Milling, Biscuit-making, Vegetable Oils, Soap, tanning and textile industries. They were quite high for Distilleries and Breweries, Cement, Glass and Glassware, Iron and Steel. In the aggregate, depreciation charges amounted to 17 per cent of the gross output.

The percentage of Cost of Materials, fuels, etc. to the value of product was as low as 39 to 40 per cent in the industries, sewing machines and Ceramics. On the other hand, material costs, fuel, etc. bulked very high in Wheat Flour and Rice Milling. Matching these extremes are the low ratios of wages for Wheat Flour and Rice Milling. In the last named industries, salaries and wage payments were but 2.9 and 3.3 per cent of the value of the product. The salary and wages percentage of figure was as high as 44.7 for Ceramics and 46.1 for sewing machines.

<u>Wages, Salaries and Overhead Costs</u>

<u>As percentages of the value added</u>

As we have already seen, the most important single

item /

item of cost in the industries was the cost of materials, fuels, etc. Material costs represent contribution of productive factors outside the particular industry to which they apply. In the total value of product of all industries, cost of materials is a duplicating item because of the transfer of unfinished products from industry to industry. The analysis of contributions of productive factors in manufacturing is incomplete without comparisons, excluding cost of materials. Accordingly, we choose a non-duplicating item such as 'value added', and calculate the wages, salaries, etc. as percentages of the value added. (Table 1·4).

TABLE 1·4

WAGES, SALARIES, AND OVERHEAD COSTS AS PERCENTAGES OF VALUE ADDED 1950

Industries	Wages	Salaries	Overhead Costs other than Salaries plus profits
1. Wheat Flour	30.2	16.4	53.4
2. Rice Milling	44.6	24.4	31.0
3. Biscuit Making	17.8	8.5	73.7
4. Fruit & Veg. Processing	21.7	11.8	66.5
5. Sugar	23.0	9.6	67.4
6. Distilleries & Breweries	34.5	21.3	44.2
7. Starch	29.8	16.3	53.9
8. Veg. Oils	39.2	22.1	38.7
9. Paints & Varnishes	17.8	15.1	67.1
10. Soap	16.5	8.1	75.4
11. Tanning	33.6	10.1	56.3
12. Cement	23.7	7.4	68.9
13. Glass & Glassware	65.9	14.3	19.8
14. Ceramics	58.7	15.9	25.4
15. Plywood & Teachests	29.0	16.6	54.4
16. Paper & Paperboard	36.6	11.0	52.4
17. Matches	35.6	17.1	47.3
18. Cotton Textiles	64.3	9.2	26.5
19. Woollen Textiles	29.8	9.7	60.5
20. Jute Textiles	50.8	7.1	42.1
21. Chemicals	25.2	18.1	56.7
22. Aluminium, Copper and Brass	36.5	12.1	51.4
23. Iron and Steel	36.7	15.2	48.1
24. Bicycles	33.9	10.1	56.0
25. Sewing Machines	60.3	13.4	26.3
26. Electric lamps	31.4	20.6	48.0
27. Electric Fans	35.2	13.9	50.9
28. Gen. Eng. and Electrical Eng.	49.1	18.1	32.8
TOTAL	48.1	11.3	40.6

In both consumption and capital goods divisions, those industries that relate to the finished manufacturing stage (Table 1·5) have the higher percentage of value added attributed to the overhead item, the lower ratio for wage-payments. A possible explanation of this relationship is that the manufacture of standardized finished products is associated with greater use of machine production and higher labour productivity. It will also be noted that the overhead item for finished consumption goods, like biscuit-making, sugar, soap, etc. is considerably higher than that for finished capital goods.

The salary payments are quite a high percentage of the value added in the industries, Rice Milling, Wheat Flour, Starch and Vegetable Oils. It appears that in the manufacture of consumption goods, the salary payments are higher than in the case of capital goods. Also, it is worth noting that in both consumption and capital goods, the industries producing finished manufactured goods share a larger percentage of the salary payment.

TABLE 1·5

CLASSIFICATION OF INDUSTRIES *

Industry	Stage of Fabrication	Durability in use	Character of ultimate use
1. Flour	Finished 50% Unfinished 50%	Transient	Consumption goods
2. Rice Milling	F. 80%, U.F. 18%	Transient	do.
3. Bisc. making	Finished	Transient	do.
4. Fruit & Veg. Processing	Finished	Transient	do.
5. Sugar	F. 68%, U.F. 32%	Transient	do.
6. Distilleries & Breweries	Finished	Transient	do.
7. Starch	F. 56%, U.F. 44%	Transient	do.
8. Veg. Oils	Unfinished	Transient	do.
9. Paints and Varnishes	F. 10%, U.F. 90%	Semi-durable	do.
10. Soap	F. 90%, U.F. 10%	Transient	do.
11. Tanning	Unfinished	Semi-durable	do.
12. Cement	Unfinished	Durable	Construction materials.
13. Glass & Glassware	F. 25%, U.F. 75%	D. 43%, S.D. 25%, T. 32%	Consumption goods, (partly producers' supplies).
14. Ceramics	F. 25%, U.F. 75%	do.	Consumption goods
15. Plywood & Teachests	F. 26%, U.F. 74%	Durable	do.
16. Paper and Paperboard	F. 50%, U.F. 50%	Transient	do.

TABLE 1·5 (Continued)

CLASSIFICATION OF INDUSTRIES

Industry	Stage of Fabrication	Durability in use	Character of ultimate use
17. Matches	Finished	Transient	Consumption goods
18. Cotton Textiles	Finished 33%, Unfinished 67%	Semi-durable	do.
19. Woollen Textiles	do.	do.	do.
20. Jute Textiles	do.	do.	do.
21. Chemicals	Finished	Transient	do. also Producers' supplies 50%
22. Al. Cu & Brass	Finished and Unfinished	Semi-durable	do.
23. Iron & Steel	Unfinished	Durable	Capital equipment
24. Bicycles	Finished	Durable	do. & consumption goods
25. Sew.Machines	F.78%, U.F.22%	Durable	Consumption goods Capital equipment
26. Elec. lamps	Finished	Durable Semi-durable	Consumption goods
27. Elec. fans	do.	do.	Capital & Consumption goods
28. Gen. Eng. & Elec. Eng.	do.	Durable	Capital

x The classification is based on the system adopted by C.A. Bliss in 'The Structure of Manufacturing Production' (Pp. 142-162) for U.S.A. and, therefore, it cannot be strictly adhered to in an analysis of Indian manufacturing. The stage of fabrication grouped into finished and unfinished categories is purely arbitrary.

TABLE 1.6

RATIO OF SALARIED EMPLOYEES TO WAGE-EARNERS

Salaried as percentage of Wage-Earner

Industries	YEAR 1948	1949	1950
1. Wheat Flour	26.1	29.3	26.3
2. Rice Milling	21.6	22.6	22.4
3. Biscuit-making	16.1	21.2	19.5
4. Fruit & Vegetable Processing	36.2	19.2	15.4
5. Sugar	25.4	24.7	16.6
6. Distilleries & Breweries	26.1	23.6	
7. Starch	9.5	9.7	
8. Vegetable Oils	21.9	22.9	23.8
9. Paints and Varnishes	25.9	32.9	
10. Soap	20.7	21.0	
11. Tanning	13.2	16.1	
12. Cement	11.7	13.4	15.3
13. Glass & Glassware	8.7	8.5	
14. Ceramics	11.1	11.4	
15. Plywood & Teachests	13.9	20.4	
16. Paper & Paperboard	12.4	10.9	
17. Matches	11.7	13.0	
18. Cotton Textiles	5.8	5.8	7.0
19. Woollen Textiles	11.4	10.9	11.8
20. Jute Textiles	5.2	5.5	5.4
21. Chemicals	26.5	27.0	
22. Aluminium, Copper & Brass	14.3	15.7	
23. Iron and Steel	21.9	21.5	23.1
24. Bicycles	25.4	31.5	
25. Sewing Machines	14.4	14.7	
26. Electric lamps	30.5	28.3	
27. Electric fans	15.4	14.7	
28. General Eng. & Electrical Eng.	14.8	15.7	
Total	10.2	10.7	11.2

Use of Labour Operations - 1950

Wage earners and Salaried employees:- (Table 1·6)

Salaried employees of manufacturing industries comprise, in the aggregate, approximately 11 per cent of all wage earners employed. The proportion is quite high in industries, Wheat Flour, Rice Milling, Fruit & Vegetable processing, Sugar, Vegetable Oils and Chemicals. The low ratio of salaried workers to the number of wage earners in the textile sector suggests that perhaps in the larger industries, the salaried employees are less numerous. The employment of salaried workers is relatively more frequent at the later stages of manufacturing operations. As products become more specialized with advanced fabrication, the need for salaried administrative assistants becomes greater. It also appears that in the case of consumption goods industries, the percentage of salaried workers is higher than in the case of capital goods.

It will further be seen from the aggregate figures that the proportion of salaried employees has been steadily increasing. Salaried employment has expanded with great rapidity in all industrial countries of the world. Industrialization creates vacancies for a number of executives in technical, supervisory, administrative and commercial posts in the undertakings. The same tendency is also apparent though to a less extent in India.

TABLE 1·7

No. of Wage-earners in manufacturing Industries			No. of Salaried and other workers		
YEAR			YEAR		
1946	1950	Per cent increase	1946	1950	Per cent increase
1,387,010	1,468,334	5.8	127,372	164,149	28.8

If we denote the 'Salaried employee coefficient' as the number of wage earners per salaried employees, we find that the coefficient has decreased from a value of 10.9 for 1946 to 8.9 for 1950.

Referring again to Tables (1·5) and (1·6), it will be seen that the higher percentage of salaried employees is in the transient goods group of the classification according to durability in ultimate use.

TABLE 1·8

THE ROLE OF LABOUR IN

MANUFACTURING PRODUCTION 1950

Industries	Value of Product per person employed Rs	Value added per person employed Rs
1. Wheat Flour	36314	2243
2. Rice Milling	9205	486
3. Biscuit-making	9131	3311
4. Fruit & Vegetable Processing	7502	2505
5. Sugar	6862	1890
6. Distilleries & Breweries	4895	1862
7. Starch	6034	1212
8. Vegetable Oils	23951	1113
9. Paints and Varnishes	12477	4234
10. Soap.	23530	5677
11. Tanning	9136	1786
12. Cement	8323	3303
13. Glass and Glassware	1999	820
14. Ceramics	2001	1142
15. Plywood & Teachests	4865	1671
16. Paper & Paperboard	5835	2212
17. Matches	5108	2464
18. Cotton Textiles	4926	1617
19. Woollen Textiles	7306	2752
20. Jute Textiles	4863	1443
21. Chemicals	7829	2803
22. Aluminium, Copper & Brass	9869	2224
23. Iron and Steel	7302	3295
24. Bicycles	6131	3222
25. Sewing Machines	3844	2243
26. Electric lamps	5965	2396
27. Electric fans	4337	2063
28. General Engineering and Electrical Engineering	4061	1664
Total	6297	1739

Values of Product and Value added per person employed.

The industries that indicate abnormally high value of product per person employed (Table 1·8) are Wheat Flour, Vegetable Oils, soap manufacture and paints and varnishes. But when we exclude the material costs, and compare the value added by these manufacturing operations with the total number of persons employed, the corresponding ratios for Wheat Flour and Vegetable Oils turn out to be quite low. The soap manufactures and paints and varnishes continue to show a high per capita value added. The lowest ratio value added per persons employed is shown by the rice-milling industry although the corresponding value of product per capita is not the least. For Glass and Glassware, the value of product per capita is as low as Rs 2000, and the corresponding ratio of value added per person employed for Glass as well as Ceramics industry is also quite low. Per capita Product tends to be low when labour is a relatively important factor in the operations, and to be high when the capital factor assumes a relatively larger share of the production load. For this reason, it is always necessary to consider the use of labour in relation to capital investment in manufacture. The statistical implications of Capital-labour structure of productivity is however discussed in a separate chapter.

The Role of Capital in the Manufacturing Production

The total productive capital útilized in manufacturing different kinds of goods and the comparable totals of value of products provide ratios of capital to sales. We have already seen that the total capital invested in manufacturing in the year 1950 was Rs 6145 million. This formed 59.7 per cent of the value of the product. The average over-all investment per person employed was Rs 3764.

Relative to value of product, the capital investment in manufacturing industries varies rather widely according to the type of the product. It is relatively high in industries (Table 1.9). Cement, Chemicals, Iron and Steel, Distilleries and Breweries, (Table 1.9) gives the ratio of capital to the value of product for a few selected industries. With the exception of Fruit and Vegetable Processing, Distilleries and Breweries, it is evident that the ratio of capital to sales is relatively low among consumption goods. The industries making construction materials, and capital goods show comparatively high ratio of capital to value of product. In the textiles sector, this ratio is not very high, only 64 per cent in the case of cotton textiles and 46 per cent for jute.

We do not notice any marked distinction among these ratios when we consider the Fixed and the working Capitals separately.

TABLE 1·9

CAPITAL INVESTMENT AS PERCENTAGE OF THE VALUE OF PRODUCT 1950

Industries	Fixed Capital	Working Capital	Total
Wheat Flour	9.2	13.8	23.0
Rice Milling	13.1	15.0	28.1
Biscuit-making	24.1	23.4	47.5
Fruit & Vegetable Processing			93.0
Sugar	22.0	37.7	59.7
Distilleries and Breweries	80.8	60.7	141.5
Cement	63.1	39.6	102.7
Cotton Textiles	20.6	43.2	63.8
Jute Textiles	20.1	26.3	46.4
Chemicals	50.3	43.6	93.6
Iron and Steel	50.3	42.2	92.5
Electric Fans	42.1	68.7	110.8
Vegetable Oils	14.7	18.6	33.3
Total All Industries			59.7

TABLE 1·10

CAPITAL INVESTMENT AS THE PERCENTAGE OF VALUE ADDED INDIA 1950

Industries	Total Capital
1. Wheat Flour	372.5
2. Rice Milling	532.5
3. Biscuit-making	131.2
4. Fruit & Vegetable Processing	278.6
5. Sugar	216.7
6. Distilleries & Breweries	372.1
7. Starch	354.1
8. Vegetable Oils	717.3
9. Paints & Varnishes	199.7
10. Soap	234.5
11. Tanning	230.1
12. Cement	258.9
13. Glass and Glassware	246.8
14. Ceramics	174.3
15. Plywood & Teachests	297.3
16. Paper and Paperboard	299.6
17. Matches	68.9
18. Cotton Textiles	194.4
19. Woollen Textiles	144.7
20. Jute Textiles	156.4
21. Chemicals	261.5
22. Aluminium, Copper & Brass	295.8
23. Iron and Steel	205.0
24. Bicycles	122.1
25. Sewing Machines	201.1
26. Electric lamps	408.0
27. Electric fans	232.9
28. General Engineering & Electrical Engineering	221.3
Total All Industries	216.4

Ratio of Capital to value added

For certain purposes, comparisons of capital investment with some non-duplicating item such as 'value added' are preferable to the ratio of 'value of product capital'. Table (1·10) gives these ratios for 28 industries. As the base of the ratios is shifted from the value of product to 'value added', we find that the ratios for certain consumption goods such as Wheat Flour, Rice Milling and Vegetable Oils, that were relatively low in Table (1·9) appear to be significantly high in Table (1·10). The striking feature in Table (1·10) is the ratio for the match industry which is very low (68·9%). It appears that corresponding to a given capital, the value added for the match industry is substantially high. The match industry seems to be the least mechanized of all. Only 7 out of a total of 37 factories utilized fully mechanized methods of production. This perhaps accounts for the low rates of capital to value added in the match industry.

Taking into account the fact that while India has plenty of labour her capital resources are comparatively small, we think that the industries should be organized in such a way that the ratio of total productive capital to the net product or the value added would not be very high. In the Bombay Plan framed by a group of industrialists for a period of fifteen years (1945-60), 2.4 was considered to be quite a suitable ratio of /

of Capital to net output as compared with similar ratios in other countries. At that time, no census report regarding manufacturers was available. On the basis of the information given in the balance sheets of the Bombay Cotton Textiles Industry and the associated Cement Companies, the panel of experts computed the ratio of Capital to net output as follows

Year	Cotton Textiles	Cement
1937	2.13	3.12
1938	2.62	2.11
1939	3.73	2.53

In view of these figures, the ratio of 2.4 was considered quite low and attainable standard. We however find on examining the ratios of Capital to value added for the year 1950, as given in Table (1.10) that for the Cotton Textile industry, it is as low as 1.94 and for cement, it is 2.59. The aggregate ratio of Capital to value added for all manufacturing industries in the year 1950 was 2.16.

TABLE 1·11

INTRA-INDUSTRY VARIATION IN THE RATIO OF CAPITAL TO NUMBER OF PERSONS EMPLOYED

Capital per person employed India 1950

	Rs
All Industries	3764
Wheat Flour	8357
Rice Milling	2591
Fruit & Vegetable Processing	6980
Biscuit-making	4345
Cement	8551
Cotton Textiles	3145
Woollen Textiles	3985
Jute Textiles	
Iron and Steel	6759
Sugar	4099
Distilleries & Breweries	6946
Starch	4298
Vegetable Oils	8006
Paints & Varnishes	8469
Soap	13326
Tanning	4115
Glass & Glassware	2025
Ceramics	1993
Plywood	4975
Paper and Paperboard	6643
Matches	1700
Chemicals	7338
Al, Cu & Brass	6581
Bicycles	4920
Sewing Machines	4512
Electric lamps	9782
Electric Fans	4809
General Eng. & Electrical Engineering	3691

TABLE 1·12

NET PRODUCT OR VALUE ADDED PER PERSON EMPLOYED

Industries	Rs
Wheat Flour	2243
Rice-milling	486
Biscuit-making	3311
Fruit & Vegetable Processing	2505
Sugar	1890
Distilleries & Breweries	1862
Starch	1212
Vegetable Oils	1113
Paints and Varnishes	4234
Soap	5677
Tanning	1786
Cement	3302
Glass	820
Ceramics	1142
Plywood	1671
Paper and Paperboard	2212
Matches	2464
Cotton Textiles	1617
Woollen Textiles	2752
Jute Textiles	1443
Chemicals	2803
Al., Cu & Brass	2224
Iron and Steel	3295
Bicycles	3222
Sewing Machines	2243
Electric lamps	2396
Electric fans	2063
Gen. Eng. & Elec. Eng.	1665

Capital per person employed

Since Capital as currently measured includes goods purchased and valued at various price levels, any comparison with items reflecting current price levels is subject to qualification. Therefore in picturing the significance of capital in manufacturing, a contrast of capital with some physical element of the manufacturing process is found useful. The most important of such ratios is that which relates the investment to the number of workers. This is in some ways a sensitive ratio for, other things being equal, an added investment will tend to reduce the relative number of persons employed. A highly mechanized industry will probably have relatively few women and the ratio of Capital per person employed will be high. Under opposite conditions the ratio will be low. Table (1·11) giving the figures on 'Capital per Capita' in various industries will be helpful in indicating the relative roles of Capital and labour in manufacturing.

It will be seen that, on the average, Rs 3764 was the equipment with which the manufacturing employee worked in 1950. Where the role of labour is quite important, capital investment per worker is less, e.g. Matches and Textile Industries. Soap manufacture for the year 1950 required unusually high capital investment per worker. Also, heavy use of Capital is made in the industries, Wheat Flour, Vegetable Oils, Paint and Varnishes, Chemicals /

INDIA 1950

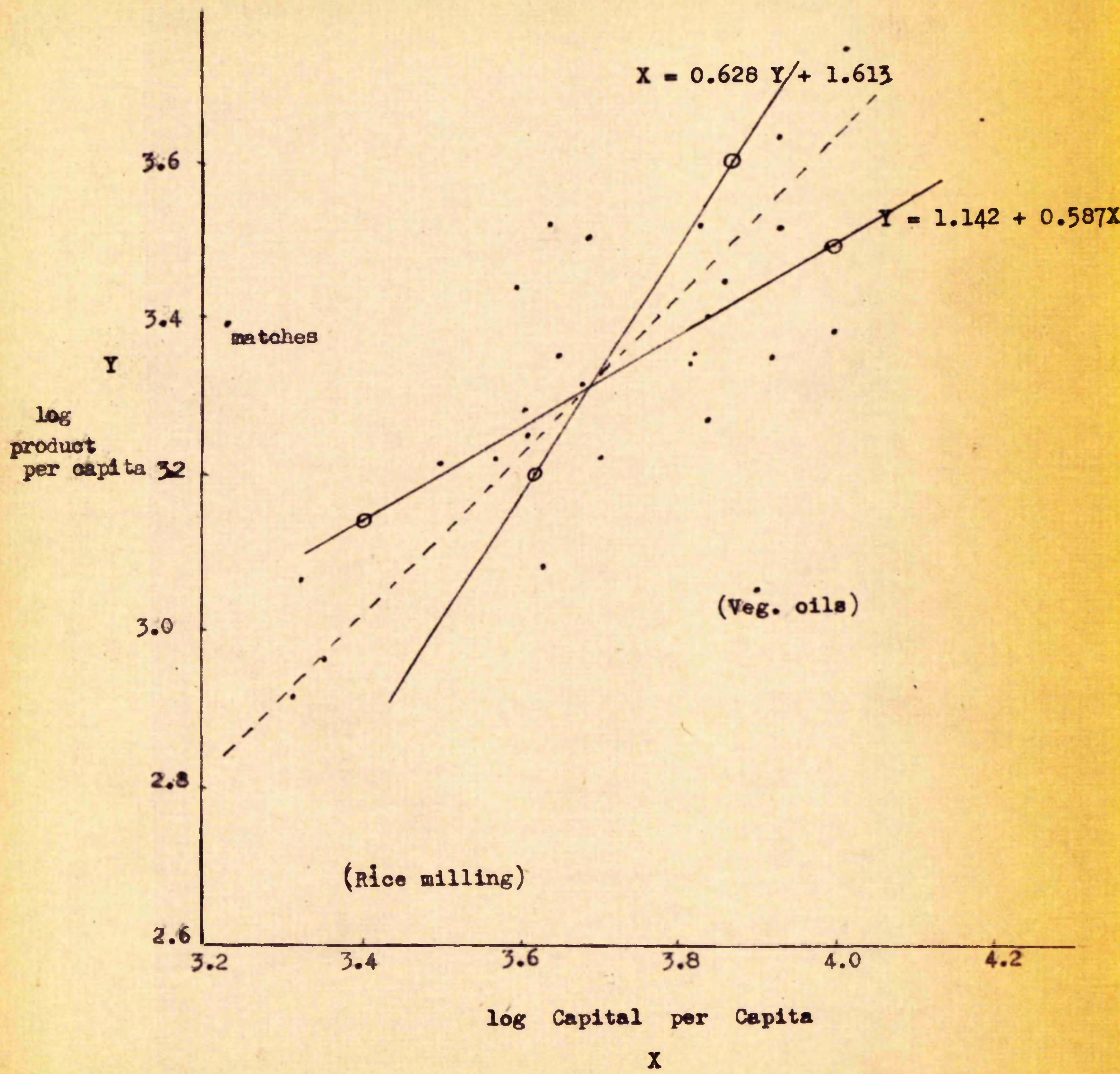


Fig 1,

Chemicals and Electric lamps. In industries where considerable manual effort is required and where mechanized processes have not made much headway, the average 'Capital per Capita' is low. Thus in the tanning, textiles and Rice-milling industries, the per capita investment is low.

This aspect of 'Capital per Capita' studied in isolation does not throw as much light on the relative structure of manufacturing industries as when it is co-ordinated with another useful ratio such as 'Net product per Capita' (Table 1·12).

It was seen that the logarithms of 'Capital per Capita' and the net product or value added per Capital are highly correlated.

