INDUSTRIAL CAPITAL

IN INDIA (1938-39)

(ESTIMATES OF CAPITAL EMPLOYED IN MANUFACTURING INDUSTRIES IN INDIA IN 1938-1939)

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FOREWORD

It is now widely recognized that planned economy is essential for India if she is to raise the standard of living of her people, and solve successfully the problem of poverty, destitution and even hunger facing her millions. A planned economy can only be built upon the knowledge of existing facts, and on the available statistical material. Proper interpretation of existing statistics and the collection of further statistics which may be needed would form an integral part of such planning. I, therefore, welcome the attempt of Mr. M. V. Divatia,* Assistant Director, Industrial Statistics, Department of Industries & Supplies, Government of India, and Mr. H. M. Trivedi to undertake an investigation regarding the industrial capital of India. The authors have attempted to collect data with regard to capital employed in existing industries in British India and in some of the Indian States about which statistics are available. They have used both direct and indirect methods for arriving from these data at their estimates of industrial capital used in manufacturing establishments. These estimates have been split up into values of Land and Buildings, Plant and Machinery and Working Capital, and relate to the year 1938-39, which has been chosen as the most recent year before the war during which economic conditions in general and industrial conditions in particular were more or less normal.

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After drawing their conclusions about the extent of industrial capital used in manufacturing establishments in India by three or four different methods, the authors have attempted to indicate some of the uses to which the estimates can be put. The planning authority in the State will have to take decisions about the best manner in which the capital resources of the country and the savings of the people can be utilised. In order to enable the State to choose between different industries or between different regions, and to ensure that the available capital and manpower resources are utilised to the best possible advantage, the assistance of such investigations as the present will be necessary. It would also be interesting to work out the relation of capital employed to gross production, wages paid, total sale proceeds, population, per capita income, etc. Such studies may be useful also in establishing the relative efficiency of different industries and of different units in the same industry from the point of view of the planners. The studies, as has been pointed out by the authors, can also be utilised for arriving at useful estimates regarding the probable requirement of machinery to be imported for replacement purposes, etc.

The authors have set before them what may be called a modest aim, and they have admirably succeeded in realising that aim, as they have devoted considerable care and thoroughness to the study of the problem. I wish that this study by Messrs. Divatia and Trivedi will be the forerunner of many more studies based on the statistical material available in the Government archives and will help to lay the foundation of a comprehensive statistical service required by a planned economy.

"Suneeta",
Ridge Road,
Bombay 6,
May 2, 1946.

PURSHOTAMDAS THAKURDAS

PREFACE

As a matter of purely academic interest, we have been interested for some time past in studying economic statistics available in published sources, both official and non-official. During the course of such studies we have found that despite the many serious lacunæ existing in the economic statistics of India, a fair quantity of material relating to certain sectors of economy is available; and also, that if this material were subjected to systematic analysis and synthesis, it would yield many interesting conclusions of a practical and far-reaching character. Because of the insufficiency of available data, any conclusions which one may draw from such analysis and synthesis must necessarily be approximations to the actual facts. Nevertheless approximate conclusions would be better than no conclusions at all. There is, therefore, on the one hand need for improvement in the existing economic statistics, and on the other, some scope for scientific treatment of the available material with a view to extracting from it, far more meaning than has hitherto been done. For this purpose, as our experience shows, it will be necessary to sift, and synthesize a mass of detailed material scattered over different publications, and interpret it in light of statistical studies conducted in other countries where organized collection of data has attained a greater degree of perfection. The labour involved in an investigation of this kind will, no doubt, be considerable. But, having finished the present

work, it seems to us that such labour would be well expended. The present investigation was, as a matter of fact, undertaken soon after the publication of the first part of the "Bombay Plan", through which the authors of the Plan voiced the lack of information relating to Industrial Capital in India. However, the primary objective in undertaking this investigation into the Industrial Capital of India has been to test our main thesis, that the existing statistics can be treated by suitable methods to give useful results. It is in this spirit that we have pursued this investigation. We shall indeed feel gratified if the reader also finds that this investigation does in fact give useful and reliable results. Since one of the authors is in the employ of the Government, it is necessary to mention that the authors assume sole responsibility for the results and conclusions stated in this book.

We are indeed grateful to Sir Purshotamdas Thakurdas, who, amidst his heavy preoccupations, found time to go through the manuscript, and to give a foreword to our book.

We must also express our sense of gratitude to the publishers for getting this book published within a very short time, in face of all the adversities of a rationed and controlled economy, such as we have in India.

Karachi,
2nd October, 1946.

M. V. DIVATIA
H. M. TRIVEDI

CHAPTER I

INTRODUCTION

There have been few, if any, scientific contributions so far, to the subject of determination of Industrial Capital in India. In other countries, estimates of Industrial and National Capital have been made by a number of distinguished economists. Sir Alfred Flux estimated the Capital Value of plant and buildings of industrial concerns in the U.K. in the years 1907 and 1914.[1] Colin Clark has also estimated the fixed capital in Great Britain for 1930.[2] In Canada, Australia, New Zealand and some other countries information about Capital employed in Industries is available from officially conducted Censuses of Production. Studies in National Capital in the U.K., the U.S.A. and other countries also give *inter alia* the Capital employed in Industry.[3] In these countries the studies in determination of Capital have reached a stage when the emphasis has been laid during recent years on investigations into capital formation over a period of time rather than mere estimation of aggregate stock of capital at a point of time. In India, however, little is known apart from published statistics relating to share capital of joint stock industrial concerns. This may be partly due to the absence of a

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[1] P. 241, "National Income and Outlay", Colin Clark.

[2] "London and Cambridge Economic Service" special memorandum No. 38 "Investment in Fixed Capital in Great Britain". September 1934.

[3] cf. (a) "National Income and Capital Formation" by Kuznetz. National Bureau of Economic Research, U.S.A.

(b) J. R. S. S. July 1919, Comparable data for several countries, by Sir Josiah Stamp.

(c) Beckerath's estimate of National Capital "Weltwirtschaftliches Archiv", July 1931. For Spain.

(d) Assessment of National Wealth in 1913 and 1930 for Japan, by Shiomi. Kyoto Economic Review. 1934.

(e) "National Capital" by Sir Josiah Stamp.

(f) Economic Journal. June 1936. Feaver year's estimate.

(g) "Kapitalbildung" by Marschak and Lederer.—estimates for France and five other countries.

(h) For Russia. "Critique of Russian Statistics" by Colin Clark.

(i) Estimate of Working Capital employed in Great Britain by J. M. Keynes, "A Treatiese on Money" Vol. II, p. 106.

census of production in this country. But the fact remains that in the economic statistics of India, information about industrial capital is totally inadequate. This lacuna is brought into relief in a most significant manner when we require to know total productive capital i.e. the capital employed.

To appreciate the need for such estimates, one has only to refer to the comments of the authors of the "Bombay Plan". In their "Plan of Economic Development for India", they say that "No figures of either valuation of capital employed in existing industries in the country or of their net product are available".[1] They add, "it is extremely difficult to make an estimate of the capital which India would require to carry out the programme of Industrial development outlined. . . ."[2] The absence of data with regard to capital employed in existing industries has been a source of persistent difficulty in judging the capital required to put through a given plan. The difficulty has been widely felt and commented upon in recent economic discussions. One of the purposes of this book is to rectify this deficiency, in a best possible manner.

The idea of a planned economy for this country was born with the publication of Sir M. Viswesvaraya's book,—"A Planned Economy for India". It was further developed by the National Planning Committee, and has now come to stay with the publication of the Bombay Plan and the setting up of the Department of Planning and Development in the Government of India. It is almost unanimously agreed that while agricultural planning is of fundamental importance for India, increased industrialization must be simultaneously planned if the standard of living of the people is to be raised. It will be readily appreciated that for effective Industrial planning, reliable estimates of Capital actually employed in the existing industries are a prime necessity. Our future needs of capital can only be measured on the basis of such estimates.

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[1] P. 28, Part I. "A plan of Economic Development for India". 1944.

[2] P. 27, Ibid.

Before making such estimates, we must define the capital to be estimated. Industrial Capital may have different meanings depending on the purpose for which the estimates of capital are required. In the economic sense, capital in relation to productive processes consists of all those goods existing at a particular time, which can be used in any way so as to satisfy wants during the subsequent period.[1] Some of these are consumer's goods, and some producer's goods, which co-operate with labour to produce further goods and services.[2] In the purely accountancy sense, capital of an industry or a firm is the aggregate of money at its disposal.[3] In a practical sense, these definitions can be related to the Assets side and the Liabilities side respectively of the balance sheet of a firm or an industry. These definitions, however, raise the crucial question whether the approach is to be from the assets side or the liabilities side, or, as Colin Clark puts it—is the approach to be a purely "money approach" as distinguished from what is termed "real approach". The answer to this question depends on our concept of industrial capital.

Let us first look at the implications of a purely money approach. A study of the methods employed in India, for raising capital for industry, lays bare the implications of such an approach. It is well known that before the development, on a large scale, of joint stock enterprise, capital for industry in India was mainly found by individual entrepreneurs. It is common knowledge that in the peculiar conditions of development of industry in India under the Managing Agency system, Capital for industry has been mainly found by the managing agent himself or his friends, or by loans on the credit of the managing agent. No estimates of savings from the total annual income are available in India. Further, it is not possible to judge what portion of these savings has been invested in Industry. But the general tendency in India, even when capital and savings increase, has been for the public to invest them in

[1] P. 73, "The Social Framework", J. R. Hicks.
[2] Ibid.
[3] P. 47, Ibid.

real property. Again investment in industry has not been diffused or broadbased. The absence, in the initial stages, of a well developed Banking System "threw the whole burden of industrial finance on a limited class of entrepreneurs (managing agents)".[1] Under the circumstances, two of the essential requirements of a money approach viz. a knowledge of the extent to which private savings have been invested in industry and the part played by bank loans in furnishing capital to industry, are absent. The difficulties of a purely money approach become even more patent when we examine the result of this mode of industrial finance. Since the burden of finding capital was thrown on the managing agents, industry was largely undercapitalized. "Even in Bombay City, where the Capital resources were ampler and the number interested in the industrial concerns larger, the cotton industry was established with the initial paid up capital not always sufficient to pay for the block and totally inadequate for the working capital required."[2] Industrialists in India have always maintained that the working capital of a business concern is to be met entirely from bank credits. Even the Central Banking Enquiry Committee held the view that industrial concerns "may reasonably expect to have the *whole* of their working capital supplied by commercial banks".[3] Wether industry should rely on bank credits or not, and the extent to which public deposits may provide finance for industry, are not relevant to our purpose. A few facts, however, emerge from this discussion. There is undercapitalization in industry. Bank credits have been limited. For Working Capital, industry relies on public deposits and managing agent's loans. Paid up or issued capital often represents only the fixed capital needed for the industry. It is also not possible to get any accurate data regarding the aggregate borrowings and reserves of industries. These facts are sufficient to demonstrate that in order to arrive at an estimate of the capital employ-

[1] P. 141, Industrial Organization in India, Dr. P. S. Lokanathan.
[2] Indian Central Banking Enquiry Committee, Vol II.
[3] P. 229, Ibid. Report.

ed in industry, the money approach or the approach from the liabilities side of the balance sheet, is not likely to give reliable results. Data for such an approach is not available even if we chose to adopt it. A considerable section of industry in India is not run on joint stock basis. Even where it is so, details of capital other than paid up capital, are not easily available. Reliable figures of loans to industries by banks and more so, loans by managing agents, are not available. The extent to which debentures form a part of working capital is also not clear. While these details may be available for specific industries, they are not available for all industries, i.e., for the whole industrial structure of India.

It is relevant to mention in this connection an estimate of capital employed in Indian industry, ascribed to Dr. Jeidels. In estimating the value of the investment market in India, Dr. Jeidels reached a figure of Rs. 700 crores as the total capital invested in Government, municipal and other local bodies, loans and securities, and in industrial and joint stock companies, including deposits with banks but excluding the bulk of foreign capital functioning in the country.[1] This estimate of capital has been often quoted in economic discussions up-to-date. It is difficult, however, to say how it has been arrived at, and, whether it can at all be related to Capital in manufacturing industry.

Because of these difficulties in pursuing the money approach, we have ventured to make a fresh estimate of industrial capital based on the "real approach", which at the same time gives capital employed in the "economic sense". Ours is an approach from the angle of production; that is to say, an approach, which would give us the estimate of capital synonymous with capital assets necessary for obtaining a given quantum of production. The sources from which capital is found, and the mode of industrial finance are not so material to our purpose as is the total money value of fixed and working capital sunk in the indus-

[1] P. 636, Report "Indian Central Banking Enquiry Committee" and Vol. IV, P. 149.

try for productive purposes. It may be noted, incidentally, that an estimate thus obtained can be theoretically equated to an estimate obtained by the money approach.

In adopting the real approach, it becomes necessary to define as clearly as possible the concept of capital which we want to estimate, because, even "real capital" can have various meanings. It may mean only fixed capital not including land, other than its improvements.[1] It may mean Fixed Capital including Land.[2] It may be the total of Fixed and Working Capital, either including Land or excluding it. The most comprehensive definition of Capital employed in Industry should be the total of the value of Land and Buildings, Plant and Machinery and Working Capital, because this would give the whole quantum of Capital needed by the industry for productive purposes. Even when the approach is clarified, and the type of capital defined, the concept is incomplete till we specify the period to which the estimate relates, the prices in which it is expressed, and the field of industry which it covers. Briefly, our estimates are for capital employed in industry during 1938-39 and are expressed in prices of the same year. They cover all factories engaging 20 or more workers and using power, whether situated in British India or the Indian States. Apart from the fact that estimates, to be useful, must relate to an year of normal economic conditions, there is another reason for selecting the year 1938-39. Just as after the World War I, the year 1914 was generally accepted as the Base Year, so with the end of World War II, we believe, a new Base Year will have to be adopted for comparisons of prices, construction of indices and judging economic progress. The choice is most likely to fall on the year 1938-39 i.e., the year immediately preceding the war. Our estimate, related as it is, to the year 1938-39 has therefore this advantage that it can be more easily related to other economic data for that base year and can itself be used as basic data for future estimates of Capital. In the

[1] P. 163, "Economica" New Series, Vol. XII, No. 47, August 1945.

[2] See discussion P. 74 "The Social Framework", J. R. Hicks.

chapter on Concept of Capital we have discussed at length these and other related questions.

Having defined the concept, we must now consider the methods by which the estimates have been made. Theoretically speaking, there may be several ideal methods e.g. a census of production should give the actual capital employed. In its absence, sampling methods can also give reliable estimates. These methods are however beyond the reach of individual research students for obvious reasons. Again, the well-known limitations of the published statistics relating to Indian industry preclude the use of any uniform method, as well as the application of any refined statistical techniques. The choice of methods of estimation is therefore primarily governed by the nature of statistical data available. In order to make the best possible use of such data, we have classified the industries into four main groups according to the nature of data available in each case. The first group consists of those industries for which reliable data is available from the Reports of the Indian Tariff Board. The second group comprises industries in respect of which imports of Plant and Machinery for a number of years prior to 1938-39 are known. The third group covers industries in respect of which it is possible to estimate the gross value of production, which when multiplied by the ratio which subsists in corresponding Canadian industries between capital employed and gross output, would give estimates of capital. The fourth group relates to those industries for which available information is confined to the number of workers employed. Depending on the different kinds of data available, the method applied also differs. We have employed four different methods which are discussed in detail in Chapter III. It may be asked, how the ratio subsisting in Canada between capital employed and gross output can be applied to comparable Indian industry. In the chapter on Methods, we have fully discussed this pertinent question and cited evidence justifying such application with necessary modifications. It will also be noticed from the tables at the end of Chapter III that the ratios which hold good in other

countries, of Fixed Capital to Total Capital, of value of Plant and Machinery to Fixed Capital, and of working Capital to total capital, have been employed to determine the components of capital employed in Indian Industry. Underlying the application of such ratios is the assumption that for a given industry working under comparable technological conditions, these ratios do not materially differ as between countries. This assumption seems to be substantiated by the fact that the values of components of capital employed, arrived at by using a different kind of ratio in each of the methods of estimation, compare very closely. The estimates arrived at by applying several methods are given in the tables at the end of Chapter III. The tables are self-explanatory. The technique of calculation in case of each industry and comparison of the estimates of capital employed, as well as its components, arrived at by different methods, are described in Chapter IV.