The equation of the regression line (Fig. 1) giving relation between $\log \frac{P}{L}$ and $\log \frac{C}{L}$ where P = Net Product, C = Capital, and L = number of persons employed, is

$$\log \frac{P}{L} = 0.5874 \log \frac{C}{L} + 1.142$$

$$\text{or} \quad P = k L^{.4126} \; C^{.5874}$$

This shows that for the year 1950 for Indian manufacturing, 1 per cent increase in labour, capital remaining constant would result in .41 per cent increase in the product. Whereas, corresponding to 1 per cent increase in Capital, labour remaining /

remaining constant, product would increase by .59 per cent. A detailed analysis of these production functions, however, is provided in the next chapter.

Summary

We have in this chapter investigated certain characteristics of manufacturing activities for the year 1950 in India. Our findings suggest that approximately 80 per cent of the productive activity for the year 1950 could be associated with goods destined for human consumption. The textile industries shared about 45 per cent of the total manufacturing activities. 'Materials, Fuels and work given out' comprised, in the aggregate, about 71 per cent of the value of the product. This percentage was abnormally high in industries, wheat flour and rice-milling and relatively low in some of the Capital goods industries such as Iron and Steel, Bicycles, Sewing Machines, General Engineering and Electrical Engineering. Wages constituted, in the aggregate, 48 per cent and salaries, 11 per cent of the 'value added'. The salary payments however were only 7 to 10 per cent of the 'Value added' in the textile sector. While studying the role of labour, we found that in the aggregate, the salaried employees comprised about 11 per cent of the number of wage-earners.

As regards the capital investment as percentage of value added, [illegible] the match industry showed a remarkably low value. Being least mechanised, this industry needs apparently little capital investment.

CHAPTER II

THE PRODUCTION FUNCTION

(CAPITAL-LABOUR STRUCTURE OF PRODUCTIVITY)

Productivity was defined by Professors Douglas and Cobb as a function of labour and capital investment.

$P = f(L, C)$

Professor Douglas assumed that the production function must be a homogenous linear function of first order i.e.

$f(mL, mC) = mP.$

By this, he meant that if each one of these variables $(L, C, ---)$ is multiplied by a constant factor m, then the production function for the new variable also becomes m times the original production function. Professor Cobb after numerous experiments suggested a suitable type of function satisfying the above condition and also satisfying the condition that when either L or C is zero, the product P must also be zero, namely

$$P = f(L, C) = b L^k C^{1-k}$$

Later however, it was decided to remove the assumption that the two exponents of labour and Capital must add up to unity and to determine them independently. In all the cases examined the removal of this assumption made comparatively little difference, the sum of the exponents still adding up to or near about .

Now, the marginal productivity of labour = $\frac{\partial P}{\partial L} = \frac{P}{L} k$

and the marginal productivity of capital = $\frac{\partial P}{\partial C} = P/_C (1-k)$

In other words, if $\frac{P}{L}$ and $P/_C$ remain fairly constant, the marginal /

marginal productivity of labour would be proportional to the exponent of labour in the production function and the marginal productivity of Capital would likewise be proportional to the exponent of Capital.

Now, the flexibility of Marginal Productivity of labour $(\phi_L) = \dfrac{\partial\left(\frac{\partial P}{\partial L}\right)}{\frac{\partial P}{\partial L}} \Big/ \dfrac{\partial L}{L} = (k-1)$ (See Appendix for proof).

and similarly ϕ_C, the flexibility of marginal productivity of Capital $= -k$

These flexibilities indicate the proportional increase or decrease of marginal productivity of labour or that of capital corresponding to a given proportional increment in the quantity of labour or Capital. The elasticity of demand for labour is the reciprocal of ϕ_L, the flexibility of the marginal productivity of labour. Thus elasticity of demand for labour $= \dfrac{1}{k-1}$

When, however, no apriori restriction regarding the sum of the exponents is made, the production function is given in the form $P = h L^k C^j$,

so that, the Marginal Productivity of labour $= \dfrac{\partial P}{\partial L} = k\,P/L$

and, the Marginal Productivity of Capital $= \dfrac{\partial P}{\partial C} = j\,P/C$

In recent years, the values of k and j, the parameter of the production function $P = b L^k C^j$ have been calculated by various authors for different countries and a list is given in the following table.

TABLE 2·1

Country & Year	k exponent L	j exponent C k j	Source
Time Series			
U.S.A. 1899-1922	0.76	0.25	Quarterly Journal of
Victoria 1901-1929	0.84	0.23	Economics, May, 1940
U.S.A. 1904	0.65	0.31	Journal of Political
1909	0.74	0.32	Economy, Feb. 1943
1914	0.61	0.36	Journal of American
1919	0.76	0.25	Statistical Soc.
			June, 1943.
Canada 1923	0.48	0.48	Journal of the
1927	0.46	0.52	American Statistical
1935	0.50	0.52	Society, June, 1943
1937	0.43	0.58	
Australia			
1922-23	0.53	0.49	Quarterly Journal
1926-27	0.59	0.34	
1936-37	0.49	0.49	of Economics,
1934-35	0.64	0.36	November, 1941
New South Wales			
1933-34	0.65	0.34	Quarterly Journal
			of Economics,
			May, 1941.

We shall now use for the Indian Census of Manufactures a production function which is linear in logarithms. This is none other than the production function which Professor Douglas used in his many empirical studies. We do not, however, make the assumption of homogenity or in other words the assumption of constant returns, i.e. the sum of the regression coefficients is not necessarily equal to one. Professor Douglas and his associates have amply demonstrated the usefulness of this type of production function.

The reason why we are prompted to use this particular form of production function is because it gives immediately elasticity of the product with respect to the factors of production (in our case the factors being labour and Capital). We straightaway get answers to the question, by how much per cent will the product increase on the average if capital and labour increased by 1 per cent. The aspects of increasing or decreasing marginal returns could not have come into evidence had we just fitted a linear function to our data instead of using the logarithms. Again, if the errors in the Data were small and normally distributed, a logarithmic transformation of our variables would procure the normality to a substantial degree. But even if the errors are not normally distributed we shall still get the best linear unbiased estimate by application of the method of least squares.

The /

The following study gives the empirical values to the parameters of the function $P = h L^k C^j$ without assumption of the fact $j+k = 1$, taking into consideration the Indian manufacturing industries as reported by the Census of Manufacture Volumes from 1947 to 1952. We have also endeavoured to compute these parameters for the manufacturing industries of the United Kingdom for the years 1948 and 1949.

Ineach of these years, each manufacturing industry has been treated as an observation with its respective quantities of labour (L), Capital (C) and Product (P).

For India, the data provided by the census of manufactures has been used. For product P, value added by manufacture column has been chosen. For labour, we have considered the total number of persons employed - employees included both the workers and persons other than workers. For Capital, 'total productive capital employed' including fixed and working capitals in terms of current prices was chosen.*

For U.K., the Census of production for 1950, 1949 and 1948 (Summary Tables) Pt I provided necessary figures for about 14 broad manufacturing industries. For production, we have used the column for net output. For Capital, we have considered the column under investment. For labour L, the total number employed was /

* For detailed notes on these terms, please refer to Appendix ii).

was chosen. The number employed included both operatives and workers.

Using the data as given by the census of manufactures and utilizing the above concepts, the production function has been fitted by the least square method and the estimates of the parameters k, j and h have been obtained. (Table 2·2).

It should be pointed out however that sufficient care has been taken in working out the logarithms of the quantities P, L and C in each individual industry. The seven-figure logarithmic tables have been used for this purpose. Since we had to deal with figures as large as ten digits together with relatively small numbers comprising only about four to five digits, we had to watch that while working out the logarithms, the last few digits of the large numbers were not ignored.

After obtaining the estimates of k and j for the years under consideration, we desired to test the accuracy of the production function.

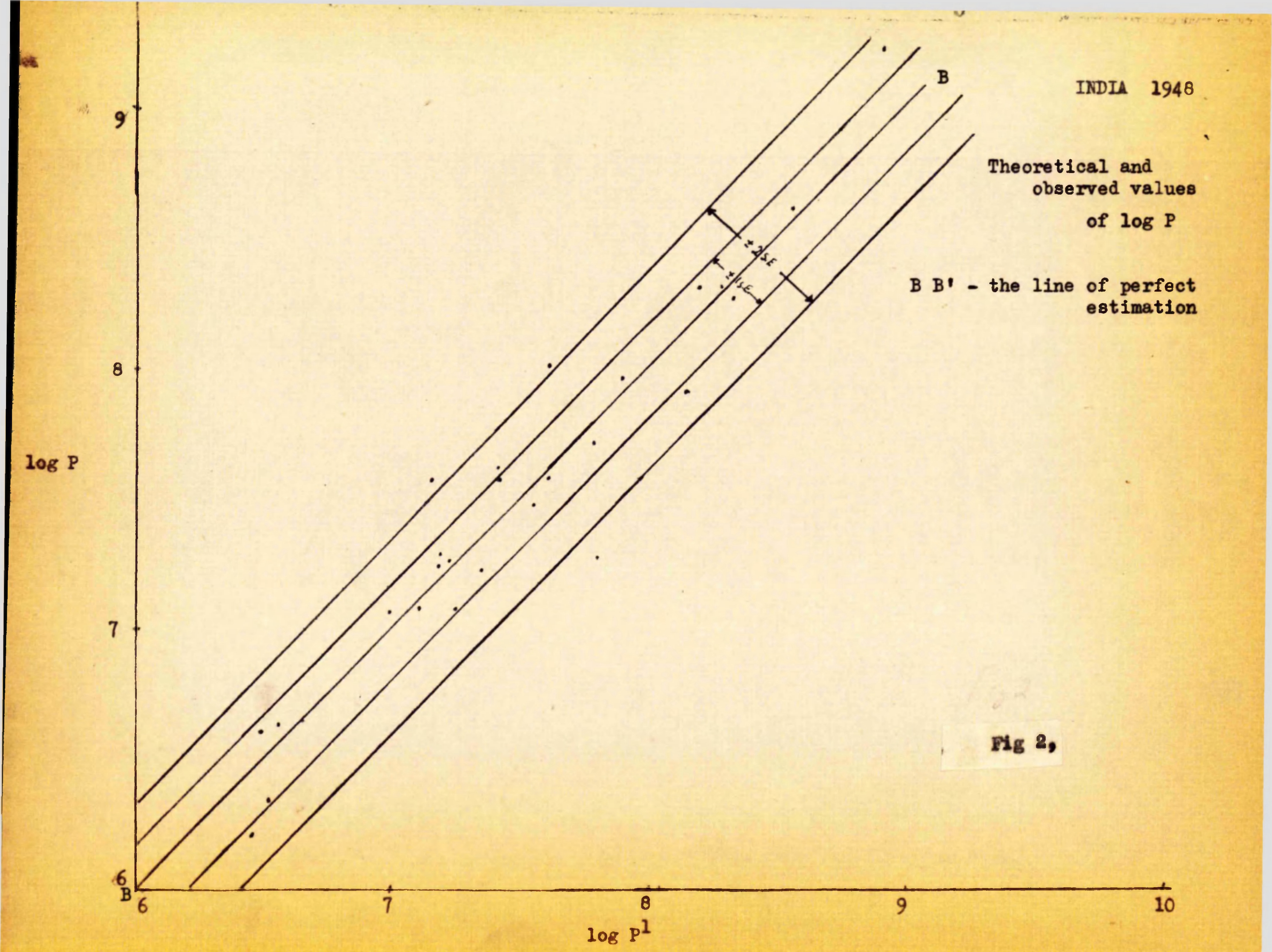
For this, we computed for each industry from its actual quantities of Labour (L) and Capital (C), what the product should be according to the formula. We call this P^1. Then, we compared the actual product P with the computed product (P^1) and examined the relative differences of the former from the latter and whether these differences could be explained by random errors of measurement or by other random causes operating upon the value product /

TABLE 2.2.

$$P = h L^k C^j$$

India	k	j	h	R^2	Propn. of unexplained variance $(1-R^2)$	(k+j)	r^2_{LC}	r^2_{PL}	r^2_{PC}
1947 s.e.	0.5141 (0.207)	0.5664 (0.223)	6.668	0.9259	0.0741	1.0805	0.9212	0.9070	0.9077
1948	0.2365 (0.173)	0.7554 (0.189)	3.945	0.9264	0.0736	.9919	0.9100	0.8857	0.9266
1949	0.5160 (0.129)	0.4012 (0.145)	145.880	0.9502	0.0498	.9172	0.9070	0.9351	0.9187
1950	0.4074 (0.152)	0.5650 (0.163)	21.777	0.9326	0.0673	.9727	0.8934	0.8936	0.9114
1951	0.2600 (0.166)	0.7282 (0.174)	4.667	0.9187	0.0813	.9882			
1952	0.1350 (0.183)	0.9170 (0.195)	0.434	0.9145	0.0855	1.0520			
<u>U.K.</u>									
1948 (Summary figure 55,240 large establishments)	0.6669 (0.088)	0.2680 (0.074)	501.89	0.9765	0.0235	.9349	0.7430	0.9488	0.8536
1949 (Summary figure 58,094 large establishments)	0.7535 (0.066)	0.2252 (0.055)	318.13	0.9841	0.0159	.9787			

Figures in parentheses denote the standard errors.



INDIA 1948
Theoretical and observed values of log P
B B' - the line of perfect estimation
B
±2SE
±1SE
log P
9
8
7
6
B
6
7
8
9
10
log P1

Fig 2,

INDIA 1951

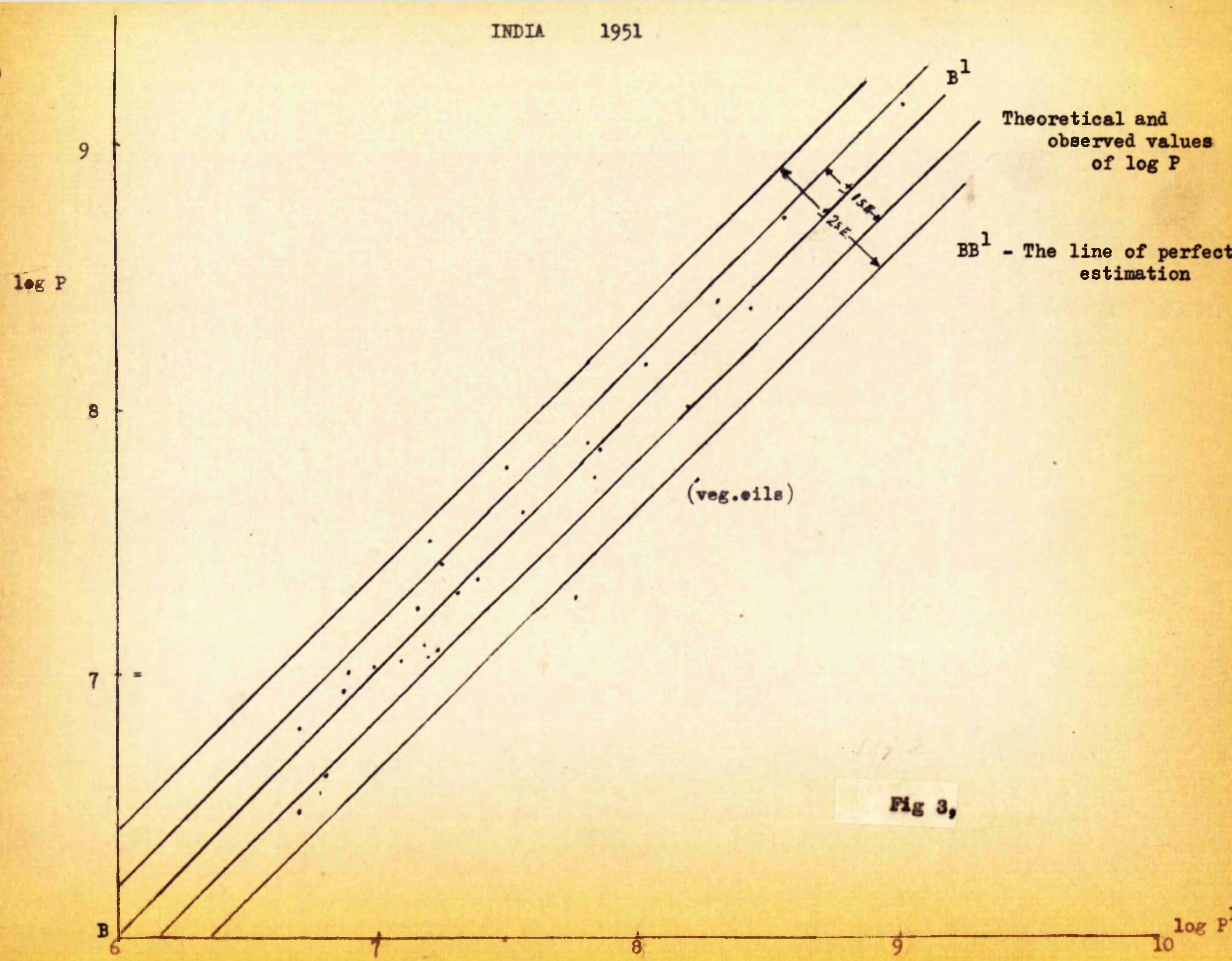


Fig 3,

Theoretical and observed values of log P

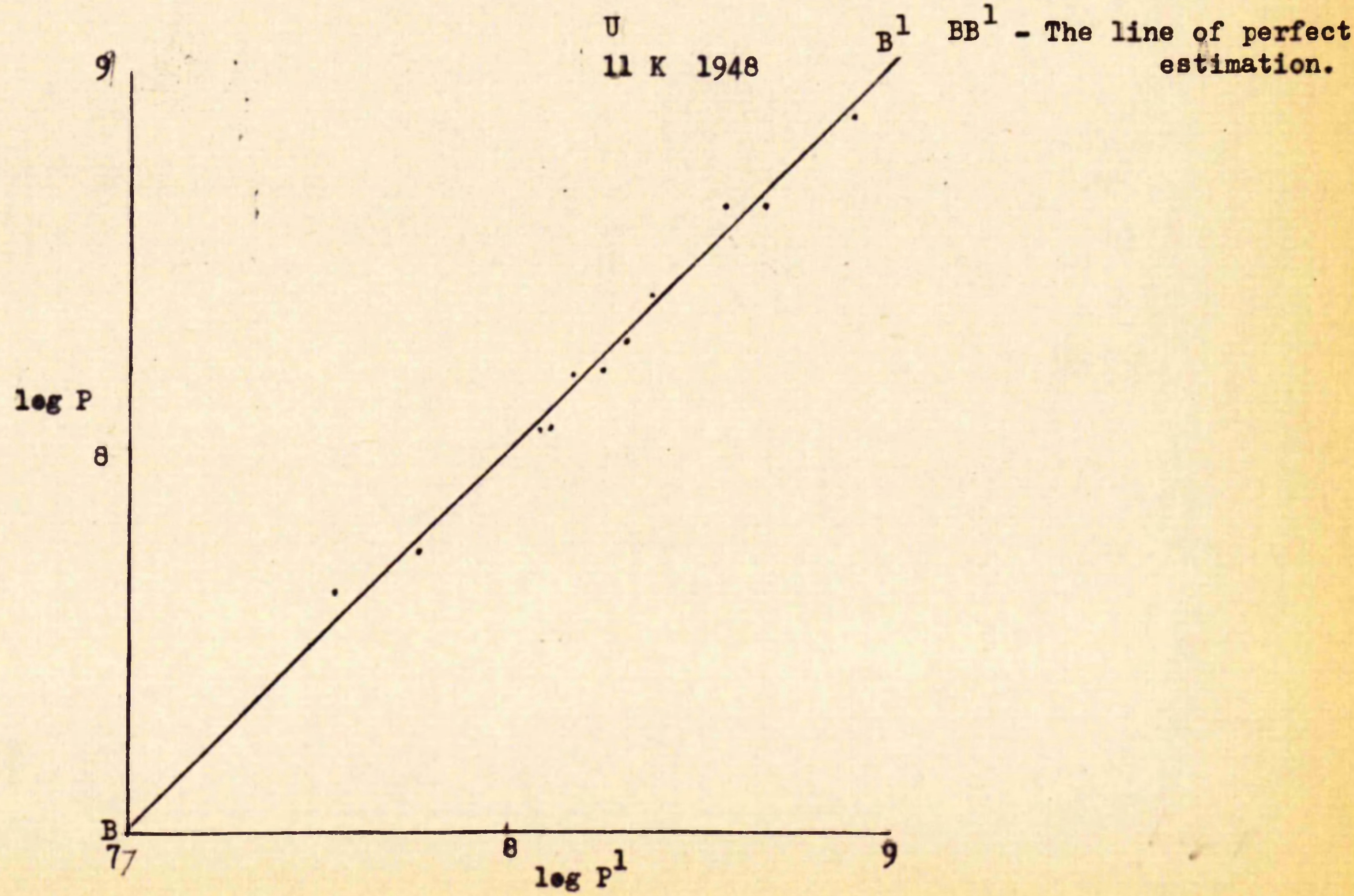


Fig 4,

product of specific industries.

This has been done for the years 1947 to 1951 for India and for the years 1948 and 1949 for U.K. The logarithms of the actual product or P are shown on the vertical axis; (Figs 2, 3 & 4) the logarithm of the computed product or P^1 is shown on the horizontal axis. Were there to be perfect correspondence between the two, each observation would fall on the line BB^1. The differences between the actual product P and those which we would expect under the formula (P^1) are measured by the horizontal deviations of the observations from the line BB^1. To measure these more accurately two sets of bands have been laid out. The first is at a distance of one standard error of estimate to the right and to the left of the line BB^1 while the second set of bands is at a distance of from one to two s.e. of estimate from the line of expected relationship.

It is found that the observations cluster closely round the line BB^1 for U.K. and the scatter is practically negligible. For India too, the scatter is not very great. This is an evidence that the production formula does furnish a description of the product of manufacturing industries.

In table (2·3) there is shown the percentage of observations deviating from the line of perfect correspondence by less than one and two and by more than two standard errors of estimate of P^1.

TABLE 2·3

DEVIATIONS OF ACTUAL PRODUCT (P) FROM PRODUCT (P^1) COMPUTED UNDER THE FORMULA

Percentage of observations of given deviation from P^1

	Year	within ± 1 S.E.	within ± 2 S.E.	outside ± 2 S.E.
India	1947	75	96	4
	1948	82	93	7
	1949	68	89	11
	1950	75	95	5
	1951	82	93	7
U.K.	1948	78	100	0
	1949	78	100	0

We should not expect that there should be precise agreement in each industry between P and P^1. Some differences between P and P^1 would however inevitably result from errors of measurement. Differences in the technical effectiveness of labour and capital in specific industries may as well be contributing to this deviation. It should not be assumed that the /

the labour and capital must have the same exponent in each and every industry. As it will be seen later, on the basis of a spatial study, the exponent of capital is nearly nothing in match industry and turns out negative in the rice-milling industry. The picture is quite different in the case of Iron and Steel and Textiles industries. Another factor that might be causing differences between actual and computed P would perhaps be the forces affecting production other than the quantities of labour and capital.

On investigating the figures for the Indian Census of Manufactures for the year 1951, we find that for 23 out of 28 industries under consideration, the deviation of the actual from theoretical products lies within ± 1 s.e. range. In other words about 82% of the deviation falls within the ± 1 s.e. range. Further, it will be seen that about 93% of the deviations fall within ± 2 s.e. range. Only for two industries, rice-milling and vegetable oils, the deviations exceed two standard errors of estimate.

For the year 1950 for India, in about 75% of the cases, the deviation fell within ± 1 s.e. And in about 95% of the cases, the deviation fell within ± 2 s.e. range. Only for one industry, rice-milling, the deviation exceeded two standard errors of estimates.

For the year 1949, for 19 out of the 28 industries, i.e.

68% /

68%, the deviations fell within ± 1 s.e. About 89% of the deviations fell within ± 2 s.e. range. For the industries, rice-milling, starch, paints and varnishes, the deviations exceeded twice s.e. of the estimate.

For the year 1948, in 82% of the cases, the deviations fall within ± 1 s.e. range. In about 93% of the industries the deviations fell within ± 2 s.e. range. For the industries, rice-milling and match industries, the deviations exceeded twice s.e. of the estimate.