Our estimates have been made from data which are admittedly insufficient. The methods are therefore mostly empirical. The ratio of capital to net output has been used in other countries for studies of capital formation, and for demonstrating its stability both over time and space. But neither this ratio nor the ratio of capital to gross output has been used, as far as we are aware, for estimation of capital at a point of time. Our attempt to use the property of statistical stability exhibited by the latter ratio, to estimate capital is, therefore, in a sense, somewhat unconventional. Similarly the use of a method based upon statistics of imports of Plant and Machinery, and the average rate of depreciation, to estimate capital for a given industry, has not been attempted so far. Because our methods are empirical and mostly novel, it is essential to ensure sufficient confidence in the estimates made by such methods before they are accepted as valid. To this end, we have checked the estimates arrived at by any one method at every possible stage, against those arrived at by other entirely independent methods. This has been done for the estimates of "Capital Employed", as well as those of its com-

ponents in case of individual industries. We have also checked the estimate of aggregate capital employed in Indian Industry, and the estimate of Plant and Machinery in industry as a whole. The discussion on checks in Chapter V and tables for individual industries in Chapter IV amply demonstrate the remarkable agreement between estimates arrived at by different methods, and hence, the reliability of our estimates for individual industries and also for industry as a whole.

If therefore we accept the findings of this investigation, we can draw several interesting conclusions. These are discussed in Chapter V. In light of the main objective of this investigation, the primary conclusion we come to is that the capital employed in large scale manufacturing industry in India in 1938-39 was of the order of Rs. 6,750 million, in terms of prices of the same year. Perhaps the most significant of the ancillary conclusions is, that the ratio of capital employed to net or gross output for a given industry, in one country, can be applied to estimate capital in the same industry in another country, provided we have sufficient material to determine the correction to the ratio, for offsetting the effects of difference in industrial efficiency between the two countries. Another important conclusion is that the ratios between the components of capital employed, relevant for a given industry in one country, may be applicable to the same industry in another country, provided the technological conditions in the two countries can be assumed to be more or less identical.

In the concluding chapter, we have discussed some of the uses to which these estimates can be put. We may however state here, three of the more important uses which are of current interest. Firstly, having known the estimate of capital employed in industry in the immediate prewar year, we can ascertain capital formation in industry during the war when, either an estimate is made for the immediate postwar year on basis of data yet unpublished, or necessary figures of capital are obtained through the enforcement of the Industrial Statistics Act, 1942. Secondly, an approximation to the wartime accumulated

demand of Plant and Machinery for replacements in Indian industry can be obtained on the basis of our estimate of Plant and Machinery installed in Industry in the prewar year, and a knowledge of the appropriate rate of depreciation, as well as of prices of machinery, under wartime conditions. Thirdly, these estimates can be utilized to measure additional capital requirements to raise National Income from Industry to a given level, and more particularly, to select industries which should be fostered with the object of making the best possible use of the available capital resources.

Since these estimates can be put to many important uses, we have been constantly aware of the danger inherent in overestimating or underestimating the capital employed in Indian industry. The task we have undertaken is admittedly difficult. As Colin Clark observes "The tedious and intractable problems of measuring real National Income are child's play in comparison with the difficulties of measuring National Capital."[1] However, in so far as this investigation relates to measuring capital in manufacturing industry only, the difficulties are not insuperable. Even so, it is highly important in a work of this nature to ensure that the estimates obtained are neither inflated nor deflated. The evils of improper estimates are many. In France, for instance, formulation of estimates of capital with a view to measuring the country's economic progress was once in vogue. But, by and large, these estimates were inflated. In fixing the French War Indemnity in 1871, Bismarck quoted, much to the French Government's embarrassment, a number of inflated estimates of National Capital made by French statisticians. While we do not fear that Indian Industry will ever have to face the evil genius of a future Bismarck, moral of the history is clear. That every precaution has been taken to avoid inflated or deflated estimates will be evident from the methodology of the investigation and the checks exercised at every possible stage. Even so, the use of quasi-statistical methods in-

[1] P. 374, "Conditions of Economic Progress", Colin Clark.

evitably implies a bias, which may be present in our estimates. We have therefore stated the aggregate capital with an awareness of a possible margin of error, which according to our calculations, comes to approximately 6 per cent. The aggregate capital in Indian Industry would thus be Rs. 6,750 million + 6 per cent.

Even with regard to estimates for individual industries, we have sufficient reason to state that they are not likely to have a margin of error greater than + 6 per cent.

CHAPTER II

THE CONCEPT OF INDUSTRIAL CAPITAL

The main problem in this investigation is to formulate reliable estimates of capital invested in important individual manufacturing industries, and to arrive at the approximate aggregate capital locked up in the whole sphere of manufacturing industry in a recent year, which, in the economic sense, can reasonably be regarded as a normal year.

For a scientifically accurate solution of the problem it is of the utmost importance to define as precisely as is practicable, the meaning and character of the capital which we propose to estimate, both for individual industries and industry as a whole. In other words, our concept of capital must be unambiguous and clearly defined if the estimates are not to be meaningless. The concept of capital to be adopted in an investigation of this kind is governed by the purpose for which the estimates are perpared, and the use to which they are to be put. It also depends partly on the adequacy of available data and the possibility of basing a scientific investigation on the same. As we have already observed, theoretically, it is possible to have more than one concept of capital. This is clearly indicated by the different meanings attached, in common usage, to the term "capital invested in industry". We do not intend to enter here into a detailed discussion of the different possible con-

cepts of capital and related estimates based on differing purposes. It seems to us that such a discussion is not likely to bring us nearer the object we have in view. To lead us up, however, to the concept we have adopted, and for clarity in presentation, it is relevant to state briefly the classes of different concepts of Industrial Capital. These classes may be stated as follows:—

(1) Amount in Rupees of "Paid up", or subscribed share capital of industry.
(2) The value of the industry's fixed assets, Working Capital and non-productive assets such as investment in Securities Shares of other concerns, etc.
(3) The value of Paid-up Share Capital of the Industry, *plus* the reserves and non-productive investments.
(4) The value of Paid-up Share Capital of the Industry, *plus* the value of debentures issued, and amounts borrowed from banks, and/or the public, and/or the managing agents.
(5) The value of Paid-up Share Capital of the industry, Debentures issued, Loans from Banks and/or managing agents, and deposits from the public, excluding non-productive investments such as holdings of securities and shares of other concerns.
(6) The value of Paid-up Share Capital of the industry, the reserves maintained, debentures issued, and borrowings from banks and/or the public and/or managing agents, excluding non-productive investments.
(7) The value of Land and Buildings, Plant, Machinery and Equipment, *plus* the Working Capital actually employed in the industry.

Of these different concepts we have adopted the concept last defined in the present investigation. Our estimates of capital both for individual manufacturing industries and for manufacturing industry as a whole are in effect estimates of the money value of real capital em-

ployed in the relevant spheres. This is essentially an economic concept of Capital, and in so far as it relates to finances required for production of goods and services, it is fundamentally different from the balance sheet concept, considered either from the Assets or Liabilities side, both of which inevitably take into account non-productive investments such as interest bearing securities and shares of other concerns. These estimates give for the industry concerned the value of Land and Buildings, the value of Plant, Machinery and Equipment and the Working Capital.

The year for which the estimates are made is an integral part of the concept of capital which we have adopted. The estimates must relate to the most recent normal year to give validity to the concept adopted and to make the estimates useful. We have, therefore, selected the year 1938-39. There are many reasons which can be cited in support of the concept of capital adopted here, as well as the year chosen for purposes of estimation. The main reason for the choice, however, is that both the concept and the year chosen are most appropriate to the purpose underlying this work.

Before the blue-prints of industrial development of a nation can be prepared we must know two things. Firstly, we must have reliable estimates of the total capital actually employed for productive purposes in individual industries, as well as the whole industrial structure; these estimates must again relate to a year of normal economic conditions. Secondly, we must have estimates of finances needed for purchase of Land, erection of factory buildings, purchase and installation of Plant, Machinery and Equipment, and for maintaining an appropriate level of Working Capital, so as to attain given levels of production in existing individual industries, as well as the totality of industries. Owing to lack of proper estimates of this kind the authors of the 'Bombay Plan' were compelled to adopt rough and ready methods for estimation of Industrial Capital required for projected development. For this reason alone, a precise concept of Capital such as the one adopted here, would be justified. Apart from this main

justification, however, the concept is useful for several other purposes. Since these estimates give separately the values of Land and Buildings, Plant and Machinery and Working Capital, both for important individual industries and industry as a whole, they provide a basis for estimating separately under these subdivisions, the capital required for attaining predetermined levels of physical production in certain cases, and net production for all industries. There is also another important purpose. The capital employed in a given industry, during a given period, bears a relation to the net as well as gross production during the same period. This relation is statistically stable for a given industry or a group of industries over a short period, provided there is no revolutionary technological change in the industry during the period. The present estimates thus provide the basic material for determining these relations between capital and production for Indian Industries. Thirdly, these estimates, split up as they are into value of Land and Buildings, Plant and Machinery and Working Capital, can be used for determining the proportions *inter se* of these components of total capital. This can be further done for individual industries and the structure as a whole. It is interesting to note that for a given industry these proportions are, in a statistical sense, indicative of the characteristics peculiar to the industry.

As the year chosen for these estimates is also relevant to the concept, we may now examine some of the reasons governing the choice of the year 1938-39. It will be readily appreciated that the year 1938-39 is the most recent year during which economic conditions in general and industrial conditions in particular can be said to have been more or less normal. Soon after the outbreak of the second world war prices began to rise, slowly at first, and then more steeply. Industry began to operate on multiple shifts, facing all kinds of shortages, and changed its pattern of production to suit war-time needs. In the absence of normal imports of machinery and spares, existing Plant and Machinery suffered ever-increasing strain owing to the lack of adequate replacement of wear and tear. By very

contrast with conditions of industrial production during the war, the year 1938-39 must be considered normal. Again, the year 1938-39 is about the third year following the period of complete recovery from the depression of the thirties. Economic conditions in the country were then neither markedly characteristic of a period of acute depression nor abnormal prosperity. The methods of estimation used by us in this investigation would not hold good for a subnormal or an abnormal year when industrial production is either curtailed below normal capacity or increased artificially i.e. without a corresponding change in the capital assets of the industry. Further, estimates of capital based on data not pertaining to a normal year cannot be related to other economic data for normal periods.

Even when our concept is circumscribed in the above manner, strictly speaking, it lacks precision and clarity necessary for a scientific estimate. Apart from the definition of the type of capital to be estimated and the year to which the estimates relate, it is necessary to fix our ideas about the following important points:—

(1) When speaking of industrial capital what exactly is our concept of "Industry"?
(2) For what sphere of industry do we require the estimates of capital employed?
(3) How do we propose to express our estimates of capital employed?
(4) What is the territory covered by the present estimates?

Let us discuss the first two points.

In common usage the word "Industry" has many meanings. To some it may mean the aggregate of productive activities of a nation; to others it may connote one or more of the many spheres of productive activity such as agriculture, manufacturing, mining, banking, insurance, shipping, etc. In fact, it is difficult to define "industry" so as to bear only one meaning in practical economics. We can only state what we mean by "Industry" in the present context. The concept of industry here connotes the aggre-

gate of factories governed by section 2(*j*) of the Factories Act, 1934, i.e., factories operating with the aid of power, and employing 20 or more persons per day on an average. Industry so defined covers practically all large scale manufacturing establishments of India, and thus excludes small scale and cottage industries, as well as mining. This concept of industry is the same whether we are speaking of any one manufacturing industry or of manufacturing industry as a whole. One of the reasons why we have selected this specific sphere of industry is that, it is only in the case of large-scale manufacturing industry that we can hope to arrive at any reliable estimates. The data available for other sectors of manufacturing industry is scanty and uncertain, and even the most detailed investigation would not give reliable results. Further, estimates of capital employed in manufacturing industry are likely to prove far more useful than would appear at first sight, for the reason, that in the present day economic conditions of India, manufacturing industry is relatively far more important than other sectors of industry. It has been amply recognized that the solution to the problem of raising the standard of living in India largely lies in increasing national income by accelerating and expanding production of large scale manufacturing industry capable of turning out both producers' goods such as Machinery, Machine Tools, Steel, Heavy Chemicals, etc., and consumers' goods such as textiles, sugar, paper, etc.

It is true that capital is only one of the factors of production. Other items such as labour, power, etc., will also have to be taken into account in laying out development plans. However, in a country like India, which, though industrially backward, possesses ample resources of labour and of unexplored or under-utilized raw materials, capital is probably the most flexible factor of production. This being so, in India, Capital can be employed to utilise available labour and exploit raw materials to the fullest extent. The main problem then will be to adjust our capital resources to capital requirements, with the object of attaining the optimum level of economic development in

terms of per capita national income. It seems to us that for this purpose estimates of the capital employed in Indian industries are a prime necessity.

Let us now consider how we propose to express our estimates of capital employed. To obtain the necessary clarity in our concept of industrial capital it is also necessary to decide on the unit in terms of which "Capital Employed" is to be measured. Our concept of capital relates to the productive assets of manufacturing industries. The character of various items comprising industrial assets will vary somewhat between one factory and another in a given industry, but considerably, between different industries. It may also to some extent vary in time. It, therefore, becomes imperative to adopt a unit for measuring assets, which is commonly applicable to all types and classes of industrial assets and all industries. The aggregate estimates of capital employed measured in such uniform unit will then be comparable as between industries and at different time-intervals. Since all assets can be sold or purchased, the common monetary unit, viz., the Rupee, immediately suggests itself. But the concept of capital, or in the present context, the assets, cannot be said to be sufficiently clear even when assets are expressed in terms of their rupee value. As is well known, the assets of a given industry can be evaluated in terms of three different prices, viz.:—

(a) Cost Price
(b) Market Price
(c) Replacement Price.

In so far as Working Capital is concerned, it is immaterial whether estimates are made at one or the other of the above prices. This is so because items comprising Working Capital are essentially consumable goods and as such the cost, market and replacement prices over a short period would very nearly be the same. The fixed capital of an industry, however, consists of durable goods or assets such as Land and Buildings, and Plant and Machinery. Estimates of fixed capital based on three different types of

prices are therefore likely to vary widely. In the present work we have attempted to estimate capital employed in India's manufacturing industries, at its replacement value in the year 1938-39. There are several reasons why we have chosen the replacement value. The primary reason is that this value is the most appropriate if estimates of capital employed are either to be utilised for judging future capital requirements, or for comparison of capital employed at different points of time. It will be readily appreciated that Market price is altogether unsatisfactory, because, firstly, it cannot be ascertained without a detailed investigation; and secondly, even if it were so determined, it will be governed to a greater extent by institutional and subjective factors, rather than the reality of economic conditions. The determination of "present value" on the basis of original cost, additions, improvements, and depreciation, would enable us to estimate fixed capital in the usual balance sheet sense. Such an estimate should not in fact differ materially from an estimate at replacement value, as machinery prices do not fluctuate widely over a short period in normal times. But for our purpose it will not be as relevant as the estimate at replacement value. The original cost of fixed assets of an industry cannot be correctly ascertained because:—

(a) Individual units in the industry will have come into existence at different times, and, therefore, the aggregate original costs of assets in each unit cannot be related to a particular period.

(b) The aggregate of original costs cannot be estimated by use of price indices, since even the basic data, regarding the date of establishment of each unit of industry and the machinery prices ruling at the date, is not available.