For the year 1947, deviations for 21 out of the 28 industries (i.e. 75%) fell within ± 1 s.e. range. In about 96% of the industries, the deviations lie within ± 2.s.e. range of the estimate. Only for the rice-milling industry the deviation falls beyond ± 2.s.e. range.

Another feature of this production function is revealed by examination of the deviation of observed output figures in the different industries from the production surface. In general it was found that during the years under consideration, the manufacturing industries lying above the surface were either expanding or not being subject to competition characterized by monopolistic tendencies - the textile groups and the match industries being typical examples. On the other hand, the industries, rice-milling, starch, paints and varnishes for which the observed values lie below the ± 2 s.e. range i.e. farther below /

below the production surface, were, during the period under consideration contracting rapidly or were subject to excessive competition.

For the fourteen manufacturing groups, that we have considered for U.K. for the years 1948 and 1949, it will be seen that 11 deviations i.e. about 78% of the deviations fall within ± 1. s.e. range. All the deviations are included within twice standard error of the estimate. The industries for which deviations fall beyond ± 1 s.e. range are ( ) Leather and leather goods, ( ) Food, drink and tobacco and other manufacturing industries.

Before proceeding to discuss the various aspects of the production function, we wish to present in table (2·4), the value of the exponents of the production function computed individually for a few States in India.

Sometimes, the number of man-hours worked is preferred to the 'number of persons employed' in that the latter does not allow for overtime hours worked during the periods of prosperity or for a short-time during depression. Since the Indian Census of Manufactures provides data for the number of man-hours worked by wage-earners we have tried to make use of this variable as denoting labour in computing the production function for the years 1949, 1950 and 1951, and the results are tabulated in Table (2·5).

TABLE 2·4

State and Year	No. of Industries Considered	k exponent L	j exponent C	k + j
W.Bengal 1950	23	0.7302	0.2915	1.0217
Bombay 1950	22	0.2600	0.7456	1.0056
Madras 1950	20	0.5972	0.6102	1.2074
U.P. 1950	20	0.4250	0.5360	0.9610
W.Bengal 1949	25	0.4030	0.5427	0.9457
Bombay 1949	24	0.2420	0.8210	1.0630

TABLE 2·5

	No. of Industries Considered	k exponent H *	j exponent C	k + j
India 1950	28	0.513	0.463	0.976
W.Bengal 1951	17	0.5614	0.5062	1.0676
India 1949	28	0.231	0.693	0.924

* H stands for man-hours worked by wage-earners.

It is also interesting to study the behaviour of this production function within particular industries. We have made use of the spatial data (i.e. the data for the individual states where the given industry occurs) and applying the usual multivariate analysis, we obtained the production functions as given in Table (2.6).

TABLE 2·6

Industry	k exponent L	j * exponent C	k + j
Rice-milling	1.0412	-0.3475	0.6937
Textiles (Cotton, Woollen and Jute)	0.3031	0.6186	0.9217
Matches	0.5137	0.0890	0.6027
Iron and Steel	0.6525	0.5891	1.2416

* The data for the industries refer to the year 1950.

In Table (2·2) we presented the values of the parameters of the production function for the manufacturing industries in India. The really surprising feature of the results obtained is the tendency of the exponent of labour to remain fairly low in spite of the fact that no apriori constraint (for example constant returns) had been imposed. For the years 1948, 1951 and 1952, the value of k is very low and the corresponding value of j is relatively high. The increasing capital per worker might explain to some extent this low value of labour elasticity of output. Let us take for example the two relatively prosperous years 1948 and 1951.

The Production equations for these years are

$$P = 3.945 \; L^{0.2365} \; C^{0.7554} \quad \text{for } 1948$$

and

$$P = 4.667 \; L^{0.2600} \; C^{0.7282} \quad \text{for } 1951$$

so that the marginal Product of Labour $= \frac{\partial P}{\partial L} = 0.2365 \frac{P}{L}$ for 1948

and $= 0.2600 \frac{P}{L}$ for 1951

Labour elasticity of output $= \frac{\partial P}{\partial L} \frac{L}{P} = 0.2365$ (1948)

$= 0.2600$ (1951)

Marginal Product of Capital $= \frac{\partial P}{\partial C} = 0.7554 \frac{P}{C}$ (1948)

and $= 0.7282 \; P/C$ (1951)

Capital Elasticity of output $= \frac{\partial P}{\partial C} \frac{C}{P} = 0.7554$ (1948)

$= 0.7282$ (1951)

In /

In other words, in 1948 an increase of labour by 1 per cent Capital remaining unchanged was associated with a rise in product of 0.2365 per cent; while if Capital went up by 1 per cent, labour remaining constant, product increased by 0.7554 per cent.

In 1951, an increase of labour by 1 per cent Capital remaining unchanged was associated with a rise in product of 0.2600 per cent; while if Capital went up by 1 per cent, labour remaining constant, product increased by 0.7282 per cent.

The 1948 and 1951 values are consistent in that with increasing industrialization, the Capital per worker increased by (41.9) per cent (uncorrected for price changes) between the two periods.

Professor Douglas assuming of course the state of constant returns had proved (Appendix iii) that the flexibility of the marginal productivity of labour to be k-1 and that of Capital to be -k. This would give for the year 1948 for India (for which returns are slightly less than constant; k + j = 0.99) a flexibility of the marginal productivity curve of labour ϕ_L of -0.7635 and of capital -0.2365).

This means that an increase of 1.0 per cent in the quantity of labour (with Capital constant) would normally be accompanied by a decrease of 0.76 per cent in the marginal productivity of labour; while a similar increase in the quantity of /

of Capital (with labour constant) would be accompanied by a decline of 0.24 per cent in the marginal productivity of Capital. If the rates of wages and of interest are determined by the respective marginal productivity of labour and Capital, this would necessitate corresponding decreases in their returns. Similarly, for the year 1951, an increase of 1.0 per cent in the quantity of labour (with Capital constant) would normally be accompanied by a decrease of 0.74 per cent in the marginal productivity of labour while a similar increase in the quantity of Capital would be accompanied by a decline of 0.26 per cent in the marginal productivity of capital.

Again, assuming that the demand curve of any of these factors is determined by its relative marginal productivity, the elasticity of demand for a given factor will be the reciprocal of its Coeff. of flexibility. This would then be -1.3097 for labour and -4.2283 for capital for the year 1948. This would mean that an increase of 1 per cent in the wage rate would, if conditions were normal, lead to a decrease of +1.31 per cent in the quantity of labour demanded, while a similar relative increase in the rate of interest would lead to a decrease of (4.23) per cent in the quantity of capital demanded.

We now turn our discussion to Table (2.4) which gives the values of the parameters of the production function as computed for some of the States in India. The striking feature of /

of this table is the structural variation of the production function between West Bengal and Bombay. For the year 1950 for W. Bengal, the labour elasticity of output was as high as 0.73 and the capital elasticity, 0.29. On the other hand for Bombay, for the same year, the labour elasticity of output was only 0.26 and capital elasticity was 0.74. To investigate the possible reasons for this variation, we decided to consider only the industries that were common to both the States. There were 19 industries to be considered in this way and the resulting production functions were

$$P = 3.177 \; L^{0.228} \; C^{0.768} \quad \text{for Bombay}$$

and $$P = h \; L^{0.798} \; C^{0.242} \quad \text{for W. Bengal.}$$

Even now, there was hardly any difference from the first stage of these equations. The Production functions still exhibited a queer structural difference for these States. We then tried to examine the industries individually and calculated the values of Product-labour (P/L) and Product-Capital ratios for each industry to find out if any particular industry offered relatively large productivity and thereby affected the production surface. It was found that the value for P/C for the match industry for W. Bengal had been unusually high for the year 1950 being 4.03 as against the corresponding value of 1.02 for Bombay.

TABLE 2·7

MATCH INDUSTRY

	P/C	P/L
India 1950	1.449	2463.7
Bombay 1950	1.021	2911.8
W. Bengal 1950	4.030	2685.5

We therefore decided to omit the match industry from our calculations, and then taking into account the remaining 18 industries that were common both to W. Bengal and Bombay, we obtained the new production function,

$$P = 8.128 \quad L^{0.5065} \quad C^{0.5617} \quad \text{for W. Bengal (1950)}$$

The values of k and j in this equation are not significantly different from the corresponding values of the parameters of other States in India, the values for which are tabulated in Table (2·4). However, the foregoing analysis indicates the danger in fitting a production formula for a country or its States which function to some extent on an unstable state of economy. It is quite possible that a single industry /

industry with apparently negligible significance can alter the structure of the production function. In spite of the omission of some industries for both the States, W. Bengal and Bombay, we still find that the value of j (exponent of C) is higher in Bombay than in W. Bengal. It will be seen from Table (2·6) that within the textile industry, the capital elasticity of output is very high compared to other industries. The high value of j for Bombay, therefore, may to some extent be explained for her share of capital in the textile industries being more than W. Bengal.

The textile industries play a very important role in the economic structure of India. About 45 per cent of the total capital in manufacturing is invested in textile industries alone. We obtained the production function for these textile industries as

$$P = 35.400 \; L^{0.3031} \; C^{0.6186} .$$

*Colin Clark, on the basis of the data given by Dr. Lokanatha in Eastern Economist estimated the production function for a few textile industries. He obtained the relationship

$$P = h \; L^{0.22} \; C^{0.78} .$$

Our findings are consistent with Colin Clark's in that the

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* 'Conditions of Economic Progress'.

the Capital elasticity of output is equally high.

It was also proposed to investigate this Capital-labour structure of productivity in the textiles sector for the United Kingdom. Here, we considered only four different industries within the textiles:-

(1) Cotton spinning and doubling

(2) Cotton weaving

(3) Woollen and worsted

and (4) Textile finishing.

We had only four observations and assuming the sum of exponents of labour and capital to be 1, we fitted a linear regression equation to the values log P/L and log C/L for the year 1949. The resulting equation was $P = 56.475 \; C^{0.719} \; L^{0.281}$.

Here, the exponent of Capital was very high and that of labour low, unlike the production function obtained for U.K. (Table 2.2) taking all the manufacturing industries together where it was found that the labour elasticity product was much higher than that of Capital.

The production function for the textile industries in U.K. again justifies our assumption that the Capital elasticity of output in the textile sector is very high compared to other industries.

Looking back now to the values of parameters computed for /

for the manufacturing industries in India for various years (Table 2·2), the most noticeable feature is the high values of j and correspondingly low values of k for the years 1948, 1951 and 1952. We examined each individual industry to find out if some industry could possibly affect the structure of the production function. For the textile industries we obtained the following table for product and capital for some of the years under consideration.

TABLE 2·8

ALL TEXTILES

Year	C Capital Invested (Million Rs.)	P Product (value added) Million Rs.
1947	1873	1433
1948	2303	2080
1949	2406	1566
1950	2781	1527

It will be seen that P/C is quite large for the year 1948 compared to other years. The textile industries definitely showed good production for that year. Since textiles play a major role in the industrial economy of India, the corresponding production /

production function for India for the year 1948 was naturally altered. The exponent of Capital (j) had gone as high as 0.7554 in 1948 as against 0.4 to 0.6 in other years.

The fact will be more clear when we examine the following figures for the production of cotton yarn, cotton fibres and jute manufactures reproduced from the 'Economic Survey of Asia and Far East'.

TABLE 2.9

INDIA

	1938	1946	1947	1948	1949	1950
1. Cotton Yarn (Thousand Metric tons)	585	634	598	660	603	536
2. Cotton Fabrics (Million Metres)	3,937	3,680	3,425	4,044	3,480	3,360
3. Jute Manufacture (Thousand Metric tons)	1,286	1,106	1,068	1,103	958	850

The table shows that there has been a sharp fall in the Indian production of textiles since after 1948. The 1947 figures were also not as high as the figures in 1948. The decline in cotton textile production had been perhaps due to the shortage of cotton, the closure of some mills and also due to the deterioration /

deterioration of equipment. Almost all the world's jute is grown in the Indo-Pakistan Sub-Continent and the major share comes from the northern and eastern regions of Bengal, which now forms part of Pakistan. During 1949 and 1950, a considerable portion of Pakistan's jute lands was devoted to rice. Production of jute in both India and Pakistan suffered greatly from excessive rains.

In the year 1951, the manufacturing industry in India was running higher than the post-war peak (1948) and pre-war 1937. Production of Engineering and Chemicals maintained steady progress. Production of textiles showed an increasing trend. Production of iron and steel surpassed pre-war levels.

In consideration of all these facts and keeping in mind that the capital elasticity of output in textile industries is quite high it will not perhaps be very difficult to explain the high values of the exponents of capital for India for relatively prosperous years, 1948 and 1951. It does not however mean that a high value of capital elasticity indicates prosperity.

For the year 1947, if labour was doubled accompanied by no change in Capital, the product would be $2^{0.5141}$ times of what it was before. On the other hand, if Capital was doubled with no change in labour, the product would be $2^{0.5664}$ times the original value. If both labour and Capital were simultaneously doubled, the product would be $2^{1.0805}$ times, i.e. more /

more than doubled. This indicates a stage of increasing returns i.e. by increasing Capital and labour by a given amount, the product will be increased more than the amount. This state of increasing returns could not be maintained for subsequent years. For the year 1948, doubling of both the factors, labour and capital would make the product $2^{0.9919}$ times of what it was before. In the year 1949, it would be still less $2^{0.9172}$ times the original product. For the year 1950, the doubling of both factors Capital and labour would result in making the product $2^{0.9724}$ times its original value.

In contrast to Indian manufacturing, the Capital-labour structure of Productivity for the United Kingdom showed a higher labour elasticity of output . The equations obtained for U.K. were

$$P = 501.89 \quad L^{0.6669} \quad C^{0.2680} \quad \text{for the year 1948}$$

and $$P = 318.13 \quad L^{0.7535} \quad C^{0.2252} \quad \text{for the year 1949.}$$

This means that for the year 1948, an increase of labour by 1 per cent Capital remaining unchanged was associated with a rise in product of 0.6669 per cent; which if Capital went up by 1 per cent, labour remaining constant, product increased by 0.2680 per cent.

In 1949 for the U.K., an increase of labour by 1 per cent capital remaining unchanged was associated with a rise in product of 0.7535 per cent; while if capital went up by 1 per cent /

cent, labour remaining constant, product increased by 0.2252 per cent.

In both these years for U.K., the sum of the exponents k and j is less than 1, showing a state of diminishing returns to the scale of production.

The values of the exponents k and j that we have computed for the U.K. manufacturing industries resemble the corresponding exponents for the U.S.A. as estimated by various authors (Table 2'10).

TABLE 2'10

	Year	k	j	k + j
	1904	0.65	0.31	0.96
	1909	0.74	0.32	1.06
U.S.A.	1914	0.61	0.36	0.97
	1919	0.76	0.25	1.01
	Time-Series 1899-1922	0.76	0.25	1.01

In both the countries, it will be seen that the labour elasticity of output is high, and the capital elasticity of output is fairly low.

TABLE 2·11

INDIA 1950

Industries	P/L	P/C
1. Wheat Flour	2243.1	0.268
2. Rice-milling	486.4	0.187
3. Biscuit-making	3311.2	0.762
4. Fruit and Vegetable Processing	2504.9	0.358
5. Sugar	1889.8	0.461
6. Distilleries	1861.6	0.268
7. Starch	1212.2	0.282
8. Vegetable Oils	1112.8	0.139
9. Paints and Varnishes	4234.4	0.500
10. Soap	5677.0	0.426
11. Tanning	1786.1	0.434
12. Cement	3302.6	0.386
13. Glass and Glassware	820.3	0.405
14. Ceramics	1142.2	0.573
15. Plywood	1671.5	0.336
16. Paper and Paperboard	2212.2	0.333
17. Matches	2463.7	1.449
18. Cotton Textiles	1617.1	0.516
19. Woollen Textiles	2751.6	0.690
20. Jute Textiles	1443.4	0.639
21. Chemicals	2803.1	0.382
22. Al, Cu and Brass	3224.3	0.338
23. Iron and Steel	3295.5	0.487
24. Bicycles	3222.4	0.655
25. Sewing Machines	2242.6	0.497
26. Electric lamps	2396.5	0.245
27. Electric fans	2063.1	0.429
28. General Eng. and Electrical Eng.	1664.6	0.451

TABLE 2·12

INDIA

Year	Total P (Rupees)	Total L (Number)	Total C (Rupees)	P/L	P/C
1946	2,114,131,371	1,514,382	3,668,337,440	1396.03	0.576
1947	2,421,791,889	1,632,516	4,034,416,601	1483.47	0.600
1948	3,173,422,223	1,697,223	5,221,875,284	1869.77	0.608
1949	2,726,940,644	1,685,186	5,095,795,917	1618.18	0.535
1950	2,839,285,673	1,632,483	6,145,286,280	1739.24	0.462

TABLE 2·13

Year	Salaries and Wages paid Rupees	Wage Productivity (P)	Annual Average Wages per worker
1946	1,018,048,701	0.481	
1947	1,357,065,302	0.560	831.2
1948	1,658,165,368	0.522	976.9
1949	1,771,882,982	0.649	1051.4
1950	1,721,654,172	0.606	1054.6

TABLE 2·14

U.K.

Year	P Net output £000	L Number employed	C Invest-ment £000	W Wages and Salaries paid	P/L	P/C	W/L
1948	3,770,017	6,705,002	260,318	2,091,676	562.2	14.48	311.9
1949	3,968,068	7,051,044	324,927	2,288,316	562.7	12.21	324.5

TABLE 2·15

Manufacturing Industries	U.K. 1949 P/L (in £s.)	U.K. 1949 P/C	U.K. 1948 P/L (in £s.)	U.K. 1948 P/C
1. Treatment of non-metal mining Products (other than coal)	547.5	9.97	546.1	11.53
2. Chemicals & Allied Trades	752.5	4.88		
3. Metal Manufacture	653.0	10.44		
4. Engineering, Shipbuilding & Elec. Goods	534.9	20.34	522.6	20.59
5. Vehicles	522.5	18.10		
6. Metal Goods not elsewhere specified	525.1	14.81		
7. Precision Instruments	544.0	15.14		
8. Textiles	516.5	9.91	516.0	12.16
9. Leather Goods	651.0	21.58		
10. Clothing	395.9	31.34		
11. Food, drink and tobacco	735.7	10.37		
12. Wood and Cork	489.6	17.06		
13. Paper and Printing	609.6	13.10		
14. Other Manufacturing Industries	552.6	9.18		

Table (2·11) gives the Product-labour (P/L) and Product-Capital ratios for individual industries for the year 1950 in India. The table suggests that it would perhaps be most useful to invest Capital in the following industries:- Matches, Cotton Textiles, Woollen Textiles, Jute Textiles, Biscuit-making, Ceramics, etc. The industries for which investment of Capital is least useful are Rice-milling, Distilleries, Starch, Vegetable Oils and Electric Lamps.

On examining the column for P/L, we find that for employing additional labour, more profitable industries are Biscuit-making, paints and varnishes, Cement, Iron and Steel, Bicycles, etc. The least profitable industries from this point of view are Rice-milling, Vegetable Oils, Glass and Glassware, General and Electrical Engineering and Starch.

In this connection, we might refer to Table (2·6) in which, on the basis of spatial data, the production function had been obtained for a few industries. The rice-milling and Match industries seem to have been working under diminishing returns. The Capital elasticity of output is negative or practically nothing for these industries.

For the British Manufactures, as will be seen from Table (2·15), it is perhaps more useful to employ Capital on Clothing, Leather Goods, Engineering, Shipbuilding, Electric goods and vehicles. The industries for which Capital investment

is /

is least profitable are chemicals and allied trades, textiles, etc. For employing additional labour, the most profitable manufactures are chemicals and allied trades, Food, Drink and Tobacco.

Looking back now to Table (2·2), we find in the last three columns, the value of the squares of the correlation co-efficients between pairs of the three variables log L, log C and log P. All these correlation co-efficients are seen to be very high. This reflects the fact that Production, Capital and Labour are highly correlated within industries.

Let us now consider the co-efficient of determination, R^2 (Table 2·2). In regression terms, the square of the correlation co-efficient is an estimate of the proportion of variance in the dependent variable (say, Y) that is accounted for by the regression of Y on one or more independent variables.

When Capital and labour are both considered jointly as factors of manufacturing production, the square of the multiple correlation co-efficient (R^2) as given in Table 2·2, provides explanation for the percentage of variation in the product. For all the years under consideration for India, the value of R^2 ranged between 0.91 and 0.95. It seems therefore that about 91 to 95 per cent of the variation could be explained by the two variables, Capital and labour. In the case of the manufacturing production in U.K., the proportion of variance explained /

explained by these two factors is still higher, being about 97 to 98 per cent.

Singly, Capital, the more powerful of the independent variables was, for the year 1948 in India, capable of explaining about 93 per cent of the variation

(coeff of correlation r^2_{PC} = 0.9266).

Labour alone was capable of explaining 88 per cent of the variation in the product.

The proportion of unexplained variance obviously is very small ranging between 4 to 8 per cent.

We had also used the figures given for the 'number of man-hours worked' as representing labour, instead of 'the average number of persons employed'. The man-hours refer to the hours worked by wage-earners alone. The hours worked by salary earners and other workers could not be obtained. On the basis of this data, Production function was fitted and the values of the parameters so obtained are given in Table (2·5).

A striking feature of the production function has been the fluctuation of the values of the constant h in the equation $P = h\ L^k\ C^j$, from year to year, (Table 2·2). This fluctuation is not restricted to Indian manufacturing industries alone, but the manufacturing industries of U.K., U.S.A. and many other countries as well indicate such behaviour. Ordinarily, this constant h should denote the product that could be derived

from /

from one unit of labour working with one unit of capital. But it is unlikely that this product could differ considerably from year to year in any country. Attempting to reason for this fluctuation, it was desired to calculate the standard error of this constant h or preferably log h.

Our Production function is $P = h L^k C^j$

In other words,

$$(\log P - \overline{\log P}) = k(\log L - \overline{\log L}) + j(\log C - \overline{\log C})$$

and estimate given by $\log h = \overline{\log P} - k\,\overline{\log L} - j\,\overline{\log C}$

Now, let $\log P = y$; $\log L = x_1$; $\log C = x_2$

then we have $\log h = \bar{y} - k\bar{x}_1 - j\bar{x}_2$

Hence, $Var(\log h) = Var\,\bar{y} + Var(k)\,\bar{x}_1^2 + Var(j)\,\bar{x}_2^2 + 2\bar{x}_1\bar{x}_2\sqrt{Var(b_1)\,Var(b_2)}$

Necessary substitutions for $\bar{y}$, $\bar{x}_1$ and $\bar{x}_2$ may now conveniently be made. We adopted this formula for calculating the variance of log h and obtained the following table.

TABLE 2·16

		log h	Var (log h)	s.e. (log h)
India	1949	2.1638	3.828	1.956
	1950	1.3315	4.782	2.186
U.K.	1949	2.5026	0.587	0.766
	1948	2.7006		

The /

The above table shows that log h has a very large s.e. for India. It is apparent, the s.e. of log h being quite large, all the values of log h could be contained within one standard error range. Thus, the values of log h for different years are not significantly different from each other.

The same is true for the manufacturing industries of U.K. The standard error here is also proportionately quite large and the values of log h obtained for the years 1948 and 1949 are not significantly different from each other.

In view of such large error attached to log h and hence to h, it would perhaps be more convenient to express the production equation in the original form.

$$\log P = \overline{\log P} + k\,(\log L - \overline{\log L}) + j\,(\log C - \overline{\log C})$$

Now, $\overline{\log P} = \log g_P$ where g_P is the geometric mean of P's

similarly $\overline{\log L} = \log g_L$ and $\overline{\log C} = \log g_C$

Then, $\log P = \log g_P + k \log \left(\frac{L}{g_L}\right) + j \log \left(\frac{C}{g_C}\right)$

i.e. $P = g_P \left(\frac{L}{g_L}\right)^k \left(\frac{C}{g_C}\right)^j$

The values of g_P, g_L and g_C, the geometric means of Product, Labour and Capital do not differ considerably from year to year and also the s.e. attached to is very small.

Therefore, it would perhaps be more convenient to work out the Production function with $\frac{L}{g_L}$ and $\frac{C}{g_C}$ i.e. the ratio of /

of the variables to their respective geometric means, rather than the variables as they are.

TABLE 2·17

$\frac{W}{P}$ (RATIO OF WAGES TO VALUE ADDED)

	1948	1949
Wheat Flour	0.36	0.43
Rice-milling	0.89	0.72
Biscuit-making	0.32	0.34
Fruit and Vegetable Processing	0.16	0.38
Sugar	0.38	0.41
Distilleries and Breweries	0.38	0.50
Starch	0.54	0.54
Vegetable Oils	0.42	0.51
Paints and Varnishes	0.28	0.23
Soap	0.21	0.22
Tanning	0.58	0.48
Cement	0.35	0.39
Glass and Glassware	0.79	0.87
Ceramics	0.74	0.67
Plywood and Teachests	0.37	0.41
Paper and Paperboard	0.54	0.51
Matches	0.38	0.46
Cotton Textiles	0.51	0.72
Woollen Textiles	0.42	0.61
Jute Textiles	0.62	0.87
Chemicals	0.39	0.44
Al. Cu and Brass		
Iron and Steel	0.55	0.47
Bicycles		
Sewing Machines		
General Eng. and Electrical Eng.	0.66	0.71

We now proceed to consider the marginal productivities of labour and Capital. We had seen earlier that the marginal productivities of labour and capital are respectively,

$$\frac{P}{L} = P/L\ k \quad \text{and} \quad \frac{P}{C} = \frac{P}{C}\ j.$$

The following tables illustrate the marginal productivities of labour and capital for some of the years under consideration for both India and U.K.

TABLE 2·18

INDIA (Rupees)

Year	P/L^k	P/C^j	Average Annual wages per worker
1947	762.6	0.34	831.2
1948	442.2	0.46	976.9
1949	834.9	0.21	1051.4
1950	670.5	0.27	1054.6

TABLE 2·19

U.K. (Pounds)

Year	P/L^k	P/C^j	Average Annual wages per worker
1948	374.9	3.88	311.9
1949	424.0	2.75	324.5

The striking feature in the above tables is that for

all /

all the years under consideration, the marginal productivity of labour (MP_L) for India is less than the annual wages, whereas for U.K., the marginal productivity of labour is found to be greater than the wage-rate. The (MP_L) of labour was very low for the year 1948 for India, and the corresponding marginal productivity of Capital (MP_C) was quite high. From the year 1949 to 1950, the MP_L has decreased and MP_C has slightly increased. For U.K., the MP_L has gone up in 1949 as compared to 1948 and the corresponding MP_C has decreased.

Since in a perfect economy, one would expect the wages to equal the marginal Productivity of Labour, the wage-bill would naturally amount to k times the product where k is the exponent of Labour in the production equation. In the case of Indian manufacturing, we have already observed that the MP_L was less than the wage-rate; therefore the fraction that the total wage bill bears to product (value added) will correspondingly be greater than k. Therefore from table (2·13) we find that in general, $\frac{W}{P}$ has been greater than k for nearly all the years for India. On considering individual industries as well and examining the table of W/P (Table 2·17), it will also be seen that this fraction has been greater than k in most industries.

Note

The second five year plan suggests that during the years 1955-56 to 1960-61, the Government would aim at increasing the national income in the Factory enterprises by about 67 per cent. During the period, employment has been estimated to have increased by about 42 per cent. The rate of investment would be, as reported, roughly double of the first plan. The theoretical value of the output, on the basis of the production function, (with exponent of labour, $k = 0.45$ exponent capital, $j = 0.55$) would be $0.45 \log (1.42) + 0.55 \log 2 = 1.71$ about 1.71 times its value at the beginning of the plan. On attributing a higher coefficient to capital, say 0.7 and correspondingly a lower coeff to labour, say 0.3, we reach a still higher value of output, about 1.80 times. Therefore, a target of 67 per cent increase in the value of output in the factory sector during the next five years appears quite a reasonable estimate.

Since this thesis had already been prepared, a paper entitled 'Production function for Indian Industry' by Murti and Sastry has appeared in Econometrica Vol. 25, No2, April, 1957. In this paper, the estimates of the parameters of the production function are based on the averages per firm in each industry, and are therefore different from the computed parameters in the present text. However, the paper, on the whole, shows that Cobb-Douglas production formula does furnish a description of the product of Indian manufacturing.

LAND, LABOUR AND PRODUCTIVITY

Land, Labour and Productivity

The Production equation can as well be used in relation to the agricultural output. In the agricultural sector, besides the working population, the most important factor of production is land. We assume that it is only land and labour that together produce agricultural products.

The production formula in this case may be stated as

$$P = h\, u^{\lambda} v^{\mu}$$

where, P = total product; u = Agricultural labour; v = land; λ = elasticity of Production w.r.t. labour; μ = elasticity of Production w.r.t. land and h = constant.

The general elasticity of product w.r.t. labour in the agricultural sector is found to be 0.5. In the 'Economics of 1960', Colin Clark states that, 'In a diminishing returns industry, the wage of the agricultural labourer would, in the long period be more or less adjusted to his marginal productivity, which should be about half of the average productivity per head of the whole agriculturally occupied population'.

Dr. Tintner (Econometrica, April, 1941) obtained a production equation, using data from Messrs. Bayer and Landsburg brought up to date by U.S. department of Agricultural statistics for /

for the period 1920-41.

His equation was

$$x_1 = 2.7735\, x_2 + 0.9020\, x_3 + 0.0087\, x_4 - 0.2644$$

where x_1 = log of agricultural Production.

x_2 = log of Employment.

x_3 = log of Capital.

and x_4 = time in years

An unexpected deduction from this equation, however, is that a loss of 1 per cent in the labour force causes a fall of about 2.8 per cent in the output. It should be mentioned here that i.e. log (Employment) had been falling throughout the period under consideration.

This certainly conflicts with the concept of diminishing returns agriculture, so far as short run changes are concerned. This may be as Colin Clark puts it, because American Agriculture is already seriously undermanned in relation to its resources.

We now intend to frame an equation of the similar type for Productivity in the Indian agricultural sector. We could not obtain figures for both area and yield for each individual district in India. The area figures of districts are, however, available for the year 1947 in the 'Agricultural Statistics, detailed tables'. But we could not make any use of these /

these figures owing to the lack of figures for 'yield' or 'production'. Only, the estimates of 'Area under Principal Crops' and the 'Production of Principal Crops' for each individual State in India were obtainable from a Government publication for the year 1950-51.* We utilized the 1951 Census figures in the Agricultural Class to represent the labour. We included both self-supporting persons and the working dependents (according to their secondary occupation) in the agricultural sector in this category.

Considering figures for 10 major States of India, we obtained the production equation as follows:-

$$P = 1.6054\, U^{0.6753}\, V^{0.1940}$$

where P = Production of Principal Crops.

U = Actual working population in Agriculture.

and V = Area under Principal Crops

The Productivity in the agricultural sector, however, follows the law of diminishing returns and, therefore, it is not surprising to find the sum of the exponents of U and V in the above equation to be 0.8693 i.e. < 1. The omission of other important factors like Capital, management, etc. might as well be attributed for the sum of the exponents being less than 1.

The /

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* Estimates of Area and Production of Principal Crops in India, 1950-1951.

The equation suggests that corresponding to 1 per cent increase in agricultural labour, agricultural land remaining constant, the output will increase by 0.67 per cent, whereas if the land was increased by 1 per cent, the labour remaining constant, the output would increase by only 0.19 per cent.

The existing over-population in the Agricultural sector can hardly allow the agricultural labour to increase for better production; the high value of the exponent of labour may be due to the absence of other factors like Capital and equipment which, when brought into consideration, might reduce the exponent of labour considerably.

The argument of Dr. Tintner regarding selective labour might as well be applied in the case of India. However, the figures are not adequate enough to enable us to justify any conclusion.

There seem to be very high correlations existing among the variables under consideration.

$$r_{pu} = 0.820$$

$$r_{pv} = 0.783$$

$$r_{uv} = 0.912$$

The significantly high correlation co-efficient (0.912) between land and labour should be taken note of in this connection.

Supplement to Chapter II.

(i)

We have, in computing the production function for Indian manufacturing, considered L, as the total number of persons employed. In an article by Dutt, Sankhya, Vol 15, Part 4 on the same topic, some modification has been suggested. In all industries workers are not homogeneous. It is desirable that men, women and children workers are to be considered separately. For homogenity in the measure of L, women and children workers are to be converted into equivalent male workers by using the efficiency factors. Average number of working hours per day is taken to be 8 hours. Dutt has estimated the average number of workers on the basis of 365 days, which has however reduced the weightage of the number of equivalent male workers. In computing the production function for the year 1950, we have calculated on the basis of 260 days which is the average number of working days in all industries reported in the census of Manufactures for the year.

Thus, $$L = \frac{M + \frac{2}{3} W + \frac{1}{2} C}{8 \times 260} + S$$

M = total number of Man-hours worked by men in an industry.

W = total number of hours worked by women in an industry.

C = total number of hours worked by children in an industry.

S = average number of salaried staff.

Measures of the efficiencies of female and children workers are taken to be 2/3 and $\frac{1}{2}$.

Thus $\left(\frac{M + 2/3\ W + \frac{1}{2} C}{8 \times 260} \right)$ represented the average number of workers on the basis of 260 days. No such correction could be made for salaried workers as the data for the number of man-hours worked in this sector is not available. It is assumed that the salaried workers are employed through out the year.

Using the above concept of labour (L), total productive capital employed (C) and the value added by manufacture (P), we derived the production function for the year 1950 as,

$$74.697 \; L^{0.5526} \; C^{0.4216}$$

From table 2.2 , it will be seen that when L was considered only as the total number of persons employed, the production function for the year 1950 was

$$21.777 \; L^{0.4074} \; C^{0.5650}$$

Thus, the share of labour has increased slightly in the modified formula.

Dutt's values are different from the values of exponents given in Table 2.2 due to the fact that the methods adopted were different.

Dutt's estimates of exponents k & j in formula $P = h\,L^{k}\,C^{j}$

Year	K	j
1946	0.7725	0.2326
1947	0.5704	0.4954

(ii)

We now refer to an article on'production functions for Indian Industry' by V.N.Murty and V.K.Sashtry in Econometrica Vol. 25, No. 2 , April 1957. In this article, Murty & Sashtry have adopted for the Indian industry the theory put forth by Marschak and Andrews in an Essay on " Random Simultaneous Equations and the theory of production", Econometrica Vol 12, July-Oct 1944. Here the profit maximizing principle is involved.

Considering the firms producing the same -

Considering the firms producing the same commodity, let us denote by x_0, x_1, x_2 the annual physical output, the man-power and the capital of the firm respectively. Correspondingly p_0, p_1, and p_2 mean the price of the firm's product, the wage rate and the interest rate it pays. The firm's revenue will be denoted by y_0, its pay roll by y_1, and its annual interest charges by y_2.

i.e. $y_j = x_j p_j$ (a)

The following four functions are postulated.

(b) $x_0 = \phi(x_1, x_2)$, the production function

(c) $y_0 = y_0(x_0)$, the revenue function

(d) $y_1 = y_1(x_1)$, the outlay function of labour

(e) $y_2 = y_2(x_2)$, the outlay function of interest

We further have the following definitions

(f) $\alpha_i = \frac{\partial \phi}{\partial x_i} \frac{x_i}{x_0}$ — α_1 and α_2 are the elasticities of output w.r.t capital and labour

(g) $\beta_i = \frac{dy_i}{dx_i} \cdot \frac{x_i}{y_i}$

(h) $\beta_0 = \frac{dy_0}{dx_0} \cdot \frac{x_0}{y_0}$

The firm's profit is defined as

(i) $\pi = y_0 - y_1 - y_2$

To make the profit a maximum

(j) & (k) $\frac{\partial \pi}{\partial x_1} = 0$, $\frac{\partial \pi}{\partial x_2} = 0$

By use of definitions (f) to (h), the equations (j) & (k) can be rewritten in the form

$$\beta_0 y_0 \alpha_i - \beta_i y_i = 0 \qquad (l)$$

$$\text{i.e. } \alpha_i \frac{\beta_0}{\beta_i} = \frac{y_i}{y_0} = \omega_i = \alpha_i' \qquad (m)$$

For statistical manageability the case will be tried in which the elasticities defined in (f), (g) & (h) are all independent of x_0, x_1 and x_2.

This gives the four relationships (b),(c),(d) and (e) the form,

$$x_0 = a_0 x_1^{\alpha_1} x_2^{\alpha_2} \quad \text{.....} \quad (n)$$

and since, $\beta_j = \frac{dy_j}{dx_j} \cdot \frac{x_j}{y_j}$, $y_j = b_j x_j^{\beta_j}$ .... (p)

$(j = 0, 1, 2)$

then the relation between the Y's may be written as $y_0 = a' y_1^{d_1'} y_2^{d_2'}$ .....(q)

Murti and Sashtry have attempted to evaluate by the usual method of least squares the parameters of the equation (q). The elasticities obtained by them are not the physical elasticities of output and , but and corrected for the degree of imperfection in the respective markets.

Year	Exponent of Labour.	Exponent of Capital.
1951	0.59	0.40
1952	0.53	0.50

Here also , the values of exponents differ from our calculation in that the methods adopted are completely different.

(iii)

We now proceed to state briefly the econometric model adopted by C.M.Palvia in his book on development planning in India. On assumption of Cobb-Douglas functions for productivity for both agricultural and non-agricultural sectors and also with the aid of certain supply and demand equations , Palvia has attempted to build up certain targets for aggregate national Income and some other objectives of economic policy.

Production function for agriculture

$$U_1 = h_1 a_1^{\alpha} n^{1-\alpha} = h_1 a_1^{\frac{1}{2}} n^{\frac{1}{2}}$$

U_1 = agricultural product

a_1 = working population in agriculture

n = land potential

Production function for non-agriculture

$$U_2 = h_2 a_2^{\lambda} c_2^{1-\lambda} = h_2 a_2^{0.75} c_2^{0.25}$$

a_2 = working population in non-agricultural sector

u_2 = non-agricultural product

c_2 = capital

(The labour elasticity of output which Palvia has arbitrarily adopted appears to be very high. Our computations for the manufacturing sector in India suggest a much lower value of elasticity for labour)

$$u_1 P_1 + u_2 P_2 = Y$$

Where P_1 = price of agricultural product

P_2 = price of non-agricultural product

Y = National Income

By appropriate choice of units , P_2 is taken as unity

$$\therefore \quad u_1 P_1 + u_2 = Y$$

Wage levels are given by $I_1 = P_1 \frac{\partial u_1}{\partial a_1}$

and $I_2 = P_2 \frac{\partial u_2}{\partial a_2} = \frac{\partial u_2}{\partial a_2}$

and $\frac{I_1}{I_2} = k$ which normally varies between ¼ and 1 according to relative preferences for agricultural and non-agricultural work.

Demand is a function of income and the relative price level. Hence demand for agricultural product is $u_1 = f(Y, P_1)$

In terms of elasticities $u_1 = h_3 Y^{\epsilon_1} P_1^{\epsilon_2}$

$$k = \frac{I_1}{I_2} = \frac{\frac{1}{2} h_1 a_1^{-\frac{1}{2}} n^{\frac{1}{2}} P_1}{\lambda h_2 a_2^{\lambda-1} c_2^{1-\lambda}} \quad \therefore P_1 = \frac{\lambda k h_2 \left(\frac{c_2}{a_2}\right)^{1-\lambda}}{\frac{1}{2} h \sqrt{n/a_1}} \; ; \; Y = h_1 a_1^{\frac{1}{2}} n^{\frac{1}{2}} P_1 + h_2 a_2^{\lambda} c_2^{1-\lambda}$$

Substituting the values of P_1 and Y in the equation

$$h_1 a_1^{\frac{1}{2}} n^{\frac{1}{2}} = h_3 Y^{\epsilon} P_1^{\epsilon}$$

a_2 is obtained after simplification as a function of n and ~~a2~~ c_2

$$a_2 = f(n, c_2)$$

Therefore, with the data supplying values of $h_1, h_2, h_3, \lambda, \alpha, \epsilon_1, \epsilon_2$

and with known varuables a,n, and c_2 , it is possible to estimate a_1 , a_2 , and consequently u_1, u_2 and Y.

In the November, 1957 issue of the quarterly Journal of Economics E.H. Phelps Brown has discussed some of the implications of the Cobb-Dougles functions . We shall presently utilise his methods in our study of Indian manufacturing.

Let ΣP be the sum of all reported net product , ΣL be the sum of the persons employed and ΣC, the total productive capital. The average number of Employees per unit capital = $\Sigma L / \Sigma C$ and the average net product per unit capital = $\Sigma P / \Sigma C$. In any industry i, with actual labour force L_i capital C_i and net product P_i, the " expected" labour force is $\frac{\Sigma L}{\Sigma C} C_i$ and the "expected " net product is $\frac{\Sigma P}{\Sigma C} C_i$ Figure ( ) shows ratios of the type

$$\frac{P_i - \frac{\Sigma P}{\Sigma C} C_i}{\frac{\Sigma P}{\Sigma C} C_i} \div \frac{L_i - \frac{\Sigma L}{\Sigma C} C_i}{\frac{\Sigma L}{\Sigma C} C_i} = \frac{\Sigma L}{\Sigma P} \cdot \frac{P_i \Sigma C - C_i \Sigma P}{L_i \Sigma C - C_i \Sigma L}$$

Unlike Phelps Brown's analysis which relates to Australian manufacturing , our data do not give much evidence for a systematic relation. However, we have fitted a regression equation to our data for the year 1950 and the regression line is given by $\hat{Y} = 0.581\,X - 3.31$ Fig 4 a

s.e (0.166)

Where Y = percent excess of actual over expected net product

X = Percent excess of actual over expected labour force

The slope of the regression line tells us that between one industry and another, a one percent increase in the intake of labour per unit of capital generally went with an increase of 0.58 of 1 percent in the corresponding net value product.

However, it was found, owing perhaps to lack of any systematic relationship among industries that the regression coefficient was associated with a large standard error. Whether this coefficient has the same economic meaning as the as the labour elasticity of output in the Douglas -Cobb equation is another question. But we have already seen that the later coefficient (which was 0.41 for the year 1950) too had a large standard error of the order 0.15. Phelps Brown contended that the values of P,L and C given by the Censuses of production for an array of industries were likely to be so much correlated that little reliance could be placed on the coefficients of a Cobb-Douglas function. He further states that the frequency with which the exponents k and j sum to near unity, would follow from a predominating tendency of P, L and C to vary in the same proportion between one industry and another.

It is time now to discuss why the coefficients j & k of the Cobb-Douglas equation $P = h L^k C^j$ varied so greatly from year to year in the case of Indian manufacturing (table 2.2) When we take into account the standard error associated with the estimates of these elasticities, we will notice that the existing variation is as one would expect normally. The average value of k for the six years, 1947 to 1952 is 0.3448. The average standard error for these years is 0.17. Therefore 2/3rds of the K values would be expected to lie within the range 0.34 ± 0.17. Four out of six of our observed values of k lie within this range. Again, the average value of j for the six years, 1947 to 1952 is 0.6555, and the average s.e is 0.18. Here also, we find that 2/3rds of our observations lie within the range 0.65 ± 0.18.

That the capital elasticity should be high, on an average seems quite natural for a country having adequate labour and shortage of capital.

It will be seen that between the year 1948 to 1951, total productive capital employed in the 29 manufacturing industries covered by the census increased by 47% . Even after making - corrections for the price changes, this percentage stood at 35. Whereas, the"value added " figure increased by only 9.4% . Employment on the other hand, seems to have declined from 1.7 million to 1.6 million.

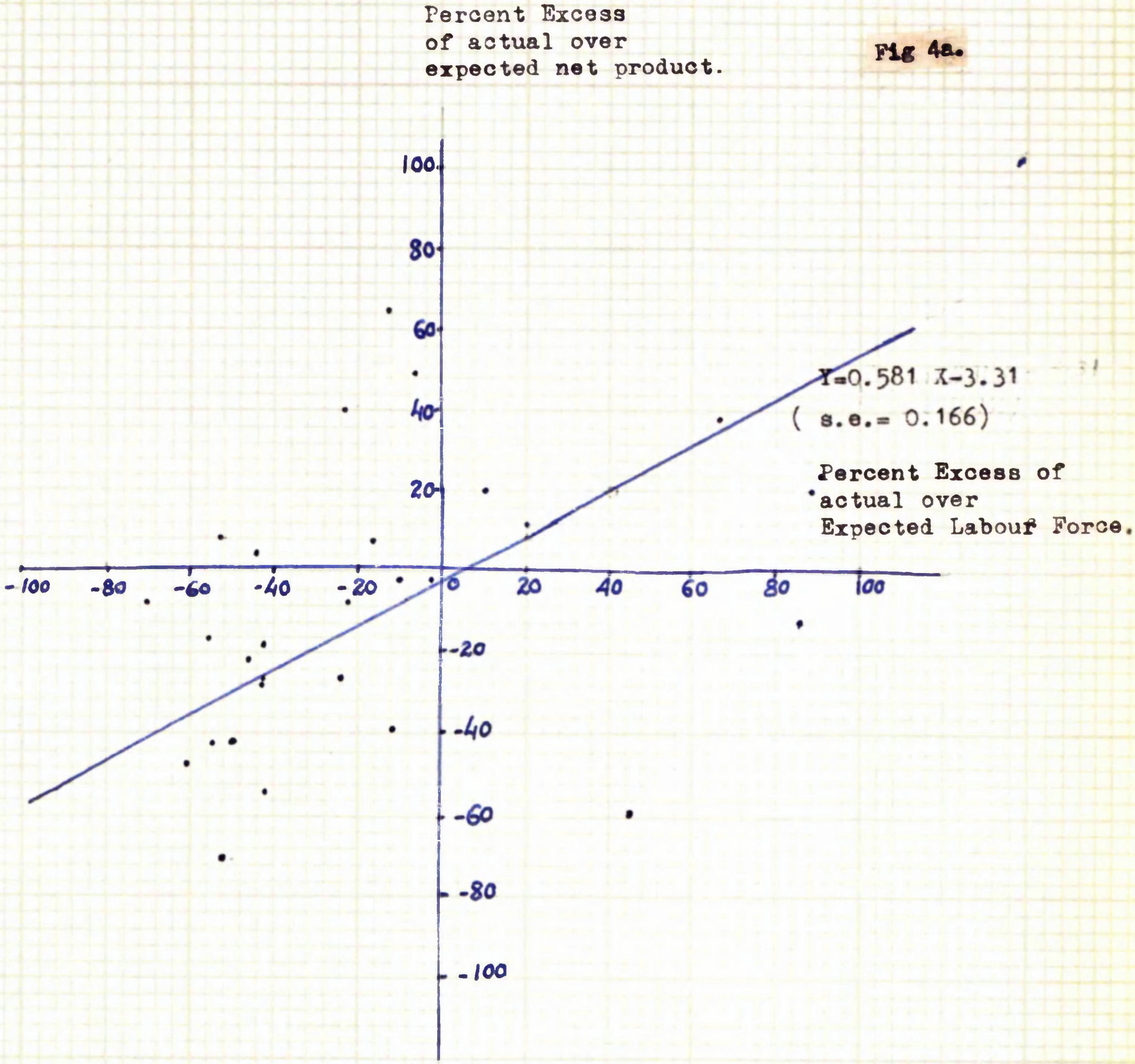
Since the percentage increase in capital in most industries was very great , the capital elasticity of output for most of the years has remained quite high.

The fluctuation in the values of k and j could also be explained due to the lack of any stable economy in Indian manufacturing. We have already seen, while utilising just the summary figures for 14 industries in the United Kingdom, that the estimates of k and j remained nearly the same for the years 1948 and 1949 and that they were associated with very small standard errors. Our studies therefore suggest that Indian manufacturing industries have not yet reached a stage where we could freely adopt a production function and make estimates or targets of our output.