These considerations show that the choice of replacement value is also justified on practical grounds; for, it eliminates considerations of individual units, and can be related to production, as well as to a particular year.

We have now to consider the territory covered by the estimates.

It will be noticed that we have defined "Industry" as the aggregate of factories covered by Section 2(*j*) of the Factories Act, 1934. Since the Factories Act is a Government of India legislation, ordinarily factories in such an Industry can be situated only in British India. Our estimates, however, cover all large-scale factories and hence all manufacturing industries, whether they are located in the British India or in the industrially advanced Indian States where legislation parallel to Factories Act is in operation, and returns under it are available.

To sum up, in the present investigation, the concept of industrial capital connotes the replacement value of capital employed in 1938-39 in manufacturing industries in India (including the Indian States) comprising factories governed by Section 2(*j*) of the Factories Act, 1934. To give a detailed itemisation, the "Capital Employed" in respect of any industry will consist of:—

(1) *Fixed Capital*—

(a) Replacement value (in rupees), of land on which factories in the industry were situated, in the year 1938-39.

(b) Replacement value (in rupees), of Factory Buildings and attachments, in the year 1938-39.

(c) Replacement Value (in rupees), of Plant and Machinery and other equipment of factories in the industry, in the year 1938-39.

(d) Replacement value (in rupees), of other fixed assets such as furniture, fixtures and fittings, Trade marks, Patents, Railway sidings, etc., in the year 1938-39.

(2) *Working Capital*—

(a) The value (in rupees), of stocks of raw materials, fuel and stores, as at the end of the year 1938-39.

(b) Value (in rupees), of stocks of finished and partly finished goods, as at the end of the year 1938-39.

(c) Cash, with factories in the industry; or in the Banks on their account, as at the end of the year 1938-39.

(d) Rupee Value of the net balance (*plus* or *minus*), as the case may be, as at the end of the year 1938-39, of total debts of the Industry, *minus* the total credits due to the industry. The debts will consist of Bills of Exchange payable, temporary loans, public deposits, and other borrowings of the industry. The credits will be the outstanding debts due to be collected, advances made against goods or to employees, Bills of Exchange received, etc.

From the details of items described above, it will be seen that the Balance Sheet can also provide material germane to the concept of capital adopted by us. The estimates based on this concept should therefore give us a snapshot of industrial finances at a point of time.

One interesting point about the concept of capital now remains to be discussed. The components of capital may assume different values at each instant during the year in question. Thus, for instance, Working Capital, in fact changes almost continuously and will therefore have different values at different moments. Depending on such continuous variations in the components, the aggregate capital may also assume a number of different values. Our estimate represents only one of the large number of values which such an aggregate may assume. Hence, theoretically we should expect industrial capital as a whole to vary every moment. To ascertain the annual average of capital employed in a given industry we must first obtain the successive differences, in the values of capital, positive or negative as the case may be, at the shortest possible time-intervals. We must then work out the average variation over the whole year, and add up this average to

the capital employed at the beginning of the year in question. In practice, however, the variations in both Fixed and Working Capital of an industry, over a short period of twelve months, are not likely to be marked or significant. In the present investigation, therefore, we have assumed that our estimates relating to the year 1938-39 are fairly representative of estimates at any given instant in the year. The application of integral calculus to the problem discussed above will give us mathematically more exact estimates. This, however, is not possible because of the difficulty of collecting adequate observational data regarding changes in capital, at short intervals. We have, therefore, to rest content with estimates such as are attempted here. The usual practice, however, of preparing Balance Sheets as at the end of the last day of the accounting year, may be noted in this connection. It is evident from this practice that an estimate of capital at a particular instant in a given year, in fact gives a sufficiently reliable picture of the financial position of industrial concerns, and that further refinement in statistical tools with a view to framing mathematically exact estimates, is not essential from a practical standpoint. Besides, such estimates bear a statistically stable relation to net output of industries, and if available for a series of years, can provide reliable statistical material for studies of Capital formation in Industries.

CHAPTER III

THE METHODS OF ESTIMATION

As we have stated in the introduction we are conscious of the fact that the data available in India for purposes of an investigation of this kind is neither comprehensive nor very precise. Even so, sufficient material is available, which if analysed with the help of statistical methods, can yield useful conclusions. It is in this spirit that we have devised the methods actually employed in this investigation. Some of these methods are, therefore, in a sense,

quasi-mathematical and some only arithmetical. Broadly speaking, the whole process of devising the method, applying it, and interpreting the result in this investigation belongs to inductive logic. The methods employed are mainly conditioned by the nature of the available data. The estimates of capital are obtained with an awareness of the possible "margin of error" inevitably introduced by insufficiency of available data, and the consequent imperfections of the methods employed to make the estimates. The "margin of error" here is, however, not synonymous with what is recognised as such in Statistical Theory. It is only indicative of the range within which the estimates may reasonably be expected to lie.

Before discussing the methods actually employed it would be useful to examine the methods which can, theoretically, be adopted for an investigation of this kind. To re-state the problem, we want to estimate the replacement value of Capital Employed in the year 1938-39 in India's manufacturing Industry, i.e., in the aggregate of factories governed by Section 2(*j*) of the Factories Act, 1934. We require this estimate for the industry as a whole as well as for certain individual industries. It is obvious that this problem can be most completely and reliably solved by conducting a full-scale census of industries and of their production. All the units of an industry, and all industries can, in such a census, be asked, under statutory obligation, to furnish exact information about the "Capital Employed" by them. A proper classification of the returns of individual factories and integration of the relevant statistics furnished under such a census would enable us to obtain immediately the figure we are after. It may be argued that employment of the census method will only give the present value—not necessarily the replacement value—of the assets of an industry. This argument is not, however, valid because, under statutory obligation, the factories can be asked to furnish the replacement value and the onus of ascertaining such value can rest on the factories concerned, as has been done in fact, under War Risk (Factories) Insurance Ordinance, 1942. In any case the appli-

cation of the census method is clearly beyond the scope of individual research workers. It can only be employed by the state with necessary enabling legislation.

Alternatively, we may employ what is known as the sampling method. From the total number of factories governed by Section 2(*j*) of the Factories Act, 1934, a suitable number of units in each specified industry may be selected at random as a sample. Necessary statistics may then be obtained from the sampled factories and applying the average of capital employed per unit labour for sampled factories in each industry to the total labour force employed in that industry, we can obtain estimates of capital in certain specified industries. Having obtained estimates of each industry by this method, they may be aggregated to give estimates for industry as a whole. Even this approach is, however, impracticable for individual workers because of the difficulties firstly of getting necessary statistics from sampled factories in response to an enquiry from an individual, and secondly the enormous task of conducting a sampling enquiry in a field comprising more than 10,000 factories spread over a vast sub-continent. Indeed, if it were possible for a couple of individuals to collect from every manufacturing unit the exact statistics required for measuring capital employed, we should have no need for estimates; we would get the exact figures. The two methods described so far are, what we may call direct methods of approach. But since it is not possible for an individual either to conduct a full-fledged census or even a scientifically sound sampling enquiry, we must devise other methods to obtain the estimates.

In the economic field, the choice of methods other than census, or sampling, for framing statistical estimates depends largely on two considerations:

(a) The nature and availability of requisite statistical data.

(b) The degree of accuracy which the estimate should ensure.

To a large extent, the nature of available data will determine the methods employed for estimation. In India,

statistical data relating to industrial capital, suitable for our purposes can be obtained from Balance Sheets of Joint Stock manufacturing concerns, statistical abstracts of India and abstracts and year books of other Empire countries such as Canada and Australia, and from certain other ancillary material such as statistics relating to prices, imports of machinery, etc. We can also obtain such material from reports of the Tariff Board, reports of the Indian Central Banking Enquiry Committee and from reports of Government, Industrial Associations Chambers of Commerce, etc. Even when all this material is gathered, it must be admitted that the data available is mostly incomplete, meagre and in some cases not wholly reliable. At any rate, it is not eminently suited for application of any refined statistical techniques. To a large extent, this paucity and incompleteness of data also militates against the accuracy which our estimates should ensure. Objectively speaking, our estimates should be as precise as possible. To put it in a statistician's parlance, our estimates should be "Best Estimates". Under the circumstances, however, it is extremely difficult to ensure such precision in the estimates, at least in the modern statistical sense. If the estimates were obtained by refined statistical methods, such precision would be automatically ensured, and their verification would be superfluous. Since such methods cannot be employed, we have sought to ensure precision by exercising one or more checks on each of the estimates made in this investigation. Thus, estimates for each of the individual industries have been obtained by two or more independent methods, and these have been accepted as fairly good estimates, only if they agree closely. Similarly, the estimate for industry as a whole has also been checked by criteria entirely unrelated to the methods employed for obtaining the estimate.

The available statistical data as indicated above immediately suggests that we may, if necessary, employ one or more of the following indirect methods based on the balance sheets of Joint Stock manufacturing concerns:—

(a) Synthesis of balance sheet statistics for the year 1938-39 of Joint Stock concerns in each manufacturing industry under the heads Paid up Capital, reserves on account of depreciation, debentures issued and other liabilities incurred (excluding reserves maintained for pension or provident funds, staff welfare, etc.).

(b) Synthesis of balance sheet statistics for the year 1938-39 of Joint Stock concerns in each manufacturing industry under the heads, Paid up Capital and the total net debts.

(c) Synthesis of balance sheet statistics of Joint Stock concerns in each manufacturing industry under the heads, Value of Land and Buildings, Value of Plant, Machinery and Equipment, and the Value of Working Capital.

While these methods will probably yield interesting results in case of industries wholly run on joint stock basis, they are not applicable uniformly to all industries or to industry as a whole. Of the total number of factories in the year 1938-39 governed by Section 2(*j*) of the Factories Act, 1934, only about 42 per cent. were run on Joint Stock basis. The application of these methods would, therefore, leave a large section of the manufacturing industry uncovered. Estimates for this remnant will then have to be obtained by relating the capital employed in joint stock concerns to the number of workers employed by the factories in question, and applying the resulting relation, to the labour employed in the remnant. It is also found that the voluminous task of analysing balance sheets will not yield commensurate results either in comprehensiveness or accuracy. For example, an analysis of the balance sheets of 30 cotton mills, each of them with a paid up capital of more than 30 lakhs, gives us the following results:

Paid up Capital	Production (in value)	No. of workers employed.
Rs. (000)	Rs. (000)	
173,301	314,752	104,225.

The production per worker on this basis would be approximately 3,020 rupees or at the average known rate of approximately Re. 1/- per lb. of cloth, the quantitative production per worker would be 3,020 lbs. of cloth. The total number of workers employed in 1938-39 in the cotton textile mills was 442,000. On the above basis, the total production must be in the neighbourhood of 1,335 million lbs. which is obviously incorrect.[1] The paid up capital per worker, from the above table, comes to Rs. 1,662.7 per worker. The total paid up capital of Cotton Textile Mills, on this basis, would thus amount to Rs. ~~171.923~~[735] million which again is a highly inflated figure.[2] More important than this, however, are other considerations. In countries where the practice of preparing balance sheets has been made uniform by statute, so as to reveal correctly the capital structure of the industry, application of these methods would be feasible. In fact such estimates have been attempted in Germany.[3] But in India, the practice widely differs, not only between industries but also between different concerns of the same industry. No uniform practice is either enforced by statute, or commonly adopted by convention. Another important consideration is the fact that the balance sheet does not reveal secret reserves, or the undercapitalisation, if any, in the industry, and inevitably takes into account unproductive assets such as investments in securities and shares of other concerns. Occasionally, assets are also overvalued in balance sheets. Then again, our analysis of balance sheets can give us the original cost of assets less depreciation for a given period, plus additions during the period, and therefore, the present value of the assets. This value is, however, equivalent to money required to replace the assets at the original cost, but is not the replacement value of the assets in the year for which the estimate is

[1] Recorded production in 1938-39 was about 920 million lbs.
[2] Recorded Paid up Capital was Rs. 408·700 million in 1938-39.
[3] P. 19, "Statistics relating to Capital Formation". Studies and report on Statistical methods, No. 4. League of Nations, Geneva, 1938.

made. Further, a proper interpretation of the figures on the liabilities side of balance sheets will give us the over-all total of capital employed in the industry, but the division of this total into fixed and working capital will not be easily possible. In so far as the balance sheet figures are not entirely related to production, the application of these methods inevitably implies a "money approach", i.e., the ascertainment of the money outlay for the acquisition of capital goods in the industry as distinguished from a "real approach", which aims at ascertaining the value of the various groups of capital goods actually employed in the industry. These complex considerations have not enabled us to employ the methods discussed above.

We may now proceed to consider other indirect methods for estimating capital employed in industry—methods which we have actually employed in this work. It may be clarified at the outset that the methods have been devised to suit the kind of data available. Industries have also been conveniently grouped according to the nature of available data. For the group of industries for which Tariff Board reports are available, the method is as given below.

(1) TARIFF BOARD METHOD

From the reports of the Indian Tariff Board, we may, for a given industry, first obtain the average value of Fixed Capital per unit quantitative production. This value is then to be corrected by a price index of capital goods, specially constructed for the purpose, to obtain fixed capital per unit of production in the year 1938-39. Applying this to the known actual production in the year 1938-39, we get fixed capital for that year in that industry. Similarly, we can also find out the average value of working capital per unit of production, correct it by the index of wholesale prices and obtain the working capital in that industry in 1938-39. The total of fixed and working capital gives us the total capital employed in the industry. We have then to work out separately the values of the components of fixed capital, viz., Land and Building, and Plant and Machinery.

To be able to do this, we have to derive the ratio of Plant and Machinery value to Fixed Capital, which subsists for that industry either in India or for the same industry in another country. For instance, such ratios are available for Glass and Match industries in India. In other cases, the ratio of value of Plant and Machinery to Fixed Capital for the same industry in Australia has been worked out. Applying this ratio to the value of total Fixed Capital already obtained, we get the value of Plant and Machinery in the industry. The remaining balance represents the value of Land and Buildings. This method has been applied to obtain estimates for some eight different industries as in Table I on page (38). It will be noticed that this method is applicable only to industries for which Tariff Board investigations are available. As an illustration of this method we may consider the Cotton Textile Industry. For this industry, the fixed capital per unit of production expressed in 1938-39 prices is Rs. 1.12 per lb. of cloth. The total production of cloth in 1938-39 was 920.476 million lbs. The Fixed Capital for the industry thus comes to Rs. 1,030.933 million. Similarly, the working capital per unit of production comes to Rs. 0.27 per lb. For the total given production it works out to Rs. 247.375 million. The aggregate capital employed in this industry, by this method, thus comes to Rs. 1.278.308 million. Estimates of capital employed in this industry by other independent methods (see Tables II and IV pages 39, 41, 42) described later, differ by less than 5 per cent. either way from the estimate by this method.

(2) MACHINERY IMPORTS METHOD

We now come to the second method of estimating capital. This method is based on statistics of imports of Plant and Machinery; and is therefore applicable only to those industries for which statistics of annual imports of relevant types of Plant and Machinery are available. In each case, the figures of imports of Plant and Machinery over a period of 15 to 20 years prior to 1938-39 are used to obtain the value of average annual imports (Table III

page 40). We have then constructed an index to reflect the price change during the period of 15 to 20 years on the basis of Statistics of machinery exports from the U.K. We have done so, because conversion of the value of average annual imports, in terms of 1938-39 prices on the basis of wholesale price index for India, would give misleading results. If the average rate of depreciation allowed for in a given industry is 5 per cent. or 10 per cent. the life of Plant and Machinery would be roughly 20 or 10 years, as the case may be. If we multiply the value of average annual imports expressed in 1938-39 prices by the length of life of Plant and Machinery, we should obtain the value of Plant and Machinery installed in the industry as at 1938-39. Two important implications of this method may be clarified at this stage. The average annual imports include, on the one hand, imports for normal replacements, against the depreciation of Plant and Machinery, and on the other, the annual additions to Plant and Machinery of the industries concerned. Assuming that replacement on account of wear and tear is more or less continuous, the multiplication effected above, gives a value composed of aggregate replacements over the lifetime of Plant and Machinery, and additions of capital equipment to the industry during the period. It, therefore, gives the value of Plant and Machinery at the end of the period, i.e., in 1938-39. Applying the appropriate ratio of value of Plant and Machinery to the value of fixed capital as observed for identical industries in Australia, we have derived the fixed capital employed in the industry. Similarly, applying the ratio which subsists in India for that industry, (as derived from Tariff Board reports), between working capital and fixed capital, we have obtained the working capital. The total of Fixed and Working Capital constitutes the total capital employed. Estimates for Cotton Textiles, Jute Textiles, Woollen Textiles, Sugar and Paper industries, have been obtained by this method (Table III page 40), in addition to estimates for these industries by other independent methods (Tables I and IV pages 38, 41, 42). It will be noticed that this method is wholly new and has not, to our

knowledge, been employed hitherto. However, in so far as estimates by this method compare very reasonably with those obtained by other independent methods, the implicit assumptions, and the validity of the method seem to be justified.