Table (   )

India 1950

Industries.	Percent Excess of actual over expected net product.	Percent Excess of actual over expected Labour force.
1. Wheat flour	-41.9	-54.9
2. Rice milling	-59.3	+45.3
3. Biscuit making	+64.9	-13.3
4. Fruit &Veg.processing	-22.3	-46.1
5. Sugar	-0.1	-10.0
6. Distilleries & Breweries	-41.8	-45.6
7. Starch	-38.8	-12.3
8. Vegetable Oils	-69.8	-52.8
9. Paints & Varnishes	+ 8.3	-55.4
10. Soap	-7.7	-71.7
11. Tanning	-5.9	-8.4
12. Cement	-16.3	-55.9
13. Glass & Glass-Ware	-12.3	+85.8
14. Ceramics	+24.1	+89.2
15. Plywood & Tea Chests	-27.2	-24.2
16. Paper & Paper Board	-27.7	-43.2
17. Matches	+213.7	+121.5
18. Cotton Textiles	+11.3	+19.7
19. Woolen Textiles	+49.4	-6.0
20. Jute Textiles	+ 38.3	+66.6
21. Chemicals	-17.2	-42.8
22. Al,cu & Brass	-26.8	-42.7
23. Iron & steel	+5.5	-44.2
24. Bicycles	+41.9	-23.3
25. Sewing machines	+7.6	-16.5
26. Electric Lamps	-46.9	-61.4
27. Electric Fans	-7.1	-21.6
28. Gen Eng.& Elect Eng.	-2.2	+2.1


Percent Excess
of actual over
expected net product.
Fig 4a.
Y=0.581 X-3.31
(s.e.= 0.166)
Percent Excess of
actual over
Expected Labour Force.
100
80
60
40
20
-20
-40
-60
-80
-100
- 100
-80
-60
-40
- 20
0
20
40
60
80
100

CHAPTER III

A STUDY OF TRENDS IN EMPLOYMENT IN RELATION TO THE VOLUME OF PRODUCTION

In 1946, the number of persons earning livelihood in the 29 manufacturing industries covered by the Census of Manufactures in India was 1,514,382. Of these, about 1.4 million were wage-earners, and the remainder were salary earners and other workers. By 1951, the number of persons engaged in manufacturing industry had grown to 1,682,700, i.e. by 11.1 per cent. However, it will be seen that there has not been a steady increase in this number engaged in industry during the intervening years.

TABLE 3.1

Year	No. of persons employed
1946	1,514,382
1947	1,632,516
1948	1,704,230
1949	1,685,186
1950	1,632,483
1951	1,682,700

In the year 1948, a prosperous year, the number of persons employed in manufacturing reached a peak value of 1.7 million. After that till 1950, there was a decline in employment and in 1951, there was a slight increase.

Within /

Within manufacturing itself there were some noteworthy changes in the composition of employment. Wage-earners, whose numbers rose by (6.5) per cent between 1946 and 1951, lost some ground to salaried and other workers whose jobs increased by (21.1) per cent. The relative rapid growth of salaried workers reflects the growing importance of supervisory, technical and clerical functions in the manufacturing process.

TABLE 3.2

Year	Persons other than wage-earners as percentage of wage-earners
1946	9.2
1947	9.8
1948	10.3
1949	10.7
1950	11.2

TABLE 3·3

Year	Number of Wage-earners	Workers other than wage-earners
1946	1,387,010	127,372
1947	1,486,592	145,924
1948	1,545,655	158,575
1949	1,522,246	162,940
1950	1,468,334	164,149
1951	1,478,473	154,227

Output in relation to Employment

We now trace the growth of product turned out by the factory employees during the period 1946 to 1951. Between these years, production rose by 17.2 per cent; the number employed as we have already seen only increased by 11.1 per cent. The increase in production has been more steady during this period (~~Chart~~ Fig 6) pp90. However, like the volume of employment, the course of output fell during the years 1949 and 1950 and again it exhibited an upward trend from the year 1951. Between 1949 and 1950, it will be seen that the drop in output has been less severe than the drop in employment.

Owing to relatively slow increase in employment as compared /

compared to increase in output during the period 1946-51, there has been a steady decline in the general index of employment per unit of product. This ratio between employment and output fell from a value of 111 per cent in 1947 to 94.7 per cent in 1951 (base 1946 = 100). For the year, 1949, the index of employment per unit of product was observed to be slightly higher than that of the previous year. The Census of Manufactures provides data for the man-hours worked by the wage-earners for individual industries under consideration. Like the employment output ratio, the ratio of man-hours to output also declined smoothly during the period 1946-51. (Table 3.7).

Significance of decline in unit labour requirements

The reduction of labour per unit of product, measured in man-hours as well as men employed reflects some change in the process of manufacture, conditions of work or material means of production. Since we do not possess adequate data for a long period, we can hardly make any statement conclusively. The steady progress of the country towards industrialization may have been one of the many reasons for the drop in labour requirements per unit of product.

A part of the changes might be attributed to the increase in capital investment. The net book value of capital investment /

investment (fixed + working capital) used in manufacturing rose from Rs 3,668 million to Rs 7,130 million. The Capital assets per worker thus increased from Rs 2422 to over Rs 4237. Price increases might have accounted for a part of this rise but even after allowing for this, we would notice considerable rise in the net value of capital investment per worker. Not much can be said, however, regarding the increased efficiency of labour. Many of the changes may have been due to improvement in the quality of machinery and equipment.

There are a variety of influences thus affecting the ratio of labour to output which are beyond direct measurement. This ratio is perhaps a readily computed simple index for all the changes. It is not alone a measure of change in efficiency of labour, nor of any single factor of production. It gives the sum total of all the influences that have been affecting the change in production.

Trends among major industries

We now proceed to study the changes in some of the major industrial groups. Cotton Textiles which accounted for about 43% of the employed population in manufacturing in 1946, only shared 39% of the total employees in 1951. In jute Textiles too the corresponding percentage of employees fell from 21.1 to 17.1. This has been presumably due to wider scope of /

of employment in other profitable industries like chemicals, General Engineering and Electrical Engineering.

TABLE 3.4

Industries	1946		1951	
	Per cent employed	Per cent value added	Per cent employed	Per cent value added
Rice milling	3.3	0.7	2.6	0.5
Sugar	6.2	3.7	7.1	6.6
Vegetable Oils	2.4	3.5	3.3	1.5
Cotton Textiles	42.9	46.0	39.2	41.4
Jute Textiles	21.1	17.5	17.1	15.4
Chemicals	1.7	3.3	2.2	4.2
Iron and Steel	4.8	7.6	4.7	7.6
General Eng. and Electrical Eng.	7.4	5.3	9.1	8.4

When measured in terms of value added by manufacture, the Textile Industries too lead the classification. The percentage share of the total value added in the Cotton Textiles in 1946 was 46.0 whereas it dropped to 41.4 in 1951. In Jute Textiles too the corresponding percentage fell from 17.5 per cent to 15.4 per cent.

In /

In terms of value added, the Iron and Steel industry has a significantly higher relative contribution than in the case of employment.

<u>Trends in Employment per unit of Product</u>

From 1947 onward, the number of workers employed in making a unit of product declined in many of the industries for which we have information (Fig 11 ɪ). Fig 11

The change in employment per unit between 1947 and 1951 range over a wide scale. In the sewing machines' industry, the index of employment per unit of product fell from a value of 243.5 in 1947 to only 48.7 in 1951. In chemicals, the corresponding index showed a significant decline from 124.7 to 57.4. In Paints and Varnishes, on the other hand, the index seems to rise steadily from a value of 110.8 in 1947 to 152.0 in 1951.

TABLE 3·5

INDEX OF INDUSTRIAL PRODUCTION
(BASE 1946 = 100)

	YEARS							
	1947	1948	1949	1950	1951	1952	1953	1954
General Index	97.2	108.4	105.7	105.0	117.2	128.9	135.3	146.6
Sugar	97.6	116.5	108.5	105.8	120.8	161.9	139.9	109.2
Paints and Varnishes	100.5	93.0	80.5	72.8	87.2	83.8	83.5	95.9
Cement	93.9	100.7	136.3	169.5	207.2	229.3	245.1	285.1
Glass	65.5	71.6	39.5	109.5	126.9	103.5	260.8	379.1
Plywood and Teachests	58.3	91.4	81.0	85.4	120.5	154.0	104.1	132.3
Paper and Paperboard	87.8	92.4	97.4	102.7	124.4	129.7	131.8	146.5
Matches	113.0	129.4	127.8	127.0	140.3	150.1	150.0	128.4
Cotton Textiles	95.8	109.0	99.7	91.1	101.3	113.8	119.9	123.3
Woollen Textiles	88.9	74.1	77.6	66.9	65.5	61.4	71.3	74.3
Jute Textiles	96.6	100.2	84.8	76.8	80.4	87.4	79.8	85.2
Chemicals	102.7	158.5	194.3	229.0	260.2	368.8	517.7	622.4
Al., Cu (Non-ferrous Metals)	95.7	96.5	103.4	106.9	114.4	100.9	90.5	125.8
Steel (Ingots and Metals for Casting)	97.1	97.1	104.6	111.2	116.0	122.0	116.5	130.2
Bicycles	74.1	129.0	149.9	240.0	265.9	458.2	614.6	866.3
Sewing Mchines	95.7	327.1	408.9	504.7	726.4	817.6	1019.8	1310.2
Electric lamps	93.9	113.9	168.1	176.3	191.3	257.3	243.6	284.4
Electric fans	144.9	163.0	162.1	175.4	192.5	177.1	180.9	216.4
General Eng. & Electrical Eng.	95.2	136.5	167.2	203.1	265.7	233.0	258.7	319.3

TABLE 3.6

INDEX OF EMPLOYMENT IN MANUFACTURING
(BASE 1946 = 100)

	1947	1948	1949	1950	1951	1952
General Index	107.8	112.5	111.2	107.7	107.8	108.8
Sugar	103.4	109.7	119.8	134.1	127.9	133.6
Paints and Varnishes	114.4	120.2	125.4	121.8	132.6	127.1
Cement	135.9	133.1	161.4	162.2	211.3	178.0
Glass	113.4	118.3	109.7	112.2	112.1	117.7
Plywood and Teachests	113.8	119.7	120.7	125.4	157.6	168.9
Paper and Paperboard	103.4	94.8	95.5	103.5	100.6	92.5
Matches	117.1	131.3	132.9	123.6	117.4	125.4
Cotton Textiles	107.3	110.3	107.3	99.1	101.5	105.1
Woollen Textiles	100.3	97.4	99.3	92.4	85.8	94.3
Jute Textiles	102.6	105.0	100.8	95.6	89.8	91.1
Chemicals	128.1	129.5	123.0	137.3	149.5	164.6
Iron and Steel	104.4	102.9	106.5	105.6	109.1	
Bicycles	107.8	129.1	138.2	166.2	194.7	254.8
Sewing Machines	233.1	252.7	269.1	291.3	353.9	352.3
Electric lamps	139.4	165.3	187.0	197.7	211.3	248.5
Electric fans	117.7	125.7	111.2	111.2	103.1	95.1
General Eng. and Elect. Engineering	108.8	124.6	124.5	129.2	136.4	127.9

TABLE 3·7

INDEX OF EMPLOYMENT PER UNIT OF PRODUCT
(1946 = 100)

		1947	1948	1949	1950	1951	1952
General Index		110.9	103.7	105.2	102.5	91.9	84.4
	m.h.	(107.3)	(100.0)	(98.2)	(90.2)	(85.9)	
Sugar		105.9	94.1	110.4	126.7	105.8	82.5
Paints and Varnishes		110.8	129.2	155.7	167.3	152.0	151.6
	m.h.	(106.1)	(122.4)	(145.5)	(162.7)		
Cement		144.7	132.1	118.4	95.6	101.9	77.6
Plywood & Teachests		195.1	130.9	149.0	146.8	130.7	109.6
Paper and Paperboard		117.7	102.5	98.0	100.7	80.8	71.3
Matches		103.6	101.4	103.9	97.3	83.6	83.5
Cotton Textiles		112.0	101.1	107.6	108.7	100.1	92.3
	m.h.	(108.0)	(96.6)	(102.1)	(97.2)		
Woollen Textiles		112.8	131.4	127.6	138.1	130.9	153.5
Jute Textiles		106.2	104.7	118.8	124.4	111.6	104.2
Chemicals		124.7	81.7	63.3	59.9	57.4	42.3
Bicycles		145.4	100.0	92.1	69.2	73.2	55.6
Sewing Machines		243.5	77.2	65.8	57.7	48.7	43.1
Electric lamps		148.4	145.1	111.2	112.1	110.4	96.5
Electric fans		81.2	77.1	68.5	63.3	53.5	53.4
General Eng. & Elect. Eng.		114.2	91.2	74.4	63.6	51.3	54.8

Figures in parenthesis denote index of man-hour per unit of product.

Inter-relation between output and Employment

In many Industries as will be seen in Chart (//), employment declined in relation to output, but the kind of divergence between output and employment varied from industry to industry. By examining the separate series on employment and output (Tables 3•5 and 3•6) we can determine some of the relationships between these quantities. There is clear evidence that, in industries with sharply rising output, the number of employees usually went up with rapid pace. The greatest increases in both employment and production came in the Bicycles and Sewing Machine industries. A relatively slow growth in output was accompanied by lagging increase in employment. The outstanding exception to the general correlation is the industry of Paints and Varnishes which attained a substantial increase in employment (index 111.4 in 1947 to 132.6 in 1951) while reducing its output (index 100.5 in 1947 to 87.2 in 1951).

The series of index on employment per unit of product, when set beside those for output and number of workers, reveals some noteworthy features among major industrial groups. This new series is quite meaningful for an interpretation of industrial development. The bicycle and sewing machine industries which are outstanding for their increases in both output and employment are characterised by an unusually sharp reduction in employment per unit. The same trend is also noticeable in chemical industries. /

1951

Relation between log Index of Employment (N) and log Index of Physical Ouput (Q)

(1946 = 100)

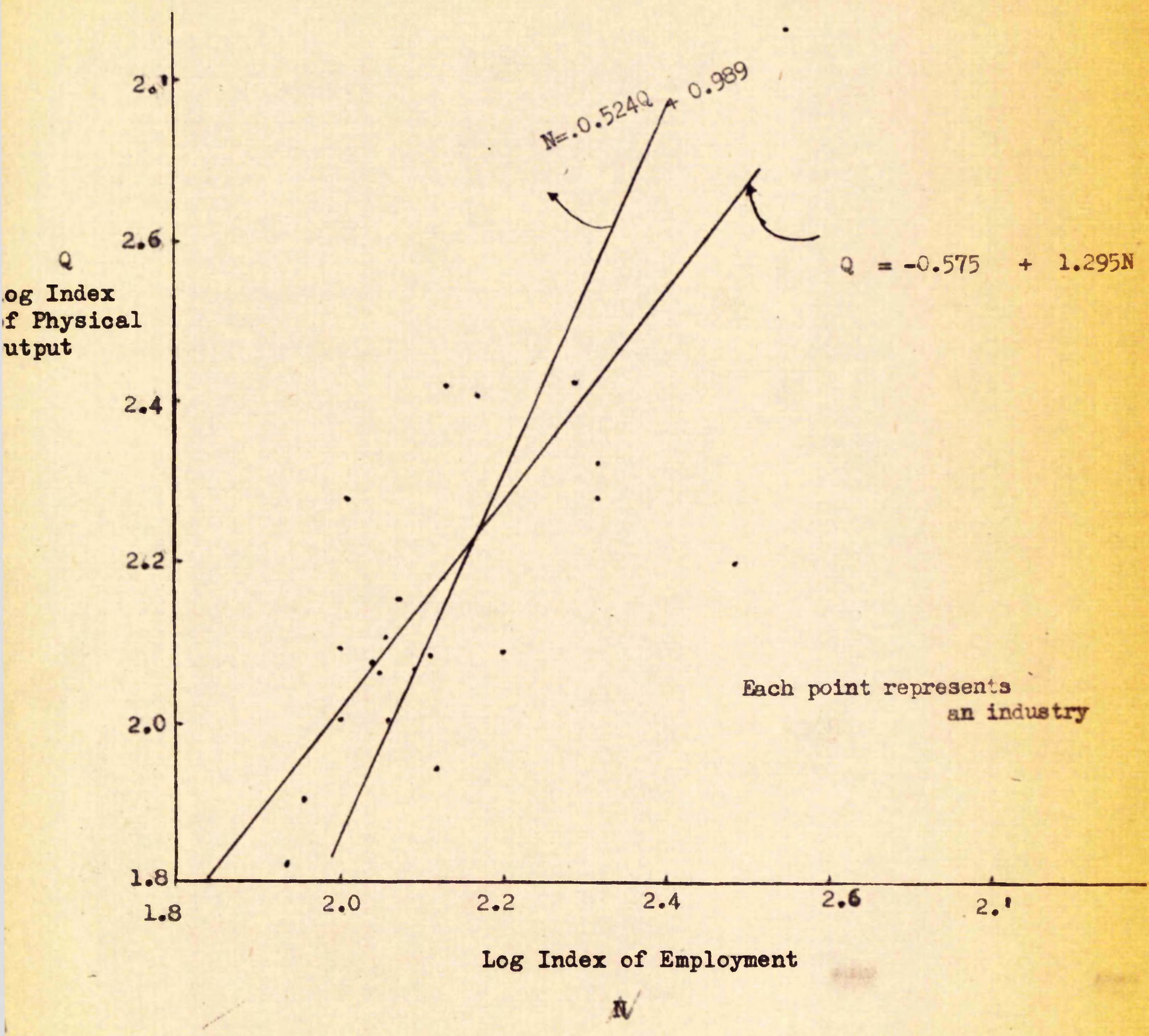


Fig 5,

industries. In Paints and Varnishes on the other hand, the output of which has been falling steadily between these years in spite of growth in employment, the series on Employment per unit indicate a rising trend. Considering the index of man-hours worked by wage-earners per unit of product, we also find a similar trend as in the case of employment per unit. The general index of man-hours per unit of product declines from a value of 107.3 in 1947 to 85.9 in 1951.

Employment, Output and related quantities

While changes in Output and Employment during the period 1946-51 remained fairly related, increases in output tended to be greater than the corresponding rise in employment. Chart (5) gives the relation between the logarithms of indexes of employment and physical output for the year 1951. The findings suggest that the difference between growth in output and growth in employment was usually wider among rapidly growing industries than among the slow-growing ones. This is shown by the fact that the slope of the regression line fitted to the points in Chart (5) is greater than 45 degrees. The difference between rate of growth in output and employment is measured also by the decline of workers per unit. The decline was greatest in the sewing machine industry which is to be credited also with relatively large expansions in output and employment.

The /

The co-efficient of rank correlation between index of employment and of employment per unit of product is -0.29; and between index of output and of employment per unit of product is -0.81 (1951). The former co-efficient is so low that it does not differ significantly from zero.

The relations found above may be checked by fitting regression lines to the logarithms of Indexes of employment and production (Chart 5).

The line obtained was

$$\log Q = 0.575 + 1.295 \log N - - - -$$

where Q = index of output for the year 1951

N = index of Employment for the year 1951.

The above equation may be transformed into

$$\log \frac{N}{Q} = 0.575 - 0.295 N$$

and $$\log \frac{N}{Q} = K(\text{const}) - 0.23 Q$$

According to these results, the relation between $\frac{N}{Q}$ and N is ~~inverse~~ negative, as is also the relation between $\frac{N}{Q}$ and Q. This confirms the sign of correlation obtained before.

Capital Assets

The inter-relations among trends in employment, in output and in labour per unit of manufactured goods, bring into question /