(3) THE RATIO METHOD

The methods described so far are applicable to some ten major organised industries. There are, however, a number of industries for which data for determination of Gross Value of Production is available. For such industries, owing to lack of other necessary data, we had to devise a special technique for arriving at estimates of capital. The method briefly consists of the application of the Canadian ratio of capital employed to Gross production (called C/G) to identical Indian industries. This method has been applied to fourteen industries for which gross value of production could be determined. The average ex-factory price per unit of production in 1938-39, for the products of an industry is first obtained [Col. (3) of Table IV page 41]. In some cases, this price determination is based on direct data, excluding, where necessary, the excise duty. In some other cases, it is based on data of fair selling prices available in the Tariff Board reports, which does not include excise duty. This is then corrected for price changes. In a few cases, where indigenous price per unit of any product cannot otherwise be determined, it is equated to the average declared landed cost, *plus* customs duty, per unit of similar imported products. This average price multiplied by the known quantitative production in 1938-39 gives us the gross value of production in that year. The capital employed in the industry is then obtained by multiplying Gross Value of Production by C/G of an identical industry in Canada. Estimates obtained by this method are given in Table IV pages 41, 42).

It will be noticed that direct estimates for some of the industries in Table IV have already been obtained in Tables I and III (pages 38, 40) by methods previously des-

cribed. They have been included, however, in Table IV with a purpose.

The estimate of capital for a given industry obtained by application of the ratio C/G for the Canadian industry, to the gross value of production of the same industry in India, is likely to be an under-estimate. This contention will be clear from the following considerations:—

(a) Since "Capital Employed" (C) consists of two main types of capital, namely, fixed capital (F) and working capital (W), we can equate the ratio C/G to the sum of ratios F/G and W/G. In other words $\frac{C}{G} = \frac{F+W}{G} = \frac{F}{G} + \frac{W}{G}$. Again, if we are examining the ratios C/G for the same manufacturing industry in two different countries, for a given year, we can assume the ratio F/G to be more or less identical in the two countries. This assumption would seem to be valid when we consider that for the same industry and during the same period, manufacturing processes as well as machines used for production are not likely to be very different in the two countries. This, at any rate, would be the position in regard to the major Indian industries, such as Textile, Iron and Steel, etc., which are known to employ fairly up-to-date methods of production as compared with Canada. It will therefore be seen that for a given industry, the values of ratio C/G in India and Canada will mainly depend upon the values of ratio W/G for the industry in these countries. This ratio represents the working capital per unit gross value of production. Since working capital consists of stocks of raw materials, stores, fuel, finished and partly finished products, as well as net amount of debts of the industry, it is apparent that the value of ratio W/G for a given industry will be lower in a country where the management of the industry is more scientific, and sounder methods of industrial organisation are practised. Critics of Industrial organisation in India have amply emphasised the point that, by and large, Indian industry is relatively backward in this particular respect.

This would mean that for a given industry, the ratio W/G should be higher in India than in Canada and we should consequently expect the Indian ratio C/G to be higher than the Canadian ratio C/G for the same industry. If, therefore, we multiply the gross value of production of a particular Indian industry by the ratio C/G for an identical industry in Canada, we obtain a figure of capital employed, which will be lower than the amount of capital which would, in fact, be needed to run the industry under Indian conditions.

(b) Again, owing to the relative inefficiency of labour in India, the physical production and hence the gross value of production per unit of capital (ratio G/C), for a given industry, is likely to be lower in India than in Canada. This factor will also tend to give a greater value of ratio C/G for the Indian industry compared to that for the corresponding industry in Canada. These considerations, however, would not hold good when comparing the ratios for entire structures of industry in the two countries. The reasons for this contention are explained in Chapter V.

It is therefore important to know the correction which should be applied to estimates made in Table IV, before they are regarded as valid for Indian conditions. With the object of finding out the correction factor, estimates by this ratio method, of seven of the important industries, are compared with estimates for those industries obtained from data entirely relating to Indian conditions, as in Tables I and III. On the basis of this comparison as in Table V (page 43), we have come to the conclusion that the correction factor would approximately be 10 per cent. In other words, we may say that 10 per cent. more capital would probably be needed in an Indian industry, for a given production, than for a similar industry in Canada. This correction factor has been applied to estimates in *Table IV, for those industries to which none of the previously described methods is applicable.* Eight such industries, with corrected estimates, are shown in Table VI

page 44. Estimates of total capital for these industries have been further subdivided into values of Plant and Machinery, Land and Buildings, and Working Capital by applying appropriate Australian and Canadian ratios. Tables IV, V and VI show clearly the details of this method. (pages 41, to 44).

The application of the ratio method is novel only in the sense, that it is used for estimation of Capital. Certain ratios have already been used for other kinds of statistical investigation. For instance, after extensive research on the relation which exists between Net Production, Capital and Labour employed, Prof. Douglas, in his admirable book "Theory of wages", has arrived at the production function

$$P = b\,L^k\,C^j, \text{ where}$$

P is Net Production
L is Labour employed
C is Capital employed

and

b, k, and j are constants, and $k = 1-j$.

Differentiating the function with respect to C, we get

$$\frac{dp}{dc} = (1 - k)\frac{P}{C}; \quad \text{or} \quad \frac{C}{P} = (1 - k)\frac{dc}{dp},$$

a relation which shows that the ratio C/P should be statistically stable.

So far, the ratio C/P is the one commonly used in statistical investigations. The main reason for using this ratio is the fact that, over time, the ratio C/P remains statistically stable for individual industries, and for industry as a whole. The application of C/P however depends on the knowledge of Net Production. In the absence of a Census of Production, data regarding Net Production of industries in India is not available. We can however estimate Gross Value of Production, and the application of the ratio C/G will equally serve the purpose, because this ratio itself bears to C/P a direct proportion, and is therefore statistically stable. This will be clear from the following observations.

TABLE (1)

Table showing the ratio G/P for Canadian Industries: 1936 to 1939.

INDUSTRY	YEARS			
	1936	1937	1938	1939
(1)	(2)	(3)	(4)	(5)
1. Cotton Textiles	..	..	2·27	2·18
2. Paper and Pulp	..	..	2·07	2·02
3. Paints and Varnishes	..	..	1·90	1·94
4. Glass	..	..	1·77	1·76
5. Heavy chemicals	..	..	1·60	1·59
6. Cement	..	..	1·38	1·35
7. All industries	2·33	2·40	2·34	2·26

From the above table it will be seen that the ratio G/P (Gross value of Production/Net value of Production) for separate industries as well as for industry as a whole is more or less constant over time. Again G/P is merely the ratio of C/P to C/G. The constancy of G/P therefore amply demonstrates the fact that C/G is proportionate to C/P. This being so, the estimates of capital obtained by applying C/G to Gross value of production will not materially differ from those obtained by applying C/P, to net value of production.

Certain studies by Carl Snyder[1] also show that the ratio C/P in various industries and the whole manufacturing industry of the U.S.A. is constant not only over short and medium periods, but also over long periods. This would also mean that C/G which is proportional to C/P is similarly stable over time.[1] Even so, it would be natural to enquire whether the ratio C/G subsisting in Canada, can be applied to estimate Capital employed in Indian industries. We can do so if we find that the ratio C/G is relatively stable in different countries over time, for a given industry as well as for the structure. The following table based on available data indicates that the ratio G/P, and

[1] Page 163, " Economica ". New Series Vol. XII, No. 47, August 1945.

therefore the ratio C/G, is more or less stable in the case of each of the four different countries.

TABLE (2)

Table showing values of ratio G/P, for different countries, over time.

INDUSTRY	COUNTRIES AND YEARS							
	Canada		U.S.A.		Australia		U.K.	
	1938	1939	1937	1939	1937-38	1938-39	1942	1930
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cotton Textiles	2·27	2·18	..	..	2·52	2·50	3·5	3·45
Breweries and Distilleries ..	1·73	1·65	1·6	1·44	1·68	1·74	..	..
Cigarettes, Cigars Tobacco ..	2·04	1·97	..	..	3·56	3·65	..	..
Heavy chemicals	1·60	1·59	1·9	1·78	1·94	1·91	..	..
Hosiery and knitted goods ..	1·92	1·96	2·0	2·0	2·18	2·16	2·8	2·44
Leather and tanneries ..	2·31	2·49	2·55	2·4	2·59	2·33	2·66	2·66
Sugar	3·58	3·30	6·43	6·4	4·79	4·86	..	..
Paints and Varnishes	1·90	1·94	2·38	2·25	..	..	..	..
Glass	1·77	1·76	1·46	1·43				
Miscellaneous	1·80	1·79	1·69	1·67	1·95	2·00	2·29	2·14
All Industries	2·33	2·27	2·41	2·3	2·55	2·46	2·42	2·24

In a recent study on "Capital requirements in progressive economies"[1] it has been demonstrated that the ratio C/P was constant over fairly long periods in the U.S.A., U.K. and South Africa. The ratio here is that of National Capital and Net National Output. The constancy of the ratio should, however, hold good even if we consider Industrial Capital and Industrial Net Output. Because of the fact that the ratio C/P is proportional to C/G, we thus get further evidence about constancy of C/G for industry, over time, in different countries.

It will, however, be noticed from the above table that the ratio G/P, and therefore the ratio C/G, for a given industry appears to vary to a greater extent between countries than over time. Such variation in the ratio between

[1] By Ernest H. Stern, P. 163, " Economica ", New Series, Vol. XII, No. 47. August 1945.

countries is to be expected depending upon technological differences, and difference in levels of efficiency for the same industry working in different countries. Before using the ratio obtaining for a given industry in one country, to estimate capital for the same industry in another country, it is therefore necessary to obtain a measure of such differences. This is precisely what we have done in deriving the correction factor in Table V. The validity of the ratio method, and the adequacy of the correction factor used, can both be judged by the fact, that estimates obtained by the ratio method, for industries in Table IV, when corrected by the correction factor of 10 per cent., agree very closely with estimates for the same industries, obtained by other independent methods. This agreement can be seen from the tables for individual industries, given in the next chapter.

(4) LABOUR STATISTICS METHOD

Even when the methods so far described have been used to the fullest extent, estimates of capital can be obtained only for some 16 large-scale manufacturing industries. These industries no doubt employ about 55 per cent. of the total labour engaged in the industry as a whole. Nevertheless, estimates of capital employed in the remaining sector of the industry, which engages about 45 per cent. of the total industrial labour in India, have to be made by other suitable methods. Available statistical information relating to such industries is confined to the daily average number of workers employed by them. Any method for estimating capital of this sector must therefore be based, on the relation either between gross value of production and labour employed or between capital and labour. We have obtained two different estimates for this sector, utilizing both these relations, as they are found to exist in the structure of specified industries for which we have derived all information by the first three methods. The method adopted here is as follows:

(a) We have first calculated for 1938-39 the gross value of production of each of the sixteen specified indus-

tries for which figures of physical production and unit prices are either available from published sources, or can be estimated (Table VII page 45). We have then calculated the Gross Value of production per Unit Labour in each of these industries, by dividing Gross Production by the daily average number of workers employed in the industry as in (col. 5 of Table VII page 45). We have then obtained the weighted average of these values of Gross Production per Unit Labour; using the number of workers engaged in each industry as the weights. Multiplying this average by the total number of workers (daily average) employed in the remaining sector, we have obtained the estimated Gross production of that sector of industry. To get the Capital employed in this sector, we have multiplied the Gross Value of production by the ratio C/G which subsists for a similar structure of industries in Canada. The figure so obtained is then corrected for probable underestimation to the extent of 10 per cent., as in the method previously given. The total Capital employed in these "Unspecified Industries" is then broken up into its components,—by applying appropriate ratios for the "miscellaneous" group of industries in Australia and Canada. The details of this method are shown in Table VIII on page (46).

(b) The second estimate is based on the relation between Capital and Labour. The Capital employed per Unit of Labour in each of the specified industries for which separate estimates have been framed by other methods, is first obtained as in col. 6 of Table VII (page 45). The weighted average of values of Capital per Unit Labour is then calculated, again applying the daily average number of workers employed in each industry as the weights. The Capital employed in the remaining structure, i.e., in the "Unspecified Industries" is obtained by multiplying this average capital per unit labour by the number of workers (daily average) engaged in such industries, as in Table IX on page 47). The total capital is then subdivided into its components by the same process as in other methods.

Estimates of Capital Employed in specified Indian Industries : (1938-39). [Based on information available in the Reports of the Indian Tariff Board, and Australian Ratios of Plant and Machinery Value to Fixed Capital (M/F). (Method 1. Chapter III)

(1) INDUSTRY	(2) Quantitative Production in 1938-39	(3) Estimated fixed Capital per Unit of Production, expressed in 1938-39 prices	(4) Estimated Working Capital per Unit of Production, expressed in 1938-39 prices	(5) FIXED CAPITAL (a) Fixed Capital Employed F	(b) Australian Ratio of Plant and Machinery Value to Fixed Capital M/F	(c) Value of Plant and Machinery Col. 5(a) × Col. (5) (b) F×M/F=M	(d) Value of Land and Buildings Col. (5)(a) Col. 5 (c) F—M=L	(6) Working Capital Employed Col. (2) × Col. (4) W	(7) Total Capital Employed Col 5(a) +Col. (6) F+W=C
				Million Rupees		Million Rupees	Million Rupees	Million Rupees	Million Rupees
1. Cotton Textiles	920·476 lbs. of cloth	Re. 1·12	Re. 0·27 per lb.	1,050·933	0·53	546·374	484·559	247·375	1,278·308
2. Iron & Steel	977,358 Ingot tons.	Rs. 255 per ton.	Rs. 44 per ton.	249·226	0·69	171·966	77·260	43·003	292·229
3. Sugar	765,000 Tons.	Rs. 402·5 per ton.	Rs. 91·8 per ton.	308·100	0·86	264·960	43·140	70·270	378·370
4. Cement	1,169.894 Tons (1937-38).	Rs. 140 per ton.	Rs. 11·1 per ton	163·790	0·70	114·650	49·140	12·990	176·780
5. Paper	59,198 tons.	Rs. 960 per ton.	Rs. 155 per ton.	56·830	0·48	27·280	29·550	9·176	66·006
6. Matches	21,063,802 Gross Boxes.	Rs. 1·04 per Gross of Boxes.	Rs. 0·206 per Gross of Boxes.	21·906	0·6*	13·143	8·763	4·339	26·245
7. Heavy Chemicals: †									
(a) Sulphuric Acid (100%)	25,585 tons	Rs. 156 per ton.	Rs. 17·5 per ton	3·990				0·448	4·438
(g) Sulphuric Acid (Fuming) ...	0·2 ton.	Rs. 78 per ton.	Rs. 13·0 ,,						
(c) Nitric Acid (100%)	588 tons.	Rs. 375 ,,	Rs. 131.0 ,,	0·221				0·077	0·298
(d) Hydrochloric Acid (100%) ...	360·6 tons.	Rs. 312 ,,	Rs. 42·0 ,,	0·113				0·015	0·128
(e) Alum	1,725 tons.	Rs. 625 ,,	Rs. 28 ,,	1·078				0·049	1·127
(f) Ammonium Sulphate Neutral and Acidic	14,860 tons	Rs. 25 ,,	Rs. 20 ,,	0·372				0·297	0·669
(g) Ferrous Sulphate	588·8 tons.	Rs. 37·5 ,,	Rs. 10·1 ,,	0·022				0·006	0·028
(h) Epsom Salt	3,506·75 tons.	Rs. 50·0 ,,	Rs. 14 ,,	0·175				0·050	0·225
(i) Glauber's Salt	832 tons.	Rs. 62·5 ,,	Rs. 11·4 ,,	0·053				0·010	0·068
(j) Aluminium Sulphate	4,503 tons.	Rs. 12·5 ,,	Rs. 12·6 ,,	0·060				0·060	0·120
TOTAL : HEAVY CHEMICALS :				6·084				1·012	7·096
				6·388‡	0·4	2·555	3·833	1·012	7·400‡
8. Glass :—									
(a) Sheet and Plate Glass	3,000,000 sq. ft.	Rs. 28·2 per 100 sq. ft.	Rs. 3·8 per 100 sq. ft.	0·846	0·82*	0·694	0·152	0·114	1·818
(b) Blownware & Pressedware ...	6,000 tons.	Rs. 60 per ton.	Rs. 83 per ton.	0·360	0·6*	0·216	0·144	0·498	

* Ratios which subsist in India, as derived from relevant reports of the Indian Tariff Board. † Value of Capital in Col. (3) is exclusive of value of land.
‡ Figures have been corrected by 5% of fixed capital, to account for value of land.