GENERAL INDEX

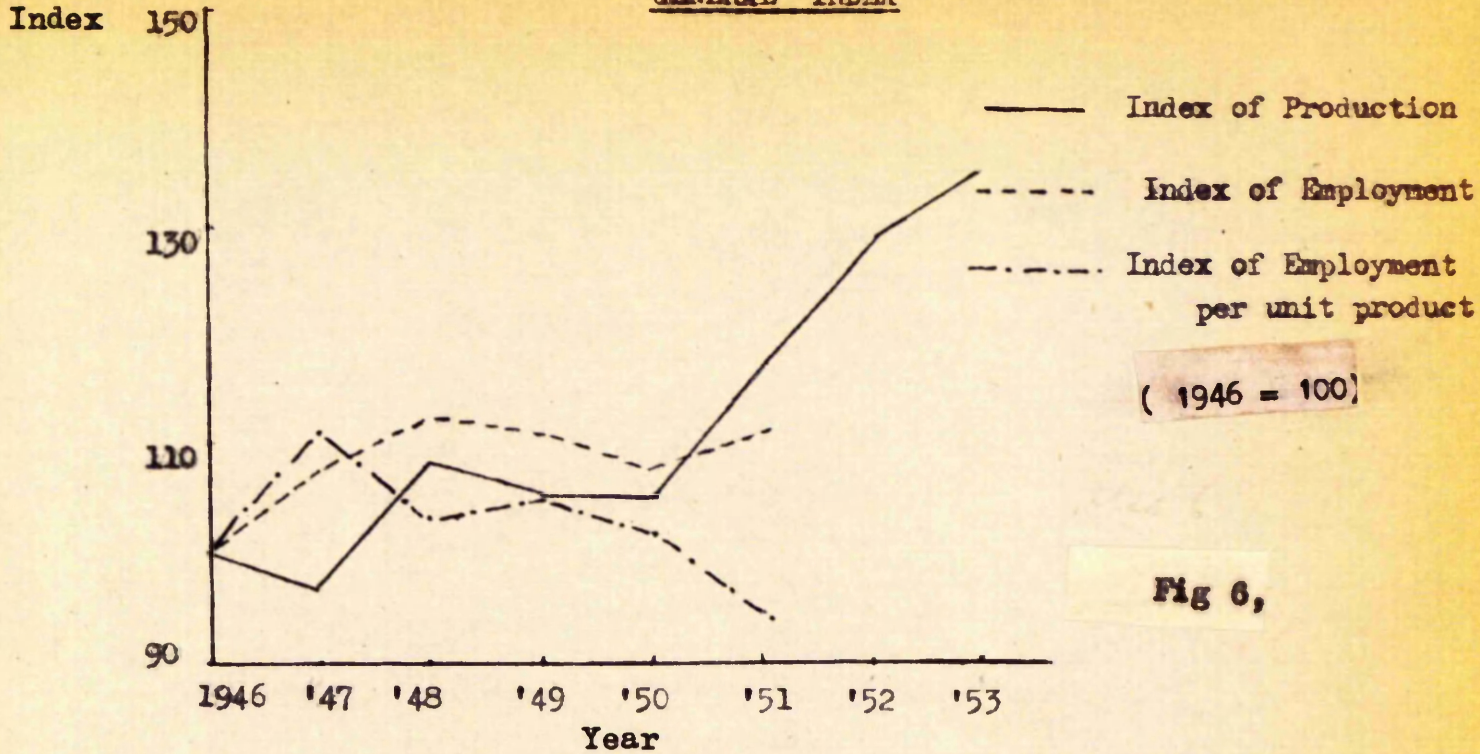


Fig 6,

SUGAR

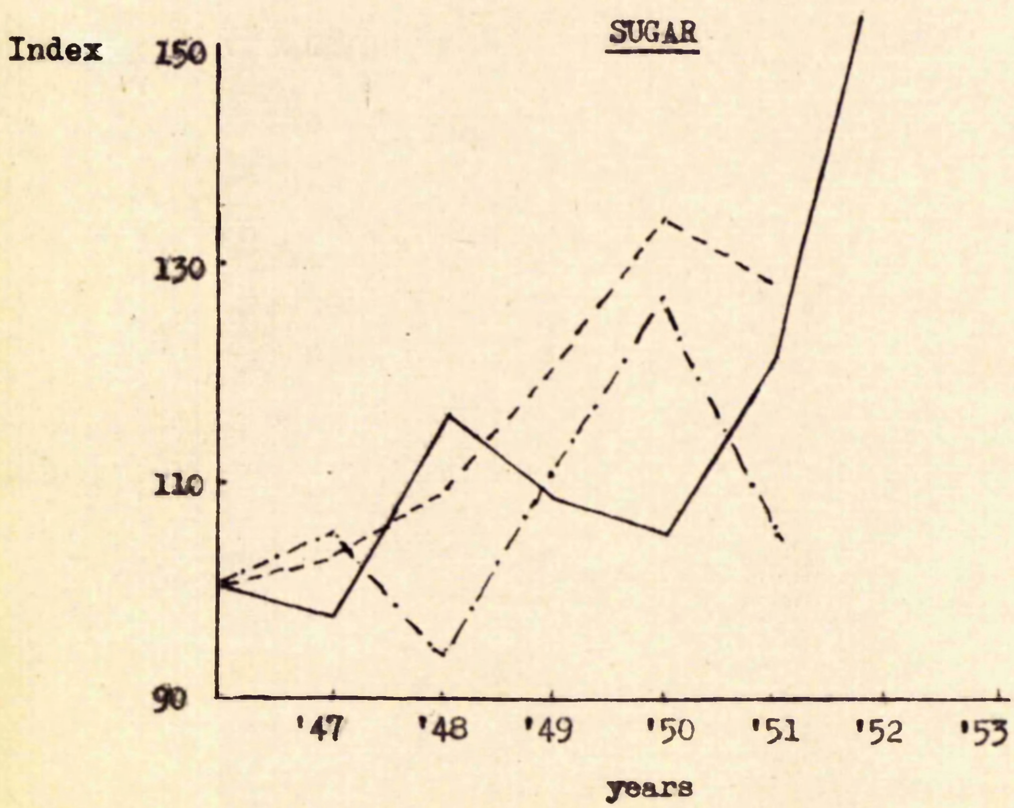


Fig 7,

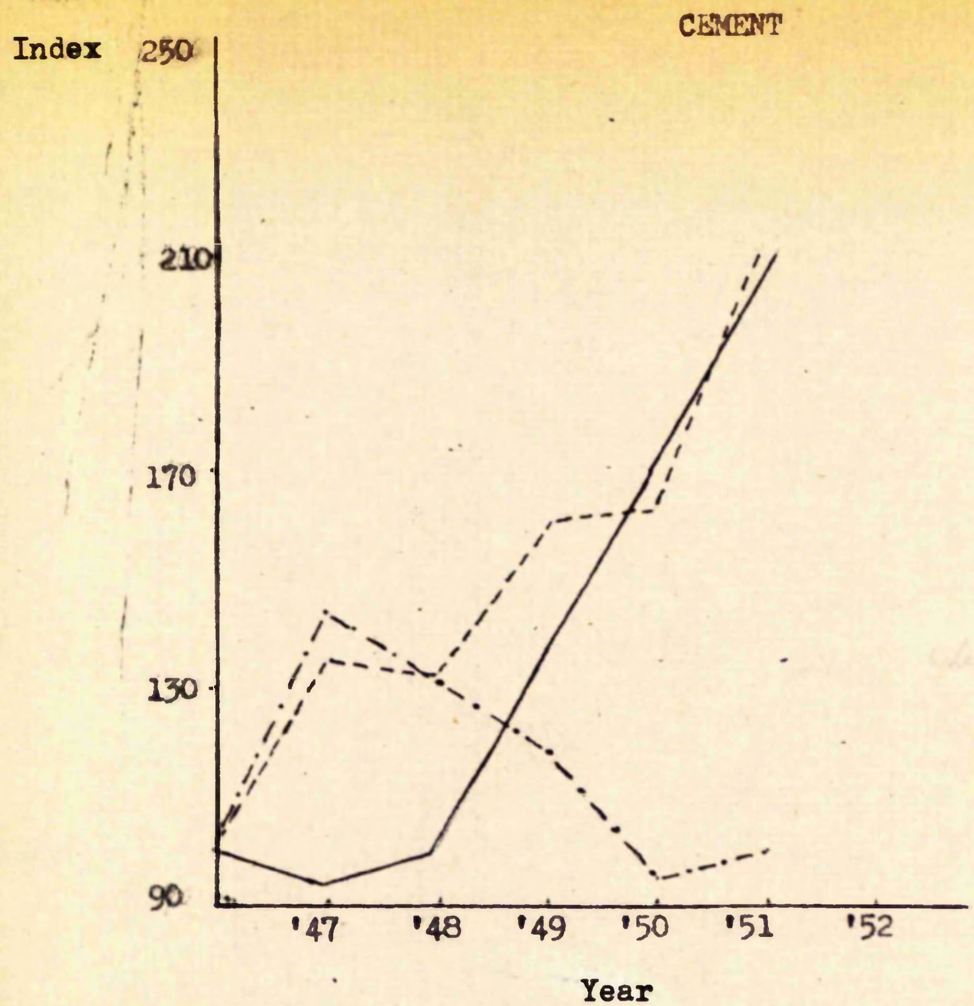

CEMENT
Index
250
210
170
130
90
'47
'48
'49
'50
'51
'52
Year
Index of Production
Index of Employment
Index of Employment per unit product
(1946 = 100)

Fig 8,

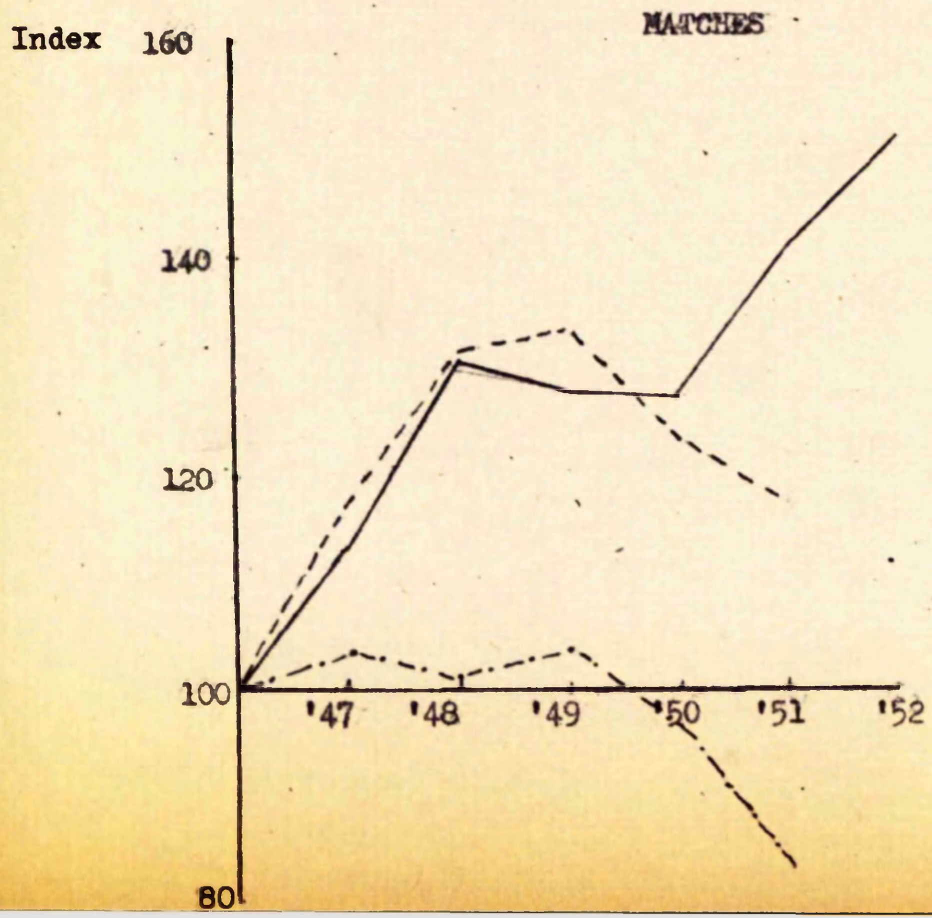

MATCHES
Index
160
140
120
100
80
'47
'48
'49
'50
'51
'52

Fig 9,

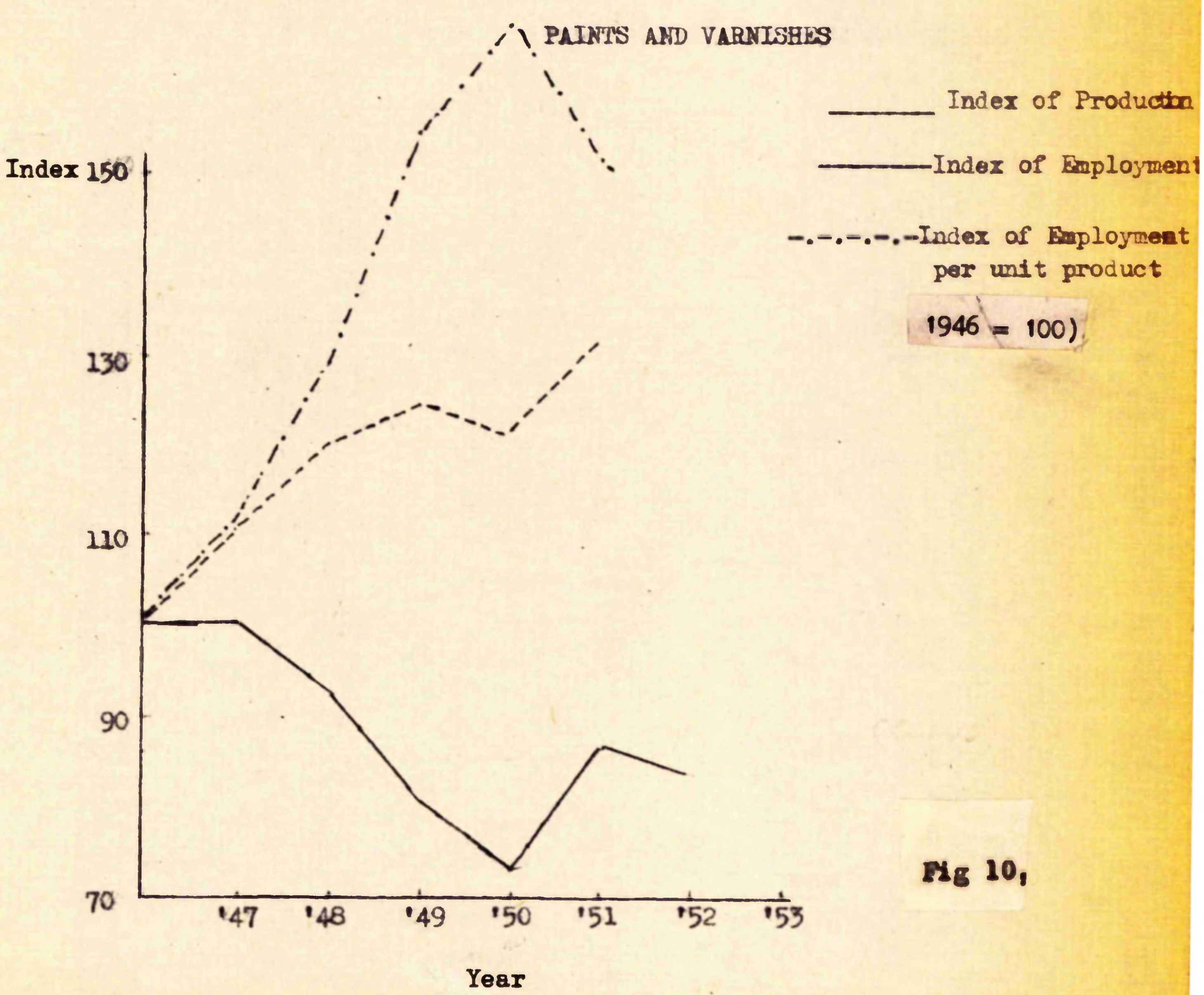

PAINTS AND VARNISHES
Index of Productin
Index of Employment
-.-.-.-.-Index of Employment per unit product
1946 = 100)
Index 150
130
110
90
70
'47
'48
'49
'50
'51
'52
'53
Year

Fig 10,

Index of employment per unit product

, (1946=100)

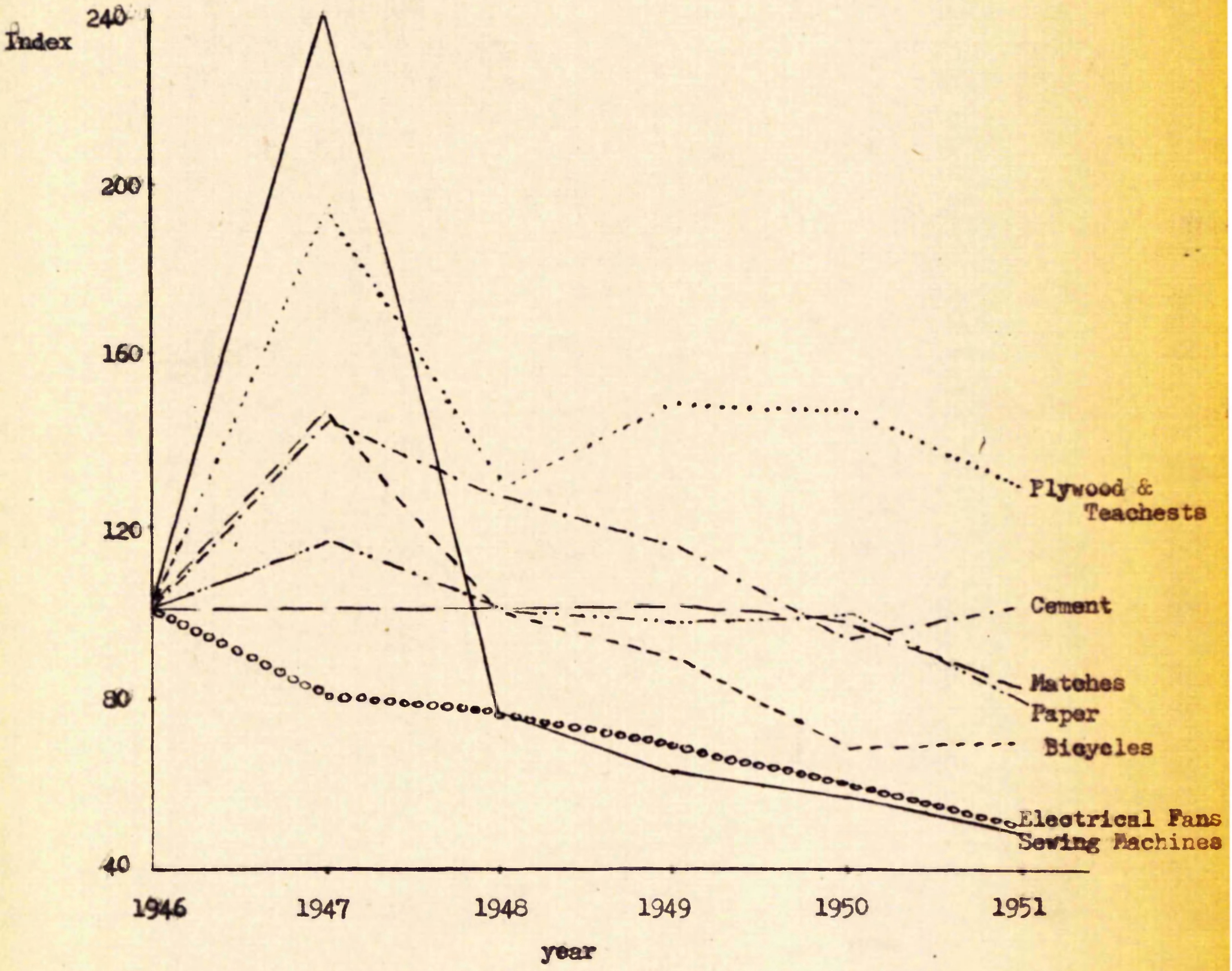


Fig 11

question the role played by capital investment and other factors of production.

A swelling stock of capital goods is one of the means by which the level of output is raised. Table (3·8) provides the Indexes of Employment, Production and Capital (without correction for price changes) for the year 1950.

TABLE 3·8

1950

	Index of Employment	Index of Production	Index of Capital (uncorrected for price changes)
Sugar	134.1	105.8	168.9
Paints and Varnishes	121.8	72.8	386.2
Cement	162.2	169.5	291.7
Plywood & Teachests	125.4	85.4	174.3
Paper & Paperboard	103.5	102.7	274.3
Matches	123.6	127.0	182.8
Cotton Textiles	99.1	91.1	155.3
Woollen Textiles	92.4	66.9	156.5
Jute Textiles	95.6	76.8	138.1
Chemicals	137.3	229.0	212.8
Bicycles	166.2	240.0	322.4
Sewing Machines	291.3	504.7	284.1
Electric lamps	197.7	176.3	487.7
Electric fans	111.2	175.4	229.8
General Eng. and Elect. Eng.	129.2	203.1	230.4

It has already been mentioned before that employment rose in industries in which output also rose at high speed. If larger /

larger increases in output have been associated with a rising volume of capital equipment, as is likely, then the growth of capital has coincided with the growth in employment. The capital data (given in Table 3·8) are uncorrected for price changes. Yet, certain conclusions are obvious. The largest increases in employment over the period under consideration occurred in industries in which capital investment also rose most rapidly. Sewing Machines, Bicycles and General Engineering and Electrical Engineering stand out in this respect. Exceptions exist of course in Textile Industries where, in spite of increase of Capital investment, employment has slightly decreased. Also, in the Paints and Varnishes Industry, the growth in employment has been negligible compared to the rise in investment. Yet, the co-efficient of correlation remains impressive - the rank correlation between index of employment and that of capital for the year 1950 being 0.65. The index of capital was also fairly correlated with the index of productions (rank correlations = 0.5)

We have seen that in the case of rapidly growing industries, there was better-than-average in employment and capital assets and impressive reductions of labour per unit. The industries that lagged pushing up output also fell behind in raising the number of workers and the stock of Capital. Now, we intend bringing in two more variables 'wage costs' and 'value added' per unit of product, and try to study if the ranks of /

Table (3.9)

Industries for the year 1950 (1946 = 100)

ranks

	Sugar	Paints & Varnishes	Cement	Plywood & teachests	Paper & paper bd.	Matches	Cotton textiles	Woollen textiles	Jute textiles	Chemicals	Bicycles	Sewing Machine	Elect. Lamps	Elect. Fans.	Gen. & Elect. Engs.
(1) Increase in Production	9	14	7	12	10	8	11	15	13	3	2	1	5	6	4
(2) Increase in Capital (book value)	12	2	4	11	6	10	14	13	15	9	3	5	1	8	7
(3) Increase in Employment	6	10	4	8	12	9	13	15	14	5	3	1	2	11	7
(4) Decline in Employment per unit of product	12	15	6	14	8	7	9	13	11	2	5	1	10	3	4
(5) Value added per unit of product (ranked average order)	14	7	11	12	10	4	2	5	1	3	6	13	15	8	9
(6) Wage per unit of product (ranked average order)	4	14	9	3	12	15	11	2	7	13	1	10	8	5	6
TOTAL	57	62	41	60	58	53	60	63	61	35	20	31	41	41	37
MEAN	9.50	10.33	6.83	10.0	9.66	8.83	10.00	10.50	10.16	5.83	3.33	5.16	6.83	6.83	6.16
deviation	1.50	2.33	-1.17	+2.00	1.66	0.83	2.00	2.50	2.16	-2.17	-4.67	-2.84	-1.17	-1.17	-1.84
			Sum of squared deviation = 72.1147												
Total of first four rows only	39	41	21	45	36	34	47	56	53	19	13	8	18	28	22
mean	9.75	10.25	5.25	11.25	9.00	8.50	11.75	14.00	13.25	4.75	3.25	2.00	4.50	7.00	5.50
Deviation	1.75	2.25	-2.75	3.25	1.00	0.50	3.75	6.00	5.25	-3.25	-4.75	-6.00	-3.50	-1.00	-2.50

$$\chi_r^2 = \frac{p-1}{p\sigma^2} \sum_{j=1}^{p} (\bar{r}_j - \rho)^2$$

$$= \frac{12n}{p(p+1)} \sum_{j=1}^{p} \left\{ \bar{r}_j - \tfrac{1}{2}(p+1) \right\}^2$$

Coeff of concordance, $\eta_r^2 = \dfrac{\chi_r^2}{n(p-1)}$

p = number of ranks

$\bar{r}_j$ = mean rank of the j^{th} column

n = number of variables.

of these new items are in any way correlated with the ranks of the indices of labour, capital and output that we have discussed before.

The ranks of these items are tabulated in Table (3·9) Milton Friedman's 'Method of ranks' (J.A.S.A. Dec. 1937, Pp. 675-701) was applied to these items to test whether the average ranks differed significantly from each other. Considering all the items, the value of χ_r^2 was found to be 21.633 and the corresponding coefficient of concordance η_r^2 was 0.2570. In other words, when all the variable in Table (3·9) are taken into consideration, the Friedman's test reveals that the average ranks are not significantly different from each other; the variation might have been just a matter of chance (χ_{14}^2 has a prob between .05 and .10). On the other hand, when we took into account the first four items alone the value of χ_r^2 was 38.75 and the coeff of concordance η_r^2 0.6919. This shows that the averages of ranks of each column, while considering only the four variables, i.e. the indexes of Production, Employment, Capital and Employment per unit of output, differ widely from each other indicating that the ranks were fairly consistent for each item. The coefficient of concordance is also significantly high. ~~Since~~ The value of this coefficient approaches unity when all ranks in each row become identicals and zero when they are entirely unrelated (See W. Allen Wallis J.A.S.A. /

J.A.S.A. Sept. 1939 pp. 533-38). Here the value of $\eta_r^2 = 0.6919$ clearly reveals a high degree of concordance among ranks of these four series. The coefficient approaches a still higher value ($\eta_r^2 = 0.7740$) when we just take into consideration the 1st, 3rd and the 4th series indicating that the ranks of the industries, according to the index of production, employment and employment per unit of product are nearly identical.

In the first case when the six series were together considered, the coeff of concordance (η_r^2) was slightly above .50. Therefore, it could not be said that there was no appreciable degree of concordance among the ranks of the six series.

Measurement of changes in efficiency

Efficiency is usually defined as,

$$\frac{\text{Output}}{\text{Input of labour} + \text{Input of other resources}}$$

where so far as manufacturing is concerned, we shall call these other resources 'Capital'.

We are interested in changes in efficiency, not in its absolute magnitude. We can measure changes in efficiency if, in addition to the indexes of output and employment we already possess, we can somehow find (1) ratio of quantity of capital resources in one period to the quantity in another period, /

period, and (2) the ratio of the quantity of labour services to that of Capital services in either period.

The ratio of efficiency in period (2) to efficiency in period (1) is given by

$$\frac{Q_2}{Q_1} \times \frac{C_1 + L_1}{C_2 + L_2}$$ where Q, L, C represent quantities of output, capital and labour respectively.

This ratio can be written as

$$\frac{Q_2}{Q_1} \times \frac{\frac{C_1}{C_2} \frac{C_2}{L_2} + \frac{L_1}{L_2}}{\frac{C_2}{L_2} + 1}$$

$$= \frac{1}{\frac{C_2}{L_2} + 1} \left[\frac{Q_2}{Q_1} \frac{C_1}{C_2} \frac{C_2}{L_2} + \frac{Q_2}{Q_1} \frac{L_1}{L_2} \right]$$

The terms within parenthesis [ ] are the ratio of output per unit of Capital in period 2 to that in period 1 and the ratio of output per worker in period 2 to that in period 1. The weights are $\frac{C_2}{L_2}$ and 1.