TABLE II

Estimate of Capital employed in Textile Industries (1938-39), based upon statistics of Paid-up Capital.

(1)	(2)	(3)	(4)
INDUSTRY.	Paid-up Capital.	Approximate Ratio of paid-up Capital to Total Capital Employed.	Total Capital Employed $\frac{\text{Col (2)}}{\text{Col (3)}} = C$
	Million Rs.		*Million Rs.*
1. Cotton Textiles ..	408·700	1/3	1,226·100
2. Jute Textiles	248·900	1/3 *	746·700
3. Woollen Textiles ..	10·210	1/3 *	30·630

* Assumed to be the same as for Cotton Textiles industry.

TABLE III

Estimates of Capital Employed in specified Indian Industries (1938-39), based upon Machinery Import Statistics, Ratio of Plant & Machinery Value to Fixed Capital, and Working Capital to Fixed Capital

(Method 2 Chapter III.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)		(10)	(11)	(12)	
INDUSTRY	Average Annual imports of Plant & Machinery in terms of 1938-39 Prices.	Approximate rate of Depreciation	Life of Plant & Machinery on the basis of depreciation rate	Plant & Machinery installed in the Industry in 1938-39 Col. (2) × Col. (4)	Australian ratio of Plant & Machinery Value to Fixed Capital	Fixed Capital Employed Col. (5) / Col. (6)	Value of Land & Buildings. Col. (7) − Col. (5)	Working Capital derived from Ratio of Working to Fixed Capital (a) Ratio	(b) Working Capital Col. (7) × Col. 9 (a)	Capital Employed Col. (7) + Col. 9 (b)	Estimate of Capital Employed, as per Table I or Table II	Difference between Cols (10) and (11), expressed as percentage of Col. (11)	
	(M)			(M)	(M/F)	(F)	(L)	(W/F)	(W)	(C)			
	Million Rupees			Million Rupees	Rupees	Million Rupees	Million Rupees	*	Million Rupees	Million Rupees	Million Rupees		
1. Cotton Textiles	27·600	5%	20 Yrs.	552·00	0·53	1,041·5	489·50	0·25	260·30	1,301·80	1,278·808	+ 1·8%	
2. Jute Textiles	15·200	5%	20 ,,	304·00	0·53	573 60	269·60	0·25†	143·40	717·000	746·700	− 3·9%	+16
3. Sugar	14·520	5%	20 ,,	290·40	0·86	326·00	35·60	0·228	74·33	400·33	378·300	+5.8%	−16·
4. Paper	2·304	10%	10 ,,	23·04	0·48	48·00	24·96	0·2	9·60	57·60	66·006	−12·7%	
5. Woollen Textiles	0·75	5%	20 ,,	15·00	0.58	25·86	10·86	0·29	7·50	38·33	30·60	+ 9%	

* Ratio which subsists in India, as derived from relevant reports of the Indian Tariff Board.

† Assumed to be the same as for Cotton Textiles Industry.

TABLE IV.

Estimates of Capital Employed in Specified Indian Industries (1938-39), based upon Ratios of Capital Employed to Gross Value of Production for comparable Canadian Industries.

(Method 3. Chapter III).

(1) INDUSTRY.	(2) Quantitative Production during 1938-39.	(3) Average ex-factory value per unit of Production.	(4) Gross Value of Production. Col. 2 × Col. 3.	(5) Canadian Ratio of Capital Employed to Gross Value of Production (C/G)*	(6) Total Capital Employed. Col. 4 × Col. 5.
			Million Rs.		Million Rs.
1. Cotton Textiles	920·476 million lbs. of cloth.	15·4 As. per lb.	885·958	1·11	983·413
	366·083 million lbs. of yarn.	7·17 As per lb.	164·062	1·11	182·109
					1,165·522
2. Jute Textiles	1,221,482 tons.	Rs. 293·44 per ton.	359·432	1·95 †	700·892
3. Iron and Steel	514,000 tons Pig iron.	Rs. 54 per ton.	172·466	1·60	275·946
	977, 400 tons Finished steel.	Rs. 148 per ton.			
4. Cotton Ginning and Pressing	5,218,845 bales.	Rs. 85·0 per bale.	443·602	0·7	310·521
5. Electric Power	2,004,418,000 units.	As. 2·2 per unit.	275·607	1·118‡	308·129
6. Cement	1,169,894 tons ¶	Rs. 21 per ton.	24·568	6·18	151·830
7. Cigarettes	7,500,000,000 Nos. §	As. 1·427 per Ten Cigarettes.	66·891	1·295	86·624
8. Paper	59,198 tons	Rs. 560 per ton.	33·151	1·75	58·014
9. Flour Mills	16,482,543 maunds.	Rs. 5.980 per maund	98·566	0·44	43·369
10. Woollen Textiles	9,000,000 lbs. ††	Rs. 3·1 per lb.	27·900	1·1	30·690
11. Soap	75,000 Tons $	Rs. 443·3 per Ton.	33·248	0·785	24·437
12. *Breweries and Distilleries*:—					
(a) Country Spirit Plain	5,911,700 L.P.Gallo	Re. 1 per. L.P. Gallon	5·9117		
(b) „ „ Spiced	682,381 „ „ns.	Re. 1 „ „ „	0·6824		
(c) „ „ Sophisticated	60.810 „ „	Re. 1 „ „ „	0·0608		
(d) Brandy	24,742 „ „	Rs. 48·82 „ „	1·2080		
(d) Whisky	16,927 „ „	Rs. 50·47 „ „	0·8543		
(f) Rum	59,962 „ „	Rs. 45·07 „ „	0·5458		
(g) Gin	10,616 „ „	Rs. 44·17 „ „	0·4689		

TABLE IV.—*(Continued)*

(1) INDUSTRY.	(2) Quantitative Production during 1938-39	(3) Average ex-factory value per unit of Production.	(4) Gross value of Production. Col. 2 × Col. 3.	(5) Canadian Ratio of Capital Employed to Gross Value of Production (C/G)*	(6) Total Capital Employed. Col. 4 × Col. 5
(h) Other Foreign Spirits ..	5,225 ,, ,,	Rs. 47·13 ,, ,,	0·2463		
(i) Rectified Spirit	487,382 ,, ,,	Rs. 0·75 ,, ,,	0·3655		
(j) Denatured Spirit	2,168,714 ,, ,,	Rs. 1·35 ,, ,,	2·9278		
(k) Indian Beer	357,164 ,, ,,	Rs. 2·27 ,, ,,	0·8108		
(l) English Beer	752,322 ,, ,,	Rs. 2·27 ,, ,,	1·7078		
(m) Stout, etc.	37,665 ,, ,,	Rs. 2·27 ,, ,,	0·0855		
Total: *Breweries and Distilleries.*			15·8756	1·45	23·020
13. *Heavy Chemicals*:—					
(a) Sulphuric Acid 100% ..	25,585 Tons	Rs. 75 per ton.	1·4088		
(b) Nitric Acid 100%	588 ,,	Rs. 552·88 Per Ton.	0·3229		
(c) Hydrochloric Acid	360·6 Tons.	Rs. 286·53 Per Ton.	0·1033		
(d) Alum	1,725 Tons.	Rs. 125·73 Per Ton.	0·2168		
(e) Ammonium Sulphate ..	14,860 Tons.	Rs. 106·3 Per Ton.	1·5796		
(f) Ferrous Sulphate	488·8 Tons.	Rs. 66·55 Per Ton.	0·0369		
(g) Epsom Salt	3,506·75 Tons.	Rs. 81·70 Per Ton.	0·2865		
(h) Glauber's Salt	832 Tons	Rs. 43·83 Per Ton.	0·0365		
(i) Aluminium Sulphate ..	4,503 Tons.	Rs. 80 Per Ton.	0·3602		
Total: *Heavy Chemicals*			3·3515	1·585	6·897
14. *Glass*:—					
(a) Sheet and Plate glass ..	3,000,000 sq. ft.	Rs. 11 per 100 sq. ft.	0·330	1·265	0.417
(b) Blownware and Pressedware	6,000 Tons	Rs. 180 Per Ton.	1·08	1·265	1.366 } 1.784
15. Sugar	765,500 Tons	Rs. 262 per Ton.	200·561	**	x
16. Matches	21,063,802 gross boxes.	Rs. 1·156 per gross of boxes.	24.350	**	x

* Ratio derived from figures available in Canadian Year Book, 1941-42.
† Derived from ratio G/P, for Jute Industry in the U. K.
‡ Ratio derived from Canadian figures of Capital per kilowatt hour.
§ Production for 1935. Later figures not available. $ Production for 1938.
¶ Production for 1937-38. ** Ratio not available. †† Estimated.

TABLE V.

Table showing the extent of under-estimation in "Capital Employed", as obtained by the Canadian Ratio C/G.

(Correction Factor. Chapter III).

(1)	(2)	(3)	(4)
INDUSTRY.	Estimate of Capital Employed obtained as per Table I.	Estimate of Capital Employed obtained by using the Canadian Ratio C/G, as per Table IV.	Percentage, Under estimation. $\frac{\text{Col.(2)} - \text{Col.(3)}}{\text{Col. (3)}} \times 100$
	Million Rs.	Million Rs.	
1. Cotton Textiles ..	1,278·308	1,165·522	9·60%
2. Iron and Steel ..	292·229	275·946	5·48%
3. Cement ..	176·780	151·830	16·44%
4. Paper ..	66·006	58·014	13·77%
5. Woollen Textiles.	33·360*	30·690	8·70%
6. Heavy Chemicals	7·400	6·897	7·29%
7. Glass ..	1·818	1·784	1·90%

Average Percentage Under-estimation. $= \frac{63 \cdot 18}{7} = 9 \cdot 02\%$

* As per Table III

TABLE VI.

Estimates of Fixed and Working Capital employed in specified Indian Industries, derived from ratios of comparable industries in Canada and Australia (excluding industries shown in Table I).

(Method 3. Chapter III).

(1)	(2)	(3)					(4)
		FIXED CAPITAL					
INDUSTRY.	Capital Employed (estimate as per Table IV with 10 % added for correction).	(a) Ratio of Fixed Capital to Capital employed.	(b) Fixed Capital employed. Col. 2 × Col. 3(a).	(c) Australian ratio of Plant and Machinery Value to Fixed Capital	(d) Value of Plant and Machinery Col. 3(b) × Col. 3(c)	(e) Value of Land and Buildings. Col. 3 (b) – Col. 3(d).	Working Capital Employed. Col. (2)— Col. 3 (b)
	(C)	(F/C)	(F)	(M/F)	(M)	(F – M = L)	(C – F = W)
	Million Rs.		Million Rs.		Million Rs.	Million Rs.	Million Rs.
1. Jute Textiles	770·981	0·773*	595·968	0·53	315·863	280·105	175·013
2. Cotton Ginning and Pressing	341·573	0·700‡	239·101	0·58	138·679	100·422	102·472
3. Electric Power	338·942	0·910†	308·44	0·924†	284·998	23·442	30·502
4. Cigarettes	95·286	0·300‡	28·586	0·475	13·578	15·008	66·700
5. Flour Mills	47·700	0·527‡	25·141	0·46	11·565	13·576	22·565
6. Woollen Textiles	33·759	0·773*	26·957	0·58	15·036	11·921	6·802
7. Soap	26·881	0·451‡	12·123	0·46	5·577	6·546	14·758
8. Breweries and Distilleries	25·322	0·445‡	11·268	0·49	5·521	5·747	14·054

* Assumed to be the same as for Textile Industry in Canada.

† Ratio derived from New Zealand statistics of Electric Power Industry.

‡ These ratios have been derived by dividing F/G for Australia by C/G for Canada for corresponding industry in each case

TABLE VII.

Estimates of Gross Value of Production per Unit of Labour. and Capital Employed per unit of labour in specified Indian Industries: 1938-39.

(1) INDUSTRY.	(2) Gross Value of Production as per Table IV. (G)	(3) Capital Employed (C)	(4) Labour Employed.* (1939). (L)	(5) Gross Value per Unit of Labour. Col. 2/Col. 4. (G/L)	(6) Capital Employed per unit of Labour Col. 3/Col. 4 (C/L).
	Million Rs.	Million Rs.	Average Daily No. of workers.	Rs.	Rs.
1. Cotton Textiles	1,050·020	1,278,308(*)	442,000(‡)	2,375	2,892
2. Jute Textiles	359·432	770·981(†)	302,300	1,156	2,550
3. Sugar	200·561	378·370(*)	81,800	2,452	4,625
4. Cotton Ginning & Pressing ..	443·602	341·573(†)	168,000	2.640	2.033
5. Electric Power	275·607	338·942(†)	14,700	18,749	23,112
6. Iron and Steel	172·466	292·229(*)	43,200($)	3,992	6,764
7. Cement	24·568	176·780(*)	9,600(§)	2,559	18.415
8. Cigarettes	66·891	95·286(†)	5,200	12,864	18.324
9. Paper	33·151	66·006(*)	10,600	3,127	6,227
10. Flour Mills	98·566	47·706(†)	5,700	17,292	8,352
11. Woollen Textiles	27·900	33·759(†)	8,300(**)	3,361	4,067
12. Soap	33·248	26·881(†)	2,230	14,910	12.054
13. Matches	24·350	26·245(*)	16,600	1,455	1,581
14. Breweries and Distilleries ..	15·876	25·322(†)	2,140	7,419	11,835
15. Heavy Chemicals	4·352	7·400(*)	5,000	870	1,480
16. Glass	1·410	1·818(*)	7,000(¶)	210	260
TOTALS ..	2,832 000	3,907·606	1 124,370	Rs. 2,520††	Rs. 3,475‡‡

* Figures from :— (1) Large Industrial Establishments in India, 1939. (2) Statistical Abstract for British India, 1942; (3) Location of Industry in India (Office of the Economic Adviser, Government of India), 1945.

(*) Table I.
(†) Table VI
(‡) Average daily number employed in Mills. Bombay Cotton Annual, 1942-43, page 133.
($) Labour employed in maior steel works only.
(§) Excludes labour in Asbestos Cement Factories.
(¶) Excludes Labour in Bangle making factories.
(**) Labour employed in Woollen Mills only.
(††) Weighted average of Gross Value of Production per unit of labour.
(‡‡) Weighted average of Capital employed per unit of labour.

TABLE VIII.

Estimate of capital employed in "Unspecified" Indian Industries (1938-39), based upon Gross Value of Production in specified industries (Table VIII) and Canadian Ratio of Capital Employed to Gross Value of Production, for Miscellaneous Industries.

(Method 4. Chapter III).

(1)	(2)	(3)	(4)	(5)	(6)					(7)
					FIXED CAPITAL.					
Average Gross Value of production per unit labour in specified industries (Table VII).	Labour employed in unspecified industries. / Average daily number of workers.	Gross value of production in unspecified industries. Col. 1 × Col. 2 (G)	Canadian ratio of Capital employed to gross value of production for miscellaneous industries.	Capital employed in unspecified industries, corrected for underestimation (Col. 3 × Col. 4) + 10% (C)	(a) Canadian Ratio of Fixed capital to capital employed, for miscellaneous industries. (F/C).	(b) Fixed Capital employed. Col. 5 × Col. 6(a) (F)	(c) Australian Ratio of Plant and Machinery Value to Fixed Capital for Misc. industries. (M/F)	(d) Value of Plant and Machinery Col. 6(b) × Col 6(c) (M)	(e) Value of Land and Buildings. Col. 6(b)— Col. 6(d) (L)	Working Capital employed in unspecified industries. Col. 5— Col. 6(b) (W)
Rupees		Million Rs.		Million Rs.		Million Rs.		Million Rs.	Million Rs.	Million Rs.
2,520	925,861	2,333·170	0·96	2,463·827	0·47	1,157·999	0·342	396·036	761·963	1,305·629

TABLE IX.

Estimate of capital employed in "Unspecified" Indian Industries (1938-39), based upon the Average Capital Employed per unit Labour in Specified Industries.

(Method 4. Chapter III).

(1)	(2)	(3)	(4)					(5)
verage capital employed er unit labour specified industries. 'able VII).	Labour employed in unspecified industries. Average daily number of workers.	Capital employed in unspecified industries. Col. 1 × Col. 2. (C)	FIXED CAPITAL. (a) Canadian ratio of fixed capital to capital employed for miscellaneous industries. (F/C).	(b) Fixed capital employed. Col. 3 × Col. 4(a). (F)	(C) Australian Ratio of Plant and Machinery value to Fixed capital. (M/F).	(d) Value of Plant and Machinery Col. 4(b) × Col. 4(c) (M)	(e) Value of Land and Buildings. Col 4(b) – Col. 4(d) (L)	Working capital employed in unspecified industries. Col. 3 – Col. 4(b)
Rs.		Million Rs.		Million Rs.		Million Rs.	Million Rs.	Million Rs.
3,475	925,861	3,217·367	0·47	1,512·162	0·342	517·159	995·003	1,705·205

CHAPTER IV

ESTIMATES FOR INDUSTRIES

We have discussed in the previous chapter an outline of methods employed in the investigation. The tables at the end of Chapter III are self-explanatory, in so far as the actual application of the methods is concerned. In order, however, to illustrate the technique and calculation of estimates, we now propose to deal with some individual industries in detail and discuss the salient features relating to estimates for the remaining industries. These illustrations will also demonstrate the manner in which estimates have been checked by independent methods.

COTTON TEXTILES INDUSTRY

Let us examine the estimate by the first method as in Table I. The Tariff Board in 1936[1] estimated that the fixed capital, excluding land, per unit of production for the whole industry, i.e., including spinning and weaving mills, was Re. 1 per lb. of cloth produced by the industry. This must now be expressed in terms of 1938-39 prices. The available indices in India reflecting price change, relate only to wholesale prices of commodities other than capital goods. No index reflecting change in Machinery prices is available. Plant and Machinery was however mainly imported from the U.K. To see the price change in fixed capital we have, therefore, constructed an index of machinery prices as shown in the table below, based on the data[2] of prices of Machinery exported from the U.K.

Index of Textile Machinery Prices :—Base—1938-39

1935	..	90·51
1936	..	93·05
1937	..	97·98
1938-39	..	100

Expressed in 1938-39 prices, therefore, the fixed capital per pound of cloth comes to Rs. 1.075. It is estimated that, on an average, value of land in this industry would be about 4.3 per cent of the Fixed Capital (excluding land). Cor-

[1] p. 101, Report of the Special Indian Tariff Board on Cotton Textiles Industry, 1936.

[2] Data in Statistical Abstract for the U. K.

recting the figure 1.075 for value of land we get fixed capital per unit production at Rs. 1.12. Multiplying the total production of 920.476 million[1] lbs. of cloth in 1938-39 by 1.12 we get Rs. 1,030.933 million as the total fixed capital of the industry. Similarly according to the Tariff Board Report,[2] the working capital required in the industry would be about one-fourth of the fixed capital exclusive of land. On this basis, in 1938-39 working capital per lb. of cloth would be Rs. 0.27. For the production stated, the working capital therefore comes to Rs. 247.375 million. The capital employed in the industry would thus be Rs. 1,278.308 million. In order to subdivide the Fixed Capital into its components, we have used the ratio of Value of Plant and Machinery to Fixed Capital for Cotton Textiles Industry in Australia for the year 1938-39. This ratio is 00.53.[3] Multiplying this by the Fixed Capital 1,030.933 million we get Rs. 546.374 million as value of Plant and Machinery; the remainder, Rs. 484.559, million being the value of land and buildings.

To check the estimate of Capital Employed, viz., Rs. 1,278.308 million obtained above, let us examine the estimate by the third method as in Table IV. The Production of cloth in 1938-39 was 920.476 million pounds. The average price realised by mills per lb. of cloth was Rs. 1-1-0 in 1935.[4] This has been derived from the prices of several varieties of cloth as given in the Tariff Board Report. The Calcutta Index of Cotton Manufactures in 1935 was 117, and in 1938-39 it was 106. Correcting the average for price change, the ex-mill price of cloth per lb. in 1938-39 comes to As. 15.4. The Gross Value of Production of cloth thus comes to Rs. 885.958 million. This is however not the total production of the industry, because the value of yarn produced by mills in India for sale to non-mill consumers

[1] Statistical Abstract for British India, 1942.

[2] P. 87 of the Special Report of the Indian Tariff Board, 1936. Also P. 479, Report of the Indian Central Banking Enquiry Committee, Vol. III.

[3] Report on Production of Secondary Industries. Australia, 1938-39, Bulletin No. 33, Commonwealth Bureau of Census and Statistics, Australia.

[4] P. 124 of the Special Report. The Indian Tariff Board, 1936.

must be added to this figure. As shown in Appendix A (page 85), the quantity of such yarn has been estimated at lbs. 366.083 million. At the average ex-factory price per lb., the gross value of such production would be Rs. 164.062 million. The total gross value of production of all the spinning and weaving mills was therefore Rs. 1,050.02 million. The average value of the ratio of capital employed to gross production in Canada for the same industry in 1938-39 was 1.11. Multiplying this ratio by the value of gross production ascertained, we get Rs. 1,165.522 million as capital employed. This estimate differs from the first by less than 10 per cent. which, as will be noticed from Table V, is the expected correction for under-estimation. A corroborative check on these estimates is also provided by the figure of paid-up capital in the industry. In 1938-39 this was Rs. 408.7 million. From Dr. Lokanathan's study of "Industrial Organisation in India"[1] it appears that on an average, in Cotton Textile industry, the paid-up capital is usually about one-third of the capital employed. On this basis the capital employed would come to Rs. 1,226.1 million (see Table II page 39) a figure which agrees closely with the previous estimates.

Another independent check is provided by the estimate arrived at by the second method as in Table III. The value of average annual imports of Plant and Machinery for the industry was Rs. 27.6 million. This is arrived at by taking the average of imports for 15 years prior to 1938-39, and adding to this 15 per cent. for the average price rise, 10 per cent. for customs duty and 10 per cent. for inland freight, erection, installation charges, etc. Assuming an overall rate of 5 per cent. for depreciation of Plant and Machinery as indicated by the Tariff Board, the life of Plant and Machinery would be 20 years. The value of Plant installed in the industry during 1938-39 would thus be $27.6 \times 20 =$ Rs. 552.00 million. Applying to this the ratio of value of Plant and Machinery to Fixed Capital in Australia for the same industry in the same year viz.,

1 P. 152, "Industrial Organization in India", Dr. P. S. Lokanathan.

.53, we get Rs. 1,041.5 million as the Fixed Capital. Deducting value of Plant and Machinery, we get Rs. 489.50 million as the value of Land and Buildings. Again as previously stated, on the basis of the Tariff Board Report, the ratio of working capital to fixed capital is about 0.25. The working capital would therefore be Rs. 260.3 million and the capital employed would be Rs. 1,301.8 million. The remarkable closeness of estimates of capital employed as well as its components by various methods is shown by the following table:

TABLE (3)

COTTON TEXTILES INDUSTRY.

(Figures in million rupees).

1	2	3	4	5	6
Method.	Value of Land and Buildings.	Value of Plant and Machinery	Fixed Capital Col. (2) + Col. (3)	Working Capital	Capital Employed Col. (4) + Col. (5)
1st method ..	484.559	546.374	1030.933	247.375	1278.308
2nd method ..	489.500	552.000	1041.500	260.300	1301.800
3rd method ..	....	..	..	..	1165.522*

Apart from checks by independent methods employed here, there is further evidence to show the reliability of these estimates. The Indian Central Banking Enquiry Committee,[1] when analysing the sources from which capital for the Cotton Textiles industry is drawn, gives figures in respect of 120 mills in Bombay and Ahmedabad. This capital comprises Paid-up Capital, loans, deposits and debentures. As we have seen in Chapter II this may be equated to capital employed. According to these figures the average capital per Mill comes to Rs. 2.97 million. For the total number of 415 textile mills in India including Indian States, in 1938-39, the capital employed would come to Rs. 1,232.55 million, which is very near our estimates.

In the Tariff Board Report,[2] the fixed capital per spindle has been estimated at Rs. 63 and per loom at

* Not corrected to the extent of 10% for under—estimation.

[1] P. 278, Minority Report of the Indian Central Banking Enquiry Committee.

[2] Special Report 1936.

Rs. 1,575 in terms of 1935-36 prices. The number of spindles and looms in 1938-39 in the industry was 9.826 million and 199,106 respectively. Thus the capitalization on spindles comes to Rs. 619.038 million and that on looms to Rs. 313.592 million in terms of prices in that period. The total fixed capital of the industry was therefore Rs. 932.63 million. Allowing for the increase in prices of Plant and Machinery between 1935-36 and 1938-39 to the extent of 5 per cent. we get total fixed capital on this basis to be Rs. 979.262 milion. This figure differs by about 5 per cent. from our estimate of Rs. 1,030.133 million, obtained by the first method.

JUTE TEXTILES INDUSTRY

As there has been no enquiry by the Tariff Board, for this industry, it is not possible to estimate the capital employed in it, by the first method. The final estimate is therefore arrived at by the third method involving application of the ratio C/G. Quantitative production of jute manufactures amounted to 1,221,482 tons[1] in 1938-39. It is also possible to estimate the average ex-factory selling price per ton at Rs. 293.44 for Jute manufactures, on the basis of available data.[2] The gross value of production of Jute Textiles Industry, therefore, comes to Rs. 359.432 million. The Canadian ratio C/G for this industry is however not available, owing to absence of this industry in Canada. We have therefore estimated the ratio, for Jute industry in the United Kingdom, and applied it to the gross value of production of Jute industry in India. On the basis of statistics available in the report on the census of production[3] in the United Kingdom, the ratio of gross value of production to net output (i.e., G/P) of Jute industry comes to 3.65. If we take the entire group of Textile industries in Canada the ratio C/G for that group comes to 1.15,[4] and the corresponding value of G/P for the same

[1] P. 682, Statistical Abstract for British India, 1942.
[2] Ibid., p. 487.
[3] *Report on the Fifth Census of* Production, U. K.
[4] *Canada Year Book, 1942.*

group of industries works out at 2.15. Making the plausible assumption that for the Jute Textiles industry the ratio of United Kingdom, $\frac{C/G}{G/P}$, or in other words the ratio C/P is practically identical to the ratio C/P (i.e., $\frac{C/G}{G/P}$) for the textile group of industries in Canada, we get an estimate of C/G for Jute textile industry in the United Kingdom. This estimate comes to $\frac{3.65 \times 1.15}{2.15} = 1.95$ If we apply this ratio to Jute production in India we get capital employed at Rs. 700.892 million. Adding 10 per cent. to this amount, to correct for under-estimation as explained in chapter on Methods (Chapter III), we get Rs. 770.981 million as Capital employed in this industry.

This total has then to be subdivided into its components. The ratio of Fixed Capital to Capital Employed for the textile group of industries in Canada, for 1938-39, is 0.773. Applying this ratio, the fixed capital in Jute industry comes to Rs. 595.968 million. The ratio of value of Plant and Machinery to Fixed Capital for Australia, for the same year, is 0.53 in the textiles industry. The value of Plant and Machinery therefore comes to Rs. 315.863 million and the value of Land and Buildings to Rs. 280.105 million. The Working Capital, viz., Rs. 175.013 million, is then derived by deducting the Fixed Capital from the total Capital. This method of subdivision into components has been applied to eight different industries as shown in Table VI. (page 44).

A check on this estimate is provided by the Second Method. The value of annual average imports of Plant and Machinery for Jute Mills, in the pre-war period, on the basis of imports for 20 years prior to 1938-39, comes to Rs. 11.5 million. Adding 15 per cent. for average increase in Machinery prices, 10 per cent. for customs duty and 10 per cent. for other charges, this value comes to Rs. 15.2 million. Assuming 5 per cent. depreciation as in cotton textiles, the value of Plant and Machinery in this industry comes to 15.2×20=Rs. 304.00 million. Calculating the values of Fixed Capital, land and buildings, and Working Capital in the same manner as in the case of cotton textiles

industry we get Rs. 573.60 million, Rs. 269.60 million and Rs. 143.400 million respectively (Table III page 40). The Capital employed would thus be Rs. 717.00 million. It will be seen from the following table how closely estimates for components of Capital employed and the total capital by the two methods agree.

TABLE (4)

JUTE TEXTILES INDUSTRY.

(Figures in million rupees).

Method.	Value of Land and Building.	Value of Plant and Machinery.	Fixed Capital Col. 2 + Col. 3.	Working Capital.	Capital Employed. Col. (4) + Col. (5).
1	2	3	4	5	6
2nd method ..	269·60	304·00	573·60	143·40	717·00
3rd method ..	280·105	315·863	595·968	175·013	770·981

A corroborative check to the total is also available if we calculate the capital employed on the basis of paid-up capital of Jute Mills, viz.,[1] Rs. 248.9 million, and assume that it bears the same proportion to the total capital as in Cotton Textiles. This proportion is one-third and the capital would come to Rs. 746.700 million.

Another verification of our estimate can also be had from the fact[2] that the average amount of Paid-up Capital and reserves, (i.e., Capital employed), per Mill in the Jute industry, was about Rs. 7 million in the pre-war period. Applying this average to 103 Jute mills[3] working in India in 1938-39, Capital employed in the industry works out to be Rs. 721 million which is very near our estimate.

OTHER INDUSTRIES

Estimates of Capital employed and its components in seven other industries, viz., Iron and Steel, Sugar, Cement, Paper, Matches, Heavy Chemicals, and Glass manufactures

[1] Statistical Abstract for British India, 1942.
[2] P. 112, "Industrial Organization in India", Dr. P. S. Lokanathan.
[3] Statistical Abstract for British India, 1942.

have been obtained by the first method as in Table I. The process of calculation will be clear from the Table. The primary information with regard to fixed capital per unit of production and working capital per unit of production has been obtained from the relevant reports of the Indian Tariff Board. These have been corrected in the same manner as in the case of Cotton Textiles industry. Fixed Capital has been corrected by the index of Export prices of machinery in the United Kingdom. Working Capital has been corrected for price change on the basis of Calcutta index of wholesale prices. Subdivision of Fixed Capital into its components in each case has been effected on the basis of ratio M/F for the same industry in Australia. For Glass and Matches industries however the Indian ratio M/F has been obtained from Tariff Board reports.