The changes in output per worker and output per unit of capital are given in Table (3.10). We however encounter some difficulty in seeking the ratio between labour and /

and Capital services. G.J. Stigler in his 'Trends in Output and Employment' considers the ratio of payroll to other value added as an estimate of the ratio of labour to Capital. He suggests that, if MP_l and MP_c are the marginal products of labour and Capital respectively, and p_l and p_c are their prices

$$\frac{MP_l}{p_l} = \frac{MP_c}{p_c}$$

and if L and C are quantities of Labour and Capital respectively, the ratio of L to C in physical (product) terms is

$$\frac{LMP_l}{CMP_c} = \frac{Lp_l}{Cp_c}$$

We have used the similar method in estimating the ratio of labour to Capital by the ratio

$$\frac{\text{Wages}}{\text{Value added} - \text{Wages}}$$

Indexes of efficiency calculated for the years 1950 and 1951 are given in Table (3·10).

TABLE 3·10

	Index of output per worker		Index of output per unit of Capital		Ratio of capital to wages (labour services)		Index of efficiency	
	1950	1951	1950	1951	1950	1951	1950	1951
General	97.4	111.4	62.7	60.3	0.64	0.83	83.8	88.2
Sugar	78.8	94.4	62.6	51.9	1.95	1.43	68.0	69.3
Paints & Varnishes	59.7	65.7	18.8	27.6	1.95	2.15	32.6	39.6
Cement	104.5	98.0	58.1	48.1	2.00	1.91	73.5	65.2
Paper & Paperboard	99.2	123.6	37.4	39.1	1.00	1.47	68.3	73.3
Matches	102.7	119.5	69.4	52.6	0.89	0.55	87.0	95.7
Cotton Textiles	91.9	99.8	58.6	56.9	0.35	0.66	83.2	82.7
Woollen "	72.4	76.3	42.7	26.9	1.46	1.15	54.7	49.8
Jute Textiles	80.3	89.5	55.6	51.7	0.69	1.05	70.2	70.1
Chemicals	166.7	174.0	107.6	103.2	1.21	1.83	134.3	128.2
Bicycles	144.4	136.5	74.4	66.8	1.22	0.97	105.9	102.2
Sewing Machines	173.2	205.2	177.6	206.5	0.26	0.45	174.1	205.6
Elect. lamps	89.1	90.5	36.1	34.6	0.84	0.74	64.9	66.7
Elect. fans	157.7	186.7	76.3	109.7	0.93	0.66	118.4	156.0
General Eng. & Elect. Eng.	157.1	194.7	88.1	93.6	0.45	0.56	135.6	158.4
Plywood & Teachests	68.1	76.4	48.9	75.3	1.01	1.45	58.4	75.7

Comparing the years 1950 and 1951, we notice that the index of efficiency has gone up in most industries. With the exception of Cement and Textile Industries for which efficiency for the year 1951 has slightly decreased, all other industries show a fair rise in efficiency.

CHAPTER IV

'A STUDY OF THE RELATIONSHIP BETWEEN THE PRIMARY, SECONDARY AND TERTIARY EMPLOYED POPULATIONS OF INDIA'

The occupations in a country or her regions are interdependent in one way or another and we cannot do justice to one without considering its effect on other work-groups. A farmer for example looks after his own farm but to do so he needs the services of many other kinds of workers either for his vocational pursuit or for his personal needs. Each work-group, no doubt, makes its own unique contribution, but it cannot be considered independent of other groups of occupations in an analysis of economic activities. Very often we are confronted with the problem as to what the proportion of workers in various occupational groups should ideally be. This is indeed difficult to decide. Each part of a country must have persons to meet the needs of agricultural, industrial, commercial and other establishments present and also to man the Governmental structure. Thus, how the workers are distributed is a question of great significance.

There are certain groups of economic activities that are primarily for production purposes. They are agriculture, manufacturing, etc. The population employed in these activities are grouped in both primary and secondary categories.[x] They meet /

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x Colin Clark 'The Economics of 1960', pp. 22.
Primary industry includes agricultural, pastoral, forestry, fishing and hunting industries. Secondary industry includes manufacture, electric power production, mining, building, and construction. Tertiary industry is defined by difference as all other economic activities.

meet the basic need of the country and form a major contribution to the national income. Trade, Transport, Public Administration and other services are subsequently developed mainly for the use of those primary and secondary workers. The population employed in these activities are called 'tertiary' population. They, in other words, help to keep the machinery of production going. There should exist, however, a certain fixed ratio of this tertiary population to the population employed in both primary and secondary activities. Corresponding to a given number of agricultural farmers and a given number of persons employed in manufacturing, it is quite likely to expect a fixed number of commercial population who in effect, would subscribe to the trading of both the farm products as well as the products in manufacturing. Subsequently too, the population engaged in Transport, Public Administration and other services will develop and bear some fixed relationship with the primary and secondary activities.

Keeping this in view, it is the purpose of the present investigation to study the relationship between the Primary and Secondary employment on one hand and the 'tertiary' on the other.

At the 1951 Census for India, the people were divided into two broad livelihood categories, viz. agricultural classes and the non-agricultural classes. The non-agricultural classes comprised of all persons (including dependents) who derived

their /

their principal means of livelihood from (i) Production (other than cultivation) (ii) Commerce, (iii) Transport, (iv) other services and miscellaneous sources.

The population was again divided into economically active, semi-active and passive groups. All non-earning dependents were called economically passive. They included persons performing housework or other domestic or personal services for other members of the same family household. All earning dependents were economically semi-active only. Although they contributed to the carrying on of the economic activities, the magnitude of their individual contribution was considered too small to justify their description as economically active. All self-supporting persons were ordinarily economically active.

Let us now make it clear as to what we mean by the total working force of the country. Although the contribution of the earning dependents is quite less than that of the self-supporters, yet, while estimating the total working force, we have included both self-supporters and earning dependents, thus giving the latter equal Weightage as the self-supporting members. Later on, however, we shall attempt to assess the share of these earning dependents so far as their economic contribution is concerned. For the 1951 Census in India, it was proposed by the Census authorities to decide about the professions of /

of these earning dependents according to their secondary means of livelihood. Therefore, in our present investigation, we took care to reckon the number of earning dependents according to their secondary means of livelihood and not by their total number given along with the self-supporters and non-earning dependents in the first few pages (Table B 1) of the economic tables at the 1951 Census.

The first question that now needs an answer is, Are the ratios of the primary plus secondary to the tertiary population consistent between districts within a state? For this, at the outset, we combined the primary and secondary populations together and tested if this total bears any constant ratio to the employment in tertiary activities. We considered 26 districts from the State of Bombay for this purpose. The χ^2 test revealed that these ratios between districts were significantly different. This was the case mainly due to the over-abundance of the primary or agricultural population in most of the districts. However, on eliminating the primary category, it was observed that the ratio of the secondary to tertiary population remained fairly consistent. The value of X^2 for 26 districts that we have selected from the Bombay State was 25.44, (Table (4.4)), which was not significant statistically indicating that the ratios were reasonably consistent between districts. Except for a few relatively more urbanized districts like

Panch /

Panch Mahals and Poona which contributed to a major share of χ^2, most of the districts showed a high degree of correlations between secondary and tertiary employment.

United Kingdom data

We have also used the occupational data for 25 rural districts of the United Kingdom based on the 1931 Census. Here also, we attempted to examine if the ratios of the population engaged in Primary plus secondary activities bore a certain fixed ratio to the population engaged in tertiary activities. It was found that but for two or three districts, the ratios for the districts in general were not significantly different.

We now straightaway come to the next question, How does this tertiary population behave in relation to the employment in primary and secondary activities? In other words, corresponding to a given percentage increase in agricultural population, employment in production (other than agriculture) remaining constant, how much increase could we expect in the employment in the tertiary sector, or in particular, in Commerce, or Transport or Public Administration? Statistical multivariate analysis could possibly give an answer to this question. On utilising the method of least squares, we obtained the following set of equations for India and her States. Similar equations based on 26 rural districts of the United Kingdom and 20 predominantly /

predominantly agricultural regions of the United States of America have also been obtained.

Y = tertiary population (population engaged in Commerce, Transport, Public Administration and other services

X_1 = population employed in primary activities

X_2 = population employed in secondary activities (Mining, Construction and Manufacturing, etc.)

All India	1951.	$Y = 0.0712\ X_1 + 1.4092\ X_2$
	U.P.	$Y = 0.0367\ X_1 + 1.3430\ X_2$
	Bombay	$Y = 0.0990\ X_1 + 1.9060\ X_2$
	W. Bengal	$Y = 0.1060\ X_1 + 0.8520\ X_2$
U. K.		$Y = 0.7541\ X_1 + 0.7405\ X_2$
U.S.A.		$Y = 0.7110\ X_1 + 0.9110\ X_2$

The residual constants in each of these equations was found not to be significantly different from zero and, therefore, has been omitted.

It was further desired to consider just 'Commerce and Transport' as the independent variable and to study the behaviour of the partial regression coefficients obtained in this way.

TABLE 4·2

COMMERCE AND TRANSPORT = X_1 (Agriculture) + X_2 (PRODUCTION)

India 1951	X1	X2	No. of dts. considered
Orissa	-0.019	0.619	13
W. Bengal	0.002	0.442	11
M.P.	0.003	0.249	22
Madras and Coorg	0.027	0.379	23
U.P.	0.003	0.560	51

The remarkable feature of the above equations is the large value of the regression coefficients of Production and correspondingly quite insignificant coefficient for agriculture for each of the equations derived for India and her States. This no doubt testifies to the fact that there exists a high degree of correlation between the tertiary activities and the secondary ones. On the other hand, these tertiary activities seem to be quite uncorrelated to Agriculture. Later on, when we discuss the inter-correlation among various economic activities, we shall have further evidence showing the existence of the above relationship.

This, /

This, however, is not the case for the economic structure of the United Kingdom or the United States of America. In spite of the fact that we have taken into account a few of the very rural districts in each of these countries, the equations obtained for them hardly bear any resemblance to those of India. For the U.K. and the U.S.A. farming is a considerably mechanised industry and, thus, the tertiary population owes its growth as much to farming as it does to manufacturing activities. Therefore, the regression coefficients for farming and manufacturing are observed to be nearly the same in each case.

Now, what do these equations imply? For India, they show that corresponding to 1 per cent increase in Production (other than agriculture), agricultural employment remaining constant, there would be on the average about 1.41 per cent increase in the population engaged in tertiary activities. Whereas if Agricultural population is increased by 1 per cent, the population engaged in production remaining constant, the tertiary population will only increase slightly, by 0.07 per cent.

For the U.K., it will be seen that with 1 per cent increase in Agriculture, manufacturing population remaining constant, the percentage increase in tertiary population would be 0.75 per cent. Similar increase in manufacturing, Agricultural population being kept constant, would result in 0.74 per cent increase in tertiary activities.

For /

For the United States, the coefficient for the secondary activities is (0.911), slightly higher than Agriculture (0.711), showing a greater degree of correlation between tertiary and secondary activities.

More or less a similar situation is revealed when we examine Table (4.2) which gives the values of the regression coefficients, where 'Commerce and Transport' alone has been taken as the dependent variable. The regression coefficients for production remain fairly high and those for Agriculture are practically negligible. In U.P. for example, the data indicate that if the Agricultural population remained constant, then corresponding to 1 per cent increase in the population engaged in production, there would be on the average, an increase of 0.56 per cent in the population engaged in Commerce and Transport.

We now refer to a statement by Colin Clark, 'Economics of 1960' pp.30. "It appears from this that we may take it as an absolute minimum that 15 per cent of the working population will be engaged in tertiary industries of various kinds." If W_1, W_2 and W_3 are respectively the numbers engaged in primary, secondary and tertiary industries, then

$$W_3 = 0.15\ W = 0.15\ (W_1 + W_2 + W_3);$$ or in other words,

$$W_3 = 0.176\ (W_1 + W_2)$$

Since this ratio of tertiary population to primary

plus /

plus secondary is considered important, we have tried to investigate statistically the relationship existing between these variables.

Denoting Y as the tertiary population and X as the total of primary and secondary, we obtained the following equations:-

India 1951

$$Y = 0.216\,x \quad \text{(all India)}$$

Uttar Pradish $Y = 0.224\,X$

W. Bengal $Y = 0.270\,X$

United Kingdom

$$Y = 0.75\,X$$

We notice that for India in general, the ratio of tertiary to primary plus secondary as estimated by the regression equation is higher than the minimum provision in Colin Clark's data. In an industrially advanced state like West Bengal, it is quite likely that the proportion of the tertiary population should bear a high ratio to primary plus secondary. On the basis of the data for a few rural districts of U.K. we find that the ratio of tertiary to the other activities is very high, being about 75%

TABLE 4·2

INTER-CORRELATION OF OCCUPATIONAL CATEGORIES BASED ON THE FIGURES OBTAINED FOR 32 DISTRICTS OF BENGAL, BIHAR AND ORISSA, 1931 CENSUS

Occupational Groups	Industry	Transport	Trade	Public Administration Professions & liberal arts	Domestic Services
Agriculture	0.3144	0.0411	0.3046	0.2637	-0.0156
Industry		0.6824	0.5910	0.5179	0.0444
Transport			0.5223	0.7004	0.3266
Trade				0.8082	0.1653
Public Administration					0.0550

Minimum value of r that is significant at the 5% level is 0.334.

Now, let us examine the Table (4.2) giving the correlation coefficients of the numbers engaged in various occupational categories based on the 1931 census of India. The table is susceptible to some interesting observations. Agriculture has a low degree of correlation with all other economic activities. The coefficient of correlation between Agriculture and Transport is as low as 0.04 and it even tends to be slightly negative in relation to domestic services. Although this negative coefficient could not imply/

imply that the domestic services decrease as the population engaged in Agriculture increases, yet it speaks in support of the fact that the poor agricultural farmers in India can hardly afford the luxury of domestic servants. The correlation coefficients between Industry-Transport, Industry-Trade, and Industry-Public Administration remain quite impressive. As a matter of fact, the activities like Trade, Transport and Public Administration are more dependent on the growth of industries. Trade and Transport as well, in their turn, are very highly correlated to Public Administration, Professions and liberal arts. The domestic services seem to have little or no relationship to other activities. This does not mean that their presence is not needed in a district, but it does imply that no occupational category affects the number of domestic servants present. The over-abundance of the population dependent on agriculture might be one of the reasons of low degree of correlation between agriculture and other economic activities in India.

Among the rural districts of the United Kingdom that we have selected for our present study, we find the coefficient of correlation between Agriculture and the tertiary activities (e.g. Trade, Transport, Public Administration, etc.) is relatively high, about 0.64, and that between Agriculture and secondary activities (manufacturing etc.) was a little higher than .40. This indicates that farming and tertiary activities

are /

are very highly correlated and it is in fact what we would expect in a system of economy where farming is highly mechanized. The coefficient of correlation between the tertiary and the secondary activities is also very high, about 0.69.

It is not possible however to justify the retention or elimination of occupational categories on the basis of a study on inter-correlations. The chief value of the inter-correlations is to show that high numbers of certain kind of workers result in high or low numbers of other kinds.

We have mentioned earlier that at the 1951 Census for India, the population was divided into three groups, namely self-supporters, earning dependents, and non-earning dependents. It is indeed of some interest to study the degree of dependency on the shoulder of these self-supporters in the various livelihood classes. First, we grouped the earning and non-earning dependents together in a broad category of dependents alone. For the State of Bombay, in the agricultural sector, it was found that

(Y = 2,918 X

Y = No. of dependents,

X = No. of self-supporters).

Each self-supporter, on the average, was associated with 2.92 dependents. On the other hand, in the non-agricultural sector, the degree of dependence was less; each self-supporter carried with /

with him, on the average, 2.13 number of dependents. A similar situation is revealed when we consider the number of earning dependents alone. Each self-supporter in the agricultural class for the State of Bombay was associated with 0.65 earning dependents, whereas in the non-agricultural sector, each self-supporter was associated only with 0.17 earning dependents. Considering India as a whole, we found that a self-supporter carried with him 0.35 earning dependents in the agricultural sector, whereas in Production, the corresponding fraction was 0.26 and, in commerce, it was still less, being only 0.18. All these clearly indicate a relatively low degree of dependency in the non-agriculture sector.

We now seek to determine the share of these earning dependents. Very much like these earning dependents, the secondary occupation of self-supporting persons too play an important role in economic activities of India. In all, according to the Census of 1951, there were about 15 million self-supporting persons in India who followed some secondary means of livelihood or the other. Out of these 15 million people following a subsidiary occupation over and above their principal ones, about 6.7 million had agricultural secondary occupations and the rest 8.3 million had non-agricultural secondary occupations. We should mention in this connection that the total number of earning dependents in India at 1951 Census /

Census was about 37.5 million. Their distribution by their secondary means of livelihood is given in the following table.

TABLE 4·3

Means of livelihood	Total No. of earning dependents following the occupation
Agriculture	27,163,366
Production (other than agriculture)	4,825,542
Commerce	1,300,992
Transport	221,348
Miscellaneous Services	3,979,831
T O T A L	37,491,079

Out of the 27 million of agricultural earning dependents in India, about 6.3 million belonged to the Uttar Pradesh. The other States in India having a large number of agricultural earning dependents were Bombay and Madhy Pradesh, both having about 4.5 million of earning dependents.

In the present analysis, we are concerned with the share of these earning dependents and the secondary occupations in /

in the agricultural economy of India. It is difficult to assess the total production in the secondary and tertiary sectors of economic activities since they involve many complicated items that are not directly measurable. In the agricultural sector on the other hand, we can to some extent obtain a true estimate of the total agricultural output without much trouble. They are obtainable from the Government Publication, 'Estimates of Area and Production of Principal Crops in India 1950-51'. Dr. V.K.R.V. Rao had included both working dependents and subsidiary workers in his calculation of the working force of the country for the year 1931 and gave them weights of ½ and 1/3 respectively as compared to 1 for the principal earners. In the first report of the National Income Committee (1948), the authors had rejected the procedure mainly because the scales of equivalence adopted was somewhat arbitrary and stated that considerable research had to be undertaken before any scale of equivalence could be justified. The report might be quoted as follows, "Moreover, the inclusion of subsidiary workers as above rests on the assumption that an earner with a subsidiary occupation necessarily earns more than one without subsidiary occupation whereas it may well be that subsidiary occupation is associated with less than average income in the primary occupation. Finally, any error arising from our procedure is likely to be negligible in the estimates of Indian income as the bulk of it

is /

is estimated in the inventory or the net output method".

In our present analysis, we intend to fit a multiple regression equation to the data on agricultural output as the dependent variable and the number of self-supporters, earning dependents and secondary workers as the independent variables.

The yield of total principal crops for each State was Y, the dependent variable. At the first stage, the number of self-supporting persons (X_1) and the number of earning dependents (X_2) were the only two independent variables. Working with the logarithm of these variables, we obtained the equation at the first stage in the form

$$Y = 7.0958 \; X_1^{0.6476} \; X_2^{0.1491} \quad ---- \quad (1)$$

At the second stage, we took the self-supporting persons having agriculture as their secondary occupation as the third variable (X_3) and obtained a new equation,

$$Y = 7.3064 \; X_1^{0.595} \; X_2^{0.141} \; X_3^{0.075} \quad ------- \quad (2)$$

These two equations do throw some light on the contributive share of the earning dependents and secondary occupations in the agricultural economy of India. Equation (1) reveals that corresponding to 1 per cent increase in the number of self-supporters, the number of earning dependents remaining constant, the agricultural output would increase by 0.65 per cent. Whereas, /

Whereas, if the number of earning dependents is increased by 1 per cent, the number of self-supporters being kept constant, the agricultural output would increase by 0.15 per cent. Therefore, it is not difficult to conceive that the share of earning dependents is about $\frac{1}{4}$th that of the self-supporters. Dr. Rao's intuitive weight of $\frac{1}{4}$ for the working dependents appears to be quite justified in view of the above equations. The share of secondary occupations as we can see from equation (2) is about $\frac{1}{8}$th that of the self-supporters. However, it is believed that the share of these secondary occupations would be higher in the non-agricultural sector. We find that the sum of the coefficients of elasticities is 0.797 in equation 1, and 0.811 in equation 2; in both cases the sum being less than 1, which indicates a stage of diminishing returns. It is, as could naturally be expected, in view of the fact that other main factors like land, management, etc. have been omitted from our discussion.

TABLE 4·4

BOMBAY 1951

Testing consistency of the ratio

between the secondary and the tertiary population

Districts	Tertiary population (000)			Secondary population (000)		
	Observed (o)	expected (e)	$\frac{(0-e)^2}{e}$	Observed (o)	expected (e)	$\frac{(0-e)^2}{e}$
	55	54.8	.00	30	30.2	.00
	44	44.5	.00	25	24.5	.00
	130	134.2	.13	78	73.8	.24
	104	102.6	.02	55	56.4	.03
	47	44.5	.14	22	24.5	.25
Panch Mahals	121	106.4	2.00	44	58.6	3.63
	57	49.0	1.30	19	27.0	2.37
	154	162.6	0.45	98	89.4	0.82
	30	32.2	0.15	20	17.8	0.27
	62	60.0	0.06	31	33.0	0.12
	96	97.4	0.02	55	53.6	0.04
	109	112.9	0.13	66	62.1	0.24
	86	92.2	0.42	57	50.8	0.75
Poona	248	225.8	2.18	102	124.2	3.96
	58	62.5	0.32	39	34.5	0.59
	48	48.4	0.00	27	26.6	0.00
	64	66.7	0.09	39	36.6	0.16
	93	100.6	0.57	63	55.4	1.04
	109	118.0	0.68	74	65.0	1.24
	168	171.6	0.07	98	94.4	0.13
	63	61.3	0.05	32	33.7	0.08
	110	107.1	0.08	56	58.9	0.14
	43	45.8	0.17	28	25.2	0.31
	122	121.3	0.00	66	66.7	0.00
	109	109.1	0.00	60	59.9	0.00
	81	80.6	0.00	44	44.4	0.00

(i)

INDIAN CENSUS

Statistics on the economic activities of the people derived from the censuses of population are among the most important sources of information about the economic and demographic characteristics of a nation. These statistics provide an inventory of the human resources of a country showing the number and characteristics of persons engaged in economic production, their occupations, and their distribution among the branches of economic activities.

Information about occupations in India was first tabulated in the census of 1881. Owing to changes in the basis of classification adopted at the various censuses, it is not possible to discover precisely what changes have occurred in the occupational distribution since 1881. In the 1881 census, only the occupation of principal earners was recorded. In the census of 1891, it was decided to record not the occupation of principal earners only but also the means of subsistence of the whole population. But, if a person had two occupations, only the principal one was entered, except in the case of a person who owned and cultivated land in addition to another occupation when both were returned. The difficulty in connexion with this system was that it was found inconvenient to record the subsidiary /

subsidiary occupation of agriculturists in the same column with the main occupation, as there was no separate column for subsidiary occupations.

In considering the figures for 1891 and 1901, we find that the numbers engaged in non-agricultural pursuits in 1891 were greatly exaggerated in some ways. In the first place, all who carried on two occupations were classed under non-agricultural heading. In the second place, a number of general labourers were entered as non-agriculturists in 1891, although they were engaged in agricultural work such as digging.

According to the census, the percentage of the total population supported by agricultural and pastoral pursuits was 61.06 in 1891, 66.50 in 1901, 72.2 in 1911, 72.98 in 1921, 67.0 in 1931 and 69.84 in 1951. But it may be noted that there has been really no substantial change in dependence upon pasture and agriculture and the difference in the percentage figures may be attributed to the changes adopted at the censuses.

The figures for 1901 cannot be compared with those of subsequent censuses because in 1911, the whole basis of classification was changed. In 1911, the returns for those pursuing dual occupations were made much more accurate and complete; entries were made more definite; and a number of actual mistakes in classification were eliminated.

It is therefore assumed that the figures prior to

1911 /

1911 were far from reliable and the new and simpler classification adopted in 1911 together with improved methods of carrying out the census, have made it possible for the first time to measure accurately the occupational distribution of the population in general, and to what extent the population is dependent upon agriculture and pasture.

We have seen that the number registered as dependent upon pastoral pursuits was 72.2 per cent in 1911 and 72.98 per cent in 1921. This increase is too slight, and it is not possible to conclude as to whether or not there was a permanent tendency towards increased dependence upon agriculture.