Of these industries, estimates, by way of checks, for Sugar and Paper industries have been obtained by the second method (Table III), and for Iron and Steel, Cement, Paper, Heavy Chemicals, and Glass manufactures by the third method (Table IV). The calculations for Sugar and Paper industries in Table III are made in the same manner as for Cotton Textiles. It will also be noticed that in Table IV the process of computation for the latter five industries is along the same lines as for Cotton and Jute Textiles. It may be mentioned here that the Gross Value of production for the Iron and Steel industry has been estimated on the basis of Pig Iron produced for sale, and tonnage of semi-finished and finished products of iron and steel as recorded in the statistical abstract for British India.

The following table shows the comparative values of capital employed, as well as its components (where separately available), for these seven industries:

TABLE (5)

COMPARATIVE ESTIMATE FOR SEVEN INDUSTRIES.

(Figures in Million Rupees)

INDUSTRY	Method	Value of Land & Buildings	Value of Plant & Machinery	Value of Fixed Capital.	Working Capital	Capital Employed.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Iron & Steel ...	1st	77.260	171.966	249.226	43.003	292.229
	3rd	.....	.....	.....	.....	275.946*
Sugar	1st	43.140	264.960	308.100	70.270	378.370
	2nd	35.600	290.400	326.000	74.330	400.330
Cement	1st	49.410	114.650	163.790	12.900	176.780
	3rd	.....	.....	.....	.....	151.880*
Paper	1st	29.500	27.280	56.830	9.176	66.006
	2nd	24.960	23.040	48.000	9.600	57.600
	3rd	.....	.....	.....	.....	58.014*
Matches	1st	8.763	13.143	21.906	4.339	26.245
Heavy chemicals ...	1st	3.833	2.555	6.388	1.012	7.400
	3rd	.....	.....	.....	.....	6.897*
Glass Manufacture	1st	0.296	0.910	1.206	0.612	1.818
	3rd	.....	.....	.....	.....	1.784*

Before concluding this discussion of comparative estimates for individual industries by the different methods, we may draw particular attention to Col. 12 of Table III (page 40). We have there derived the percentage differences between estimates by the first and the second methods. Over a group of five important industries, it will be seen that these differences cancel out each other. This appears to give validity to the second method, and provides a completely satisfactory check on the estimates of Table I (page 38) by the first method.

OTHER INDUSTRIES (Table VI) Method 3.

We may now consider the estimates of Capital for Cotton Ginning and Pressing, Electric Power, Cigarettes, Flour Mills, Woollen Textiles, Soap and Breweries and Distilleries. Estimates for these industries have been made by the application of the Canadian Ratio C/G.

* These estimates are not corrected for under-estimation to the extent of 10% as in fact, they should be, as per Chapter III. If they are so corrected, it will be seen that they are very close to estimates by other methods. This remarkable agreement, by itself, appears to justify the use of correction factor.

The process of calculation in each case will be clear from Tables IV and VI (page 41 and page 44). The quantitative production of each of these industries in 1938-39 is first taken.[1] It is then multiplied by the average ex-factory price per unit, to obtain the Gross value of production. This average price per unit has been obtained from various sources,[2] and where it does not relate to the year 1938-39, has been corrected by appropriate indices to bring it to the level of 1938-39 prices. Having obtained the gross value of production, estimates of capital employed have been obtained by applying to it the appropriate ratio C/G. The estimates of capital thus obtained in Col. 6 of Table IV (page 41), are then corrected by addition of 10 per cent. to account for under-estimation. The estimates so corrected, have been carried over to Col (2) of Table VI (page 44).

Further subdivision of the capital employed into its components has then been derived by the procedure described for the Jute Industry, by application of the ratios F/C and M/F. For the Electric Power industry, we have used ratios relating to New Zealand, as New Zealand statistics are more complete for that industry. In other cases, where the ratio F/C is not available from Canadian data, we have derived the relevant ratio from the ratios F/G for Australia and G/C for the same industry in Canada. The

[1] For Flour Mills and Breweries and Distilleries, from Statistical Abstract for British India, 1942. For Cigarettes from "Report on the Marketing of Tobacco in India and Burma", 1942, issued by the Agricultural Marketing Adviser to the Government of India. For Cotton Ginning and Pressing, from "Bombay Cotton Annual", 1942-43. For Electric Power, from "Location of Industry in India", Office of the Economic Adviser to the Government of India. For Woollen Textiles, production in 1938-39 estimated on the basis of the production shown in the Report of the Indian Tariff Board, 1935. For Soap from "Bulletin of Industrial Research No. 12", Industrial Research Bureau.

[2] For Flour Mills and Breweries and Distilleries the price per Unit including customs duty of similar imported product has been taken. For Cigarettes from reference as in [1]. For Cotton, Ginning and Pressing from references as in [1]. For Electric Power Generation, prices have been estimated from enquiries by the authors at As 1 per unit for industrial users and As. 4 for other users. From published statistics in "Location of Industry in India" it is known that 60% of electricity is consumed in industry and 40% by other users. For woollen textiles prices are estimated on the basis of data regarding fair selling prices in the Report of the Indian Tariff Board, 1935. For soap from reference as in [1].

estimates for these industries as in Table VI (page 44), have been taken as final estimates. No direct check to these estimates is possible for these industries. This has however been possible for the Woollen Textile industry, where the following table shows how close are the estimates arrived at by different methods.

TABLE 6

WOOLLEN TEXTILES INDUSTRY

(Figures in million rupees).

Method.	Value of Land and Building.	Value of Plant and Machinery.	Fixed Capital.	Working Capital	Capital Employed.
(1)	(2)	(3)	(4)	(5)	(6)
2nd Method ..	10·860	15·000	26·860	7·500	33·360
3rd Method ..	11·921	15·036	26·957	6·802	33·759

It will also be seen from Table II (page 39), that on the basis of paid-up capital, viz., Rs. 10.210 million and the ratio of Paid-up to total capital employed, viz., 1/3, the estimate comes to Rs. 30.360 million, which again differs by less than 10 per cent. from our estimate. Similarly, some evidence to verify the estimate of fixed capital in the Electric Power industry is also available. It has been estimated that the capital expenditure on generating Plant and Machinery, and transmission and distribution plant, should not exceed £37 per kilowatt installed[1] in terms of 1923-24 prices. Assuming the average annual load on the industry at 3,500 hours and dividing the total KWH generated in 1938-39, viz., 2,004,418,000 by the above figure, we get 572,690.8 killowatts as the approximate installed capacity of Indian industry. At the rate of £37 per KW the maximum fixed capital of the industry ought to be Rs. 283.940 million in terms of 1923-24 prices. The index[2] of Machinery prices in 1923-24 was 85, with 1938-39 as the base year. Correcting the above figure for the change in

[1] " Indian Industry and its Problems ", Vol. I, pp. 126-127, by H. R. Soni.

[2] Constructed on the basis of Statistics of Machinery exports from the U. K. Statistical Abstract of the U. K.

price, we get Rs. 334.2 million as the value of fixed capital in terms of 1938-39 prices in the Electric Power industry. This differs from our estimate of Rs. 308.44 million by about 8 per cent. A large portion of this difference may well be due to the fact that the maximum capitalization per kilowatt has been taken into account and is applied to *every Unit* in the industry. It will be noticed again, that as compared with a fixed capital of Rs. 308.44 million, our estimate of the working capital is 30.50 million or roughly 10 per cent. of the former. This proportion is as it should be expected for this industry which is known to need, relatively very small working capital.

While estimates for other industries in this group have not been checked as they have been, for the woollen or the Electric Power industries, overall checks as to their reliability have been exercised as explained in Chapter V.

UNSPECIFIED INDUSTRIES

(Tables VIII and IX. Method 4.)

Having obtained the capital employed in the 16 industries already discussed by the first three methods, we now come to all other remaining industries which, for purposes of convenience, are here grouped as "Unspecified Industries". Estimates of Capital employed in this sector of industry are obtained in two different ways. As will be seen from Columns 5 and 6 of Table VII, we have first arrived at the Gross Value of Production per unit labour, and capital employed per unit labour, for each of the 16 specified industries. Each of the values in col. 5 are multiplied by the labour employed (col. 4), and the total of the resultants is then divided by the total labour employed in all 16 industries. This gives the weighted average gross value of production per unit of labour at Rs. 2,520. The Gross value of production of "Unspecified Industries" is then arrived at by multiplying the number of workers (925,861), engaged in this sector of industry, by the average, viz. Rs. 2,520. The aggregate gross value of production for "unspecified industries" thus comes to Rs. 2,333.170 mil-

lion. Applying the Canadian ratio C/G of the "Miscellaneous" group of industries, and correcting the result for under-estimation, to the extent of 10%, we get Rs. 2,463.827 million as the estimate of capital employed in all the remaining industries. The ratio of 'Miscellaneous' group of Canadian industries is applied, because, by and large, the structure of industries included under the heading "Unspecified Industries" can be regarded similar to the Canadian Miscellaneous group. The total capital is then subdivided into value of Land and Buildings, Plant and Machinery and Working Capital by the application of the Canadian ratio F/C for "Miscellaneous" industries and Australian ratio M/F for the same class of industries. The details are shown in Table VIII (page 46).

In the same manner as above, we have obtained from columns 4 and 6 of the Table VIII, (page 86), the weighted average of capital employed per unit labour. This is multiplied by the number of workers (925,861) engaged in "Unspecified Industries". This gives the capital employed in these industries. It has then been sub-divided into its components in the same manner as in the alternative method already described. The details are shown in Table IX (page 47).

CHAPTER V

CHECKS AND CONCLUSIONS

It will be seen from the foregoing chapters that our estimates of capital employed in individual industries as well as, the aggregate of industries, have been arrived at by application of indirect methods of estimation. In devising such methods, we have used inductive as well as deductive reasoning to the fullest possible extent. For instance, in case of the Cotton Textile Industry, we have inferred that the value of Fixed Capital per unit production as in the Tariff Board Report, which is the average value based upon data relating to a sample of Mills, is valid

for *every* unit of product manufactured by *any* mill in the industry. Then again, we have applied this sample value of Fixed Capital to the total production in the industry as a whole, in order to deduce the Fixed Capital for the entire Cotton Textile Industry. If, therefore, we make estimates by a single method, we cannot logically accept our estimates as valid, unless these are either made by using refined statistical techniques which would give us the probability limits of variation, or these estimates are checked and tallied against those arrived at by means of entirely independent methods. Owing to the serious limitations of the available data, as well as the impracticability of collecting material suitable for refined statistical treatment, estimates *specified by their standard errors* cannot be attempted. But the alternative is feasible in case of a number of industries. As will be seen from Chapter IV, we have checked estimates of each of the eight specified industries mentioned in Table I page 38) against those calculated by entirely independent methods. In certain cases, such as Cotton Textile Industry, we have been fortunate in finding sufficient data to be able to employ a number of checks to the final estimate of capital employed and its components. In so far as these eight industries are concerned, we have therefore sufficient reason to believe that our estimates, both of total "Capital Employed" and its components, are reliable. It has indeed seemed to us somewhat remarkable that the estimates of components of Capital Employed, made by independent methods should also agree so closely. This fact has led us to several significant conclusions which are discussed later in this chapter. There are, however, eight specified industries mentioned in Table X (page 76) (Industry Nos. 2, 4, 5, 8, 10, 11, 12 and 14) for which estimates have been made, only by application of Canadian ratio C/G (Table IV page 41), and no direct check has been possible. Estimates for these industries, too, seem to us to be fairly reliable, mainly because of the fact that in case of industries for which more than one estimate has been made, we have found that estimates made by application of ratio C/G for similar Cana-

dian industries compare satisfactorily with those made by other methods (see (Tables I, III, IV and V, page 38, 40, 41, 43). This would imply that, if sufficient information were available for the rest of the specified industries, any estimates which we would obtain either by using the quantum of capial employed per unit production or the average annual imports of plant and machinery, should not be materially different from those made by application of Canadian ratio C/G. To this extent, we should be justified in accepting the estimates for other eight specified industries, viz., Jute Textiles, Cotton Ginning and Pressing, Electric Power, Cigarettes, Flour Mills, Woollen Textiles, and Breweries and Distilleries (see Table X page 76)).

Even so, there remains the aggregate of unspecified industries employing nearly 45% of the total labour force in all large-scale factories, for which the minimum and maximum estimates differ somewhat widely. As regards this divergence between the minimum and maximum estimates for unspecified industries, one significant fact must be noted. As will be seen from Table VIII (page 46) we have calculated the minimum estimate for unspecified industries by applying Canadian Ratio C/G for miscellaneous industries, to the estimated Gross Value of production of this group of industries. The ratio used is 0.96. It has been calculated by dividing the total capital employed in Miscellaneous Group of Canadian industries, by the total value of gross output of these industries. This value of gross output, however, involves a certain amount of duplication, because of the fact that products of some of the individual industries in the miscellaneous group may be used as raw materials by some of the factories in the remaining industries of the same group. The extent of such duplication for all industries has been estimated at about 1/3rd of the value of recorded gross output both in the U.S.A.[1] and the U.K.[2] It is therefore clear that in so far

[1] Sixteenth Census of the United States, 1940. Manufactures 1939. Vol II, Part I, p. 5.

[2] United Kingdom: Final Report of the Census of Production, 1930.

as the unspecified group of industries is concerned, the ratio 0.96 understates the true value of capital, even when the latter is corrected for under-estimation due to technological differences between India and Canada. Our minimum estimate should, therefore, in fact, be higher than what it is now. It is impossible to correct this ratio, since necessary information regarding the extent of duplication in miscellaneous group of industries is not available in the publications of Canadian Government. But if this information were obtained, the Canadian ratio would be higher, and the divergence between the minimum and maximum estimates for unspecified industries in India would be considerably reduced. Even so, we have no effective check to the estimates themselves, to be able to decide whether the maximum, the minimum, or the average of the estimates should be accepted. Under the circumstances, the best we can do is to combine estimates for unspecified industries, with those for specified industries, and check the aggregate of capital employed in all industries, by means of several independent criteria. If these checks show that the aggregate estimate is reliable, then there is sufficient justification to regard the estimates for unspecified industries as reliable, since the estimates for specified industries have also been checked and found valid.

The first test that we propose to apply for the verification of aggregate estimate of capital employed in Indian industry is based upon the ratio C/P (i.e., the ratio of Capital employed to net output of the industry). Paul H. Douglas & Cobb have sought a formula establishing functional relationship[1] between P(net output), L(Labour) and C(capital), under the assumption that increasing and decreasing returns do not exist, at any rate over short and medium intervals of time, the period during which neces-

[1] (a) Pp. 113-167. "Theory of wages" by Paul H. Douglas.
(b) Pp. 761-785. Journal of Political Economy XLVII. Dec. 1939.
"Cross Section Studies in the Cobb-Douglas Function" by M. Bronfenbrenner and Paul H. Douglas.
(c) P. 377-387, "The Conditions of Economic Progress". Colin Clark.

sary data is obtained is "normal", and that the industry functions under a competitive economy. The formula in question can be written as:

$$P = b\, I^{k}\, C^{1-k}$$

where b and k are constants and P, C and L have the meanings mentioned above. On differentiating this function with respect to C, we have

$$\frac{dP}{dC} = (1-k)\,\frac{P}{C}; \quad \text{or} \quad \frac{C}{P} = (1-k)\,\frac{dC}{dP}$$

Since the marginal productivity of capital can be taken to be statistically stable over a few successive normal years, it is clear that theoretically, the ratio C/P should not change significantly over such a period. This argument is again valid whether we consider all forms of national production and capital, or specific forms, such as net output and capital of manufacturing industry. This formula has been tested by applying it to data relating to U.S.A., Australia and New Zealand,[1] and the statistical fitting everywhere has been eminently satisfactory. As an additional proof of statistical stability of the ratio C/P during normal years, the following figures for Canadian manufacturing industries may be of some interest:—

TABLE 7

Ratio C/P for Canadian Manufacturing Industries[2]

Year	Ratio C/P
1921	2·401
1924	2·311
1938	2·440
1939	2·380

Another important characteristic of this ratio is that, for the industry as a whole, it has a higher value in the more highly industrialised and technologically advanced countries. This is as should be expected, since the ratio C/P is nothing but the average capital employed per unit of net output. In countries where heavy industries predominate the structure of industry, and advanced technology is practised, far more capital per unit product is employed,

[1] P. 4, "Principles of Economic Planning" Eastern Economist Pamphlet No. 1.

[2] Computed from data in Canada Year Book, 1940.

than in countries having the bulk of their production through medium or light industries, and employing relatively less automatic means of production. The figures stated in Table (7) seem to indicate, that for Canadian industry as a whole the ratio would vary between 2.30 and 2.45. The average of values of C/P for different groups of Canadian industries, also gives a figure of 2.425[1] for the year 1939. There is thus some concrete evidence to the effect that during normal years Canadian ratio C/P for the entire manufacturing structure, is statistically stable and of the order of 2.30 to 2.45. Because of the fact that in India, the bulk of industrial production accrues through light and medium industries, such as Cotton, Jute and Woollen Textiles, Sugar, Matches, and many miscellaneous industries, whereas in Canada the bulk of production is due to heavier industries, it is at once apparent that the ratio C/P for Indian manufacturing industry should be definitely lower than the one observed for Canadian industry. Owing to lack of necessary data, it is no doubt difficult to form any precise idea of the extent to which the Indian ratio C/P should be lower than the ratio for Canada. However a statistical study[2] in light of the admittedly meagre data available shows that in industry in general, especially in comparatively less industrialised countries like India, the ratio should approximately be equal to 2, i.e. the stock of capital employed should be about double the annual flow of income disbursed by the industry. If we have a reliable estimate of net output of large scale manufacturing industry of India, for the year 1938-39, we can use the aggregate estimate of Capital employed, to arrive at the ratio C/P, and test whether in fact it gives a value in the region of 2. In absence of any census of Production in India, no direct figure of net output is available. We have however made an estimate (cf. Appendix 'B'), on the basis of Dr. V. K. R. V. Rao's figure of industry's contribution to national income. Our esti-

[1] Computed from data in Canada Year Book, 1942.

[2] Pp. 6-11, "Principles of Economic Planning" Eastern Economist, Pamphlet No. 1.

mate of the net output of large scale manufacturing industry of India, for the year 1938-39, comes to approximately Rs. 3,300 million. In Table X (page 76) we have arrived at the following three estimates of aggregate Capital employed during 1938-39:—

(i) Lower limit of estimate =Rs. 6,371.433 million
(ii) Average value of estimate =Rs. 6,748.203 million
(iii) Upper limit of estimate =Rs. 7,124.973 million

Dividing each of these estimates by the estimated value of net output viz. Rs. 3,300 m llion, we have the following three values of the ratio C/P for India:—

(i) Lower limit of the Ratio C/P =1.930
(ii) Average Ratio C/P =2.045
(iii) Upper limit of the Ratio C/P =2.159

If, therefore, we accept the average value of the estimate, namely, Rs. 6,748.203 million, as the final estimate, the value of ratio C/P would closely approximate to the expected figure. Hence, the average of the aggregate estimates would seem to give a sufficiently reliable figure of the Capital employed in Indian industry during 1938-39.

The second independent check to the average estimate of Rs. 6,748.203 million is provided by Prof. Douglas' production function. As stated elsewhere, this function is given by the equation $P=b\,L^{k}\,C^{1-k}$ where b and k are constants and P. L & C represent net output, number of workers, and capital employed respectively. Since we already know the values of P & L, we can solve the equation to obtain the value of C, provided the constants k and b are also known. There is no direct way of determining these constants for Indian industry. It is, however, possible to derive their corresponding values for India on the basis of values for Canadian industry. Certain investigations into this subject by Patricia Dally & Paul H. Douglas[1] show that for Canadian manufacturing industries the average value of k, over a number of normal years, comes to 0.468. Theoretically k is equal to $1-\frac{dp/dc}{P/C}$. Since in industrially and technologically advanced countries, re-

[1] Journal of American Statistical Association, Vol. 38, No. 222.

latively greater capital will be needed per unit net output, or, in other words, smaller net output will result from unit capital, it is clear that in such countries k will have a large value than in case of less progressive countries. In fact the value of k seems to provide significant information regarding technological differences between industrial structures of different countries. (cf. Appendix C). It is higher for industrially advanced countries. For instance, the value of k for U.S.A. is 0.69[1] as against 0.468 for Canada. Its value for India will therefore be less than for Canada, to the extent that Canadian and Indian structures of industry differ. An approximation to this difference can be deduced from the fact that C/P for India is on an average less than C/P for Canada by 14%[2] of the latter ratio, and that this difference is largely due to the predominance of heavier industries in Canada. On this basis the value of k for Indian industry comes to $(0.468^{0.655} - 0.655)$ i.e. 0.4025. The value of constant b corresponding to k=0.4025 for Indian industry can also be derived from the production function as in Appedix 'D' page (90). This value comes to 12.17. Substituting the values of P, L, b & k for Indian industry, in the equation $P = b\ L^k\ C^{1-k}$, and taking logarithms of both sides of the equation we have:

$$\text{Log}\ (3300{,}000{,}000) = \text{Log}\ (12{\cdot}17) + (0{\cdot}4025)\ \text{Log}\ (2{,}050{,}231) + (0{\cdot}5975)\ \text{Log}\ C \qquad \text{(i)}$$

$$\text{i.e.}\quad 9{\cdot}5185 = 1{\cdot}0852 + 2{\cdot}5405 + 0{\cdot}5975\ \text{Log}\ (C) \qquad \text{(ii)}$$

$$\text{or Log}\ C = \frac{9{\cdot}5185 - 2{\cdot}5405 - 1{\cdot}0852}{0{\cdot}5975} = \frac{5{\cdot}8928}{0{\cdot}5975} = 9{\cdot}8624 \qquad \text{(iii)}$$

$$\text{Hence}\ C = \text{Antilog}\ 9{\cdot}8624 = 7282{,}000{,}000 \qquad \text{(iv)}.$$

The estimate of Capital employed, obtained by this method thus comes to Rs. 7,282 million, a figure which compares extremely well with the estimate of Rs. 6,748.203 million. The difference is less than 8% from this estimate and only 2% from the maximum estimate of Rs. 7,125 million. This check enhances confidence in the estimate of capital em-

[1] Ibid.

[2] In computing this percentage, we have taken the average of percentage differences of the three values of Indian C/P (p. 66), from the average value of Canadian C/P=2·375.

ployed in Indian manufacturing industry, as obtained in the present investigation.

The third evidence as to the reliability of aggregate estimate would seem to be provided by comparisons of ratio C/G for Indian and Canadian industry. According to our estimate, the gross value of production of Indian industry is Rs. 5,165.17 million (see figures in Tables VII and VIII pages 45 and 46 respectively). Dividing the average figure of Capital employed viz., Rs. 6,748.2 million by this gross value of production, we get 1.3 as the value of C/G for Indian industry in 1938-39. The value of Canadian ratio C/G for all industries, for the same period, comes to 1.047.[1] But when this value is corrected to take into account the probable duplication to the extent of 30%[2] in the gross value of production in Canada, the Canadian ratio comes to 1.49. The Indian ratio C/G for the whole structure is thus 12.6% less than the corresponding Canadian ratio. This is so, mainly because in a country where heavy industries predominate in the sense, that relatively larger value of production is obtained through industries which need large amounts of capital per unit gross output, the ratio C/G for the whole structure will tend to become larger. Again, the ratio C/G varies more rapidly from industry to industry than from location to location for a given industry. The differences in Industrial structures of India and Canada, therefore, become highly significant, when we consider the ratio C/G for the entire structures in the two countries. Some idea of structural differences between Canada and India can be had from the fact that in Canada 66 per cent. of total gross output is due to industries which require on an average 1.4 units of capital per unit gross output, whereas in India, roughly the same percentage of gross output is due to industries which require only 1.06 units of capital per unit of gross output. For these reasons, we should expect the Indian ratio C/G for the entire structure of industry, to be lower

[1] Computed from figures available in Canada Year Book, 1942.

[2] U. K. Final report of the Census of Production, 1930, and Sixteenth Census of the U. S. A. Manufactures, 1939.

than the corresponding ratio for Canada. It must however be emphasiszed that *for agiven industry*, the Indian ratio C/G should be higher than the Canadian ratio, for the reasons already stated in Chapter III. This difference of 12.6% can be easily accounted for when we consider that the Canadian structure of industry as a whole would need larger capital per unit gross production than the Indian structure, because of the relative abundance of heavier industries in Canada and also, owing to duplication in gross value of Canadian production. The difference in fact should be more or less the same (i.e. 14%) as has been estimated for the ratios C/P in the two countries. On this basis, we should expect the ratio C/G for the Indian structure to be 14 per cent. lower than the corresponding Canadian ratio, as against 12.6%, as stated above. But even this small discrepancy may be explained by the fact that G in the ratio C/G for India has not been corrected for duplication, if any. The main assumption made in calculating C/G for the Indian structure, from figures of gross production in Tables VII and VIII (pages 45, 46), is that there is no duplication in this value, arising out of the fact, that products of one industry may be used as raw material by another industry. This assumption is not fully valid when we consider the total gross production of all individual industries. But the amount of the duplication in the estimated gross value of production for Indian industry is relatively negligible for two main reasons. Firstly, our selection of industries in Table VII would at once indicate that out of the sixteen individual industries listed in that Table, end products of only three industries, viz., Cotton Ginning & Pressing, Electric Power and Heavy Chemicals are being used to varying extents, for production purposes, by other industries mentioned in the same Table. It is therefore clear that the duplication involved in the Total figure in Col. (2) of Table VII would be very small, particularly because, except for ginned cotton, value of products of other two industries, viz., Electric Power & Heavy Chemicals, would constitute only a fraction of the gross value of production of other industries mentioned in the Table. Se-

condly, the gross valu eof production of unspecified industries (see Table VIII page 46) has been worked out on the basis of the weighted average value per unit labour, derived from the total for specified industries (Table VII, page 45). Even the small duplication which might exist in case of the gross production of specified industries is thus rendered almost insignificant, and the gross production of unspecified industries (Table VIII page 46) can be considered free from such duplication for practical purposes. In view of these facts, it seems reasonable to assume that in the total value of gross production of all manufacturing industries of India, the extent of duplication is only negligible. It is perhaps due to the presence of small duplication in gross value that the Indian ratio C/G is 12.6% lower than the Canadian ratio, instead of 14%. The value of C/G for India viz. 1.30 is thus very nearly as it should be. This result also shows that our estimate of capital, on which this ratio is based can be regarded as reliable.

The foregoing checks relate to the "capital employed" in the aggregate of manufacturing industries, and not to the components of this capital. Owing to the paucity of necessary data, it is a most formidable task to check separately the values of land and buildings, plant and machinery and working capital of all industries. There is, however, a check which can be applied to verify the total value of plant and machinery, for the aggregate of industries in 1938-39. On the basis of published statistics, it is possible to estimate the average anunal value of Plant & Machinery normally imported for the manufacturing industry. The average annual imports of such machinery during the period 1936 to 1939, were Rs. 113.5 million. Again, prices of machinery in 1938-39 were, on an average, 5% above 1936-38 level. Correcting the above figure for this increase in prices, and adding 10% for erection and installation charges, the value comes to Rs. 131.092 million or roughly Rs. 131 million. (It is necessary to point out here that this figure is exclusive of value of Railway Locomotives, Engines & Tender Parts, Agricultural Machinery,

Mining Machinery, Refrigerating Machinery, and other items which are apparently not relevant in the present investigation.) From a study of the Tariff Board reports, and on the basis of enquiries made from technical experts, we consider it reasonable to assume 5% as the rate of depreciation for Plant & Machinery, for the aggregate of industries. In other words, we can assume an average life of 20 years for machinery installed in Indian industries. Following the argument employed in Chapter III, we obtain the total value of Plant & Machinery installed in the entire manufacturing industry during the immediate pre-war year at Rs. 131 million×20 years, i.e., Rs. 2,620 million. A comparison of this figure with the average estimate of Rs. 2,389.252 million (Table X page 76) shows that the difference between the two estimates is a little less than 10%.

CONCLUSIONS

Having examined the mass of available statistics relating to industry in India, as well as other countries, and having applied suitable statistical techniques to such data, with the object of estimating industrial capital in India, we come to several interesting and significant conclusions. In light of the primary objective of the present investigation, our main conclusion is that *the capital employed in large-scale manufacturing industry of India, in 1938-39, was Rs. 6,748·203 million (in terms of 1938-39 prices), with a possible margin of error of ±5·59 per cent.* [*See table X, item 22, and Col. (5) page* 76, 77].

In other words, we can say that during the immediate prewar year, all Indian factories governed by section 2(*j*) of Factories Act, 1934, needed for their productive activities, total monetary resources in shape of values of land and buildings, plant and machinery, and working capital, to the tune of Rs. 6,750 million; the capital equipment as well as stocks of materials, fuel, and finished and partly finished products being assessed in terms of 1938-39 prices.

[1] Calculated from data at pp. 756-757, Statistical Abstract for British India, 1942; and p. 96 "Review of the trade of India", 1938-39.

This estimate of aggregate industrial capital, no doubt, appears to give a figure practically identical to Dr. Jeidels' estimate of Rs. 7,000 million, which has been quoted in several places. The two figures, however, are not comparable because of the fact, that our estimate relates to a limited sphere of industry, viz. Factories governed by s. 2(*j*) of Factories Act, 1934, whereas Dr. Jeidels' estimate covers a much wider field, and again, is relevant for quite a different period.

Apart from this main conclusion, there emerge from this investigation several important ancillary conclusions. These may be stated as follows:—

(1) In arriving at the aggregate estimate of Capital employed in Indian industry we have at first had to form reliable estimates of capital employed in as many individual industries as was possible. We have been able to do this for sixteen important industries, and our final estimates of values of land and buildings, plant and machinery, and working capital, as well as the total capital employed, in respect of each of these industries, are as shown in Table X pages 76, 77.

(2) On the basis of the present investigation, we can draw the inference that the value of *capital employed per unit labour* and *gross value of production per unit labour* in respect of each of the sixteen specified industries, are as stated in columns (6) and (5) respectively, of Table VII page 45.

(3) Since the estimates made in Table II (page 39) for cotton, jute and woollen textile industries have been substantiated by other independent methods, it follows that judging from the paid-up capital of these industries, the extent of undercapitalisation in jute and woollen textiles, is of the same order as in cotton textiles industry.

(4) In making estimates for individual industries as well as for the aggregate of industries, we have used the ratio C/G $\frac{\text{(Capital employed)}}{\text{(Gross value of production)}}$, for similar Canadian *industries, the ratio* $\frac{M\ \text{(Value of Plant \& Machinery)}}{F\ \text{(Fixed Capital)}}$ for similar

Australian industries, the ratio $\frac{\text{F (Fixed Capital)}}{\text{C (Capital Employed)}}$ derived from F/G for Australian industries and C/G for Canadian industries as well as the Candian ratio W/F $\frac{\text{(Working Capital)}}{\text{(Fixed Capital)}}$. The fact that the estimates, not only of capital employed, but also of their components, arrived at by use of ratios, agree closely with those made by other independent methods, leads us to the inevitable conclusion that the application of such industrial ratios derived from statistics of other countries, to industries working under Indian conditions, is a practical proposition. Not only this, but the methods of estimation based upon such ratios and the implicit assumptions in this investigation