In the census of 1931, an attempt was made for the first time to obtain a detailed census of subsidiary occupations, because it was realised that they also play a very important part in the economic life of a country.

The Census of 1931 made a distinction between the working and non-working dependents. A person whose earnings were too casual and insignificant as compared with the requirements of the family was treated as a non-working dependent. A working dependent on the other hand was one who actually followed some occupation but whose earnings, though fairly regular, were yet too small for setting up a separate household.

The apparent decline in the numbers dependent upon agricultural and pastoral pursuits between 1921 and 1931 is really /

really surprising. The decline in those dependent upon such pursuits is almost exactly equalled by the very large increase in those entered as dependent upon domestic services. The apparent transference of some seven million women from dependence upon agriculture to domestic service is to be accounted for by a change in classification, not of occupation. In 1931, the wives and female relatives of agriculturists were entered as engaged not in agriculture, as in 1921, but in domestic service. When this is taken into consideration, it is clear that the percentage of the population engaged in agricultural and pastoral pursuits hardly changed between 1921 and 1931.

In 1931, the basis of classification was again altered, by a widening of categories and reduction of groups, and by a rearrangement as regards subdivision into principal dependent and subsidiary occupation. This makes detailed comparison with 1911 and 1921 difficult, but the main groups were unaffected.

TABLE (1.1)

PERCENTAGE DISTRIBUTION OF OCCUPIED POPULATION

Classification of Occupation	1911	1921	1931
A. Production of raw materials	72.4%	73.15%	67.1%
I. Exploitation of Animals & Veg.	72.2	72.98	67.0
(i) Pasture and Agriculture	71.5	72.43	
(ii) Fishing and hunting	0.7	0.55	
II. Exploitation of minerals	0.16	0.17	0.1
B. Preparation and Supply of material substances	18.5	17.59	16.6
III. Industry	11.2	10.49	9.7
IV. Transport	1.5	1.37	1.5
V. Trade	5.6	5.73	5.4
C. Public Administration and liberal Arts	3.3	3.12	3.0
VI. Public force	0.73	0.69	0.5
VII. Public Admn.	0.82	0.84	0.8
VIII. Professions & liberal arts	1.0	1.59	1.7
D. Miscellaneous	5.5	6.14	13.3
IX.			
X. Domestic Service	1.4	1.45	
XI.			
XII.			

The chief increase in 1931 was in domestic services accompanied by a decline in agricultural pursuits the reason for which has already been explained. The percentage of workers occupied in domestic services thus rose from 1.7 in 1921 to 7.0 in 1931.

Transport workers increased - as is only natural in view of the improvement in communications, especially in roads and the development of motor traffic. The increase in professions, etc. can be accounted for by the gradual spread of literacy. The percentage dependent upon public forces had decreased, as had also that in industry.

The 1941 Census reports do not contain figures of Occupational Classification, tabulation of occupational data having been abandoned on grounds of economy. However a 2% (every fiftieth) sample of census slips had been preserved; and after an enquiry made by the Government of India in 1945, The Indian Statistical Institute was entrusted with the task of making estimates of occupational distributions for Class A States for 1941. The National Income Committee arrived at an estimate of occupational distribution in 1948, on the assumption that the ratio of occupied population in all industrial classes and sub-classes in 1941 to the total population remained the same in 1948.

The figures and percentages of actual workers is given in the following Table.

TABLE (1.2)

INDIA 1948

Census Sub-Classes	Principal Earners + working dependents	
	No. in (000)	Percentage
1. Exploitation of Animals & Vegetation	90,537	68.2
2. Exploitation of minerals	633	0.5
3. Industry	18,019	13.6
4. Transport	2,448	1.8
5. Trade	8,250	6.2
6. Public force	1,909	1.4
7. Public Administration	1,697	1.3
8. Professions and liberal arts	5,044	3.8
9. Domestic Services	4,194	3.2
	132,731	100.0

The scheme of classification set out for the 1951 Census has been referred to as the Indian Census Economic Classification Scheme. It is based on the 1931 Scheme of Occupations. It embodies however extensive revision and rearrangement.

1951 /

1951 Census

Livelihood categories and classes:-

The people were divided into two broad livelihood categories, viz. the agricultural classes and the non-agricultural classes.

There are four agricultural classes:-

I. Cultivation of land, wholly or mainly owned and their dependents.

II. Cultivation of land, wholly or mainly unowned and their dependents.

III. Cultivating labourers and their dependents.

IV. Non-cultivating owners of land, agricultural rent receivers and their dependents.

There are four non-agricultural classes defined as comprising all persons (including dependents) who derived their principal means of livelihood from

V. Production (other than cultivation).

VI. Commerce.

VII. Transport.

VIII. Other services and miscellaneous sources.

Economically active, semi-active and passive persons:-

All non-earning dependents are economically passive. They include persons performing housework or other domestic or personal /

personal services for other members of the same family household.

All earning dependents are economically semi-active only. Though they contribute to the carrying on of the economic activities, the magnitude of their individual contribution is considered too small to justify description as economically active.

All self-supporting persons are ordinarily economically active.

A new introduction at the 1951 Census has been the tabulation of self-supporting persons in the non-agricultural classes into employers, employees and independent workers.

TABLE (1.3)

1951 CENSUS

PERCENTAGE DISTRIBUTION OF THE WORKING POPULATION (SELF-SUPPORTERS + EARNING DEPENDENTS ACCORDING TO THEIR SECONDARY)

Classification	No. in (000)	Per cent
Agriculture	98,213	69.48
Production (other than cultivation)	16,421	11.61
Commerce and Transport	9,160	6.47
Misc. and other services	17,557	12.44
T O T A L	141,351	100.00

Although /

Although figures for 'Earning dependents' are available for the four broad divisions mentioned above, yet the 1951 Census Volumes do not provide the actual number of earning dependents in various groups and sub-groups. Consequently, we cannot assess the number of actual working force in individual groups and sub-groups since we include both self-supporters and working dependents in enumerating the total working force.

The present classification is not strictly comparable with that in 1931 Census. Yet, we do not find any marked change in the dependence in agriculture. The percentage engaged in agriculture seems to have slightly increased, from 67.0 per cent in 1931 to 69.48 per cent in 1951. However, the percentage engaged in production (or broadly Industry for the 1931 Census) has also increased from 9.7 per cent to 11.61 per cent. The percentage engaged in trade and transport has been keeping steady.

Economic tables of general population based on the 1951 Census reveal that out of India's total population of 356.6 million, 249.1 million or 69.8 per cent belong to the agricultural classes, and the remaining 30.2 per cent to the non-agricultural classes. In agricultural classes, 71 million or 28.5 per cent are self-supporting persons, 147 million or 59 per cent are non-earning dependents and 31.1 million or 12.5 per cent are earning dependents. The non-agricultural population comprises 107.5 million; of these 33.2 million or 31 per cent are self-supporting persons, 67.3 million or 62 per cent are non-earning dependents, and 6.9 million or 6.4 per cent are earning dependents.

TABLE (i.4)

CENSUS OF INDIA 1951

	Self-supporters	Earning dependents	Non-earning dependents
Agricultural classes	71,049,356	31,068,905	146,956,640
Non-Agricultural classes	33,350,447	6,868,330	67,334,634

The figures stated in the column for earning dependents do not indicate the real number of earning dependents engaged in agricultural and non-agricultural occupations. These earning dependents have to be considered according to their secondary means of livelihood. The following table clearly classifies the earning dependents by their secondary means of livelihood in the various occupational divisions.

TABLE (i.5)

INDIA 1951

Occupations	Self-supporting persons	Earning dependents according to their secondary
Agriculture	71,049,356	27,163,366
Production	12,135,714	4,285,542
Commerce	5,903,038	1,300,992
Transport	1,734,395	221,348
Miscellaneous Services	13,577,300	3,979,831

Among the self-supporting persons of both agricultural and non-agricultural classes (about 104.2 million), only 15.0 million follow some secondary means of livelihood or the other.

TABLE (i.6)

SECONDARY OCCUPATIONS OF SELF-SUPPORTING PERSONS

Agricultural	6,676,596
Non-Agricultural	8,333,883
TOTAL	15,010,479

Let us now examine the proportion of actual workers

to /

to the total population in the last four Censuses of India. In the publication, 'Change in the occupational distribution of the population of India', 1941, issued by the Government of India, Dr. Ghat enumerates from the census volumes, the following figures for the number of actual workers for the corresponding census.

TABLE (1.7)

Year	No. of actual workers (millions)
1911	148.9
1921	146.4
1931	146.9 *

* (According to the 1931 Census figures, we find the number of actual workers to be 153.9 millions).

Dr. Ghat points out the remarkably high figure for the population employed in domestic services in the year 1931. The following tables give the actual number employed in domestic services in both India and Madras province for two consecutive Censuses.

TABLE (1.8)

DOMESTIC SERVICES - 1921 CENSUS

	Actual	Workers
	Male	Female
INDIA (Total)	1,710,157	821,709
MADRAS	53,850	40,426

TABLE (1.9)

DOMESTIC SERVICES - 1931

	Principal	Earners	Working	Dependents
	M	F		
INDIA	1,805,006	886,991	289,481	7,916,799
MADRAS	102,931	164,439	134,661	6,007,755

Dr. Ghat is of the opinion that owing to certain misunderstandings on the part of enumerators, about 7 million women, who would otherwise have been classified as non-working dependents were entered as dependent upon domestic services. This happened mainly in the Madras province as is obvious from the above table. Dr. Ghat therefore has deducted 7 million from the total working force of 153.9 millions and thereby obtains a figure of 146.9 millions as the actual working population /

population for the year 1931.

On the other hand, we should look to the decline in the number dependent upon agricultural and pastoral pursuits between 1921 and 1931. The decline in those dependent in such pursuits is equalled by the large increase in those entered as dependent upon domestic services. When this fact is taken into account, it seems unreasonable to deduct 7 millions from the total working population of 153.9 millions for the year 1931.

The statewise distribution of the actual working population in the various occupational groups for the years 1921, 1931 and 1951 is given in the following tables.

TABLE (1.10)

INDIA 1921

Provinces	Total employed	Total employed in pasture and agriculture	Total employed in industry	Total employed in commerce and transport
INDIA	146,413,562	104,943,712 (71.67%)	15,725,373 (10.74%)	10,019,785 (6.84%)
Assam	3,482,180	3,048,852 (87.55%)	85,212 (2.44%)	163,752 (4.70%)
Bengal	16,414,810	11,625,117 (70.82%)	1,642,004 (10.0%)	1,333,646 (8.12%)
Bihar & Orissa	16,688,685	13,240,929 (79.34%)	1,148,764 (6.88%)	802,166 (4.80%)
Bombay	8,765,611	5,408,974 (61.70%)	1,122,131 (12.80%)	808,343 (9.22%)
C.P. & Berar	8,140,304	6,328,823 (77.74%)	706,328 (8.67%)	440,738 (5.41%)
Madras	20,215,679	14,796,662 (73.06%)	2,201,299 (10.89%)	1,389,492 (6.91%)
Punjab	7,271,787	4,036,623 (55.51%)	1,561,190 (5.89%)	657,781 (9.04%)
U.P.	24,252,528	18,843,589 (77.69%)	2,622,417 (10.81%)	1,132,205 (4.66%)

TABLE (i.11)

INDIA 1931

Provinces	Total employed	Total employed in pasture and agriculture	Total employed in industry	Total employed in commerce and transport
Assam	3,876,758	3,210,673 (82.81%)	292,480 (7.54%)	162,034 (4.17%)
Bengal	14,420,661	9,664,780 (67.02%)	1,269,073 (8.80%)	1,207,133 (8.37%)
Bihar & Orissa	15,548,289	12,005,530 (77.21%)	1,060,645 (6.82%)	679,061 (4.36%)
Bombay	8,510,897	5,521,568 (64.87%)	1,015,457 (11.93%)	658,489 (7.73%)
C.P. & Berar	8,259,143	6,609,243 (80.02%)	656,685 (7.95%)	428,233 (5.18%)
Madras	25,904,490	12,424,405*	2,269,709 (8.76%)	1,314,476 (5.07%
Punjab	8,326,258	5,035,432 (60.47%)	1,593,756 (19.14%)	723,248 (8.68%)
U.P.	23,549,383	17,840,050 (75.75%)	2,629,282 (11.16%)	1,314,069 (5.58%
India Total	153, 916, 050	102,454,147 (66.56%)	15,351,953 (9.97%)	10255003 (6.66%)

* The figure for pasture and agriculture in Madras has to be corrected to about 19 millions in view of the errors encountered in enumeration.

TABLE (i.12)

INDIA 1951

States	Total employed	Total employed in agriculture	Total employed in Production	Total employed in commerce and transport
INDIA	141,350,882	98,212,722 (69.48%)	16,421,256 (11.61%)	9,159,773 (6.47%)
U.P.	26,839,316	20,226,991 (75.36%)	2,192,832 (8.17%)	1,345,985 (5.0%)
Bihar	14,344,195	12,038,772 (83.92%)	736,733 (5.13%)	648,072 (4.51%)
Orissa	5,595,942	3,919,683 (70.04%)	551,555 (9.85%)	267,093 (4.77%)
W. Bengal	8,604,140	4,110,070 (47.76%	1,836,376 (21.34%)	1,186,547 (13.78%)
Assam	3,900,255	2,511,339 (64.38%)	883,834 (22.66%)	193,996 (4.97%)
Madras	17,657,733	11,130,052 (63.03%)	2,372,970 (13.43%)	1,373,274 (7.77%)
Bombay	15,391,603	9,949,276 (64.64%)	2,027,513 (13.17%)	1,210,876 (7.85%)
M.P.	11,836,083	9,372,993 (79.18%)	1,115,431 (9.42%)	478,949 (4.04%)
Madhya Bhare	3,282,629	2,394,477 (72.94%)	361,240 (11.00%)	174,220 (5.31%)
Hyderabad	7,546,038	5,318,295 (70.47%)	921,407 (12.21%)	394,208 (5.21%)
Rajasthem	7,711,405	5,697,914 (73.88%)	780,348 (10.11%)	375,655 (4.87%)
Punjab	4,879,391	3,158,492 (64.73%)	405,127 (8.30%)	406,387 (8.32%)

The figures in this table include both self-supporting persons and the earning dependents classed according to their secondary means of livelihood.

In comparing the figures for the 1921 and 1931 Censuses, the noticeable feature is the decline in the percentage of the population engaged in industry in nearly all the Provinces. The decade 1921-1931 was a period of industrial depression. There was a tendency towards an increase in the output of large-scale industries without a corresponding increase in the numbers employed. In Bombay Presidency, there were 12.80 per cent of the total employed persons who were engaged in industry in the year 1921, whereas in the year 1931, the percentage fell down to 11.93. In Bengal, the similar percentage fell from 10.00 in the year 1921 to 8.80 in the year 1931. In Bihar and Orissa too the percentage engaged in industry showed a slight decline though not quite remarkable. In Madras Presidency the percentage fell from 10.89 in 1921 to 8.67 in 1931.

In Trade and Transport too, the percentage of workers employed showed a decline during the decade. In Bombay Presidency, the percentage engaged in Trade and Transport fell from 9.22 in 1921 to 7.73 in 1931. In Madras, it was 6.91 in 1921 and 5.07 in 1931.

Obviously, due to this decline in the secondary and tertiary activities, the percentage employed in agriculture increased in nearly all the provinces during the years 1921-1931. At the Census of 1921 in Bombay Presidency 61.70 per cent of employed persons earned their livelihood from pasture and agriculture, /

agriculture, whereas at the 1931 Census, the percentage was 64.87.

The figures at the 1951 Census are hardly comparable to the previous Censuses in view of the fact that considerable changes have been effected in the boundaries of the provinces, and also, the occupational classifications were to some extent changed. However, we can broadly make a comparative study of a few selected provinces or 'states' so far as the occupational distribution is concerned.

During the last 20 years, since the 1931 Census, India has progressed industrially to a great extent. In most of the states, the percentage of the population engaged in industry, trade and transport has shown an increase. In Bombay State, the percentage of the population in industry increased from 11.93 in the year 1931 to 13.17 in the year 1951. In Madras, the same percentage was 8.76 in 1931 and 13.43 in 1951. It is interesting to note that although the percentage engaged in agriculture has not changed considerably since the 1931 Census, the proportions engaged in industry, trade and transport have increased to some extent.

Before arriving at any conclusion from the figures of the occupied population at the various censuses, it is worth while studying the age-structure in the corresponding years, as it may well be that a change in the age-structure could as well affect /

affect the occupational distribution to some extent.

The following table gives the age-structure at the various censuses.

TABLE (i.13)

AGE-STRUCTURE AT THE CENSUSES

Age-groups	1 9 2 1		1 9 3 1		1 9 5 1	
All ages	315,350,442		335,111,821		34,919,879 (sample population)	
0-5	39,656,410	(12.57%)	51,447,036	(15.35%)	4,726,869	(13.53%)
5-14	83,489,240	(26,47%)	82,679,156	(24.66%)	8,660,275	(24.80%)
15-24	52,210,912	(16.55%)	62,113,549	(18.52%)	6,065,277	(17.39%)
25-34	53,737,827	(17.04%)	54,773,692	(16.32%)	5,445,111	(15.60%)
35-44	38,551,220	(12.22%)	38,400,897	(11.45%)	4,152,522	(11.89%)
45-54	25,384,947	(8.04%)	24,498,299	(7.31%)	2,959,170	(8.47%)
55-64	14,457,630	(4.58%)	13,927,481	(4.15%)	1,766,878	(5.06%)
Working Age Group 15-64		58.43%		57.75%		58.41%

The age-structure does not appear to have changed considerably to affect the occupational distribution very much. The proportion of the population in the working age-group, i.e. (15-64) was slightly less at the 1931 Census as compared to the 1921 and 1951 Censuses.

APPENDIX (ii)

APPENDIX (ii)

CENSUS OF MANUFACTURES

NOTE ON TERMS USED IN THE TABLES

(i) Registered factories:- For the purposes of the Census, only factories registered under the Indian Factories Act, 1948, which employ 20 or more persons and use power are taken into account. Factories in existence during the year which did not work are also included.

(ii) 'Productive Capital':- Capital employed on the relevant date in the factory itself and in running it is covered by this term. It consists of fixed capital (comprising factory land, buildings, plant, machinery and miscellaneous assets such as furniture, fixtures, fittings, railway sidings, automobiles, patents and trade-marks, etc.) and working capital (comprising stocks of raw-materials, finished and semi-finished products, cash in hand and at the bank, excluding fixed deposits and current credits). The value of Capital items is taken as in the books of the factory.

(iii) 'Number of persons employed':- The average number of persons employed by each factory, under various heads such as workers, persons other than workers, etc. on days on which manufacturing operations were carried on in the factory, is /

is computed by adding the number of persons employed on all these days and dividing by the number of days. These averages are aggregated for all factories in the State or industry, as the case may be, and the aggregate is taken as the number of persons employed in the State or industry, respectively.

(iv) 'Workers':- The term 'workers' is used in the same sense as in the Factories Act 1948, but excludes persons holding positions of supervision or management or employed in a confidential position. Section (I) of the Factories Act, 1948, defines 'worker' as a person employed, directly or through any agency, whether for wages or not, in any manufacturing process or in cleaning any part of the machinery or premises used for manufacturing process, or any other kind of work incidental to, or connected with, the manufacturing process, or the subject of the manufacturing process.

(v) 'Persons other than workers':- This term includes all employees other than workers, as defined in (iv) above.

(vi) 'Man-hours':- The estimate of the number of man-hours worked by a factory during the year relates to the entire year, including days on which no manufacturing operations were carried on, and is calculated by multiplying the number of persons employed in each shift by the number of hours in the /

the shift, and aggregating the products for all the days in the year. The number of man-hours for a State or an industry is the total of the number of man-hours worked by all factories in that State or industry.

(vii) 'Wages':- The term 'Wages' has been used in the same sense as in section 2 (vi) of the Payment of Wages Act, 1936, and means 'all remuneration, capable of being expressed in terms of money which would, if the terms of the contract of employment, express or implied, were fulfilled, be payable, whether conditionally upon regular attendance, good work or conduct or other behaviour of the person employed or otherwise, to a person employed in respect of his employment or if work done in such employment, and includes any bonus or other additional remuneration of the nature aforesaid which would be so payable, and any sum payable to such person by reason of the termination of his employment, but does not include:-

(a) the value of any house-accommodation, supply of light, water, medical attendance or other amenity, or of any service excluded by general or special order of the States Government.

(b) any contribution paid by the employer to any pension fund or provident fund.

(c) any travelling allowance or the value of any travelling /

travelling concession.

(d) any sum paid to the person employed to defray special expenses entailed on him by the nature of his employment or

(e) any gratuity payable on discharge.

(viii) Other benefits:- These include various benefits over and above wages, such as free or subsidised housing, food grains at concessional rates, etc.

(ix) Fuels and Materials consumed:- This excludes any fuels or materials manufactured within the factory and consumed in it. Electrical Energy, generated and consumed within the factory, is a case in point. The coal used in generating the energy is however included, since it is brought into the factory from outside.

(x) Value of fuels, materials, etc. at factory:- This is the cost of materials, etc. delivered at the factory, and includes the purchase price and transport charges and other incidental costs.

(xi) Work done for factory by other concerns:- This term denotes the cost of services rendered to the factory by other concerns and by individuals other than its own employees.

(xii) Products manufactured for sale:- This term includes all products made during the year for sale, whether actually sold /

sold during the year or not. It is generally estimated by adding sales during the year, and stocks at the end of the year, and deducting stocks at the beginning of the year.

(xiii) 'Ex-factory value of products':- Represents the value of products at factory and is exclusive of transport charges from the factory.

(xiv) Work done for customers:- Work done for customers on payment, on material supplied by them.

(xv) "Value added by Manufacture":- This represents that part of the value of the product which is created in the factory and is computed by deducting from the gross ex-factory value of the product the value of fuels and materials used, work done for the factory by other concerns, and depreciation of fixed assets. Depreciation is calculated at the rates allowed by the income tax authorities for assessing taxable income. The rate varies according to the type of assets and industry.

Appendix (iii)

Flexibility of Marginal Productivity of Labour

$$\phi_L = \frac{\partial\left(\frac{\partial P}{\partial L}\right)}{\frac{\partial P}{\partial L}} \Big/ \frac{\partial L}{L} = \frac{\partial}{\partial L}\left(\frac{\partial P}{\partial L}\right) \cdot \frac{L}{\frac{\partial P}{\partial L}} \quad \ldots (1)$$

Since $P = hL^{k}C^{j}$ $\qquad j = 1-k$

we know,

$$\frac{\partial P}{\partial L} = k\frac{P}{L} \quad \ldots\ldots (2)$$

$$\frac{\partial}{\partial L} \cdot \frac{\partial P}{\partial L} = k(k-1)\frac{P}{L^2}$$ which can be proved as follows ....(3)

From (2)

$$\frac{\partial}{\partial L} \cdot \frac{\partial P}{\partial L} = \frac{\partial}{\partial L} \cdot k\frac{P}{L} = \frac{\partial}{\partial L} kPL^{-1}$$

$$= -kPL^{-2} + kL^{-1}\frac{\partial P}{\partial L}$$

$$= \frac{-kP}{L^2} + \frac{k}{L} \, k\frac{P}{L}$$

$$= \frac{-kP}{L^2} + \frac{k^2 P}{L^2} = \frac{k(k-1)P}{L^2} \quad \ldots (4)$$

Substituting in (1), the values shown in (2) and (4),

$$\phi_L = k(k-1)\frac{P}{L^2} \cdot \frac{L}{\frac{kP}{L}} = \frac{k(k-1)}{L^2} P \frac{L^2}{kP}$$

$$= k-1 \quad \ldots (5)$$

A similar proof could be obtained for ϕ_C, the flexibility of marginal productivity of capital.

$$\phi_C = -k \quad \text{----} \quad (6)$$

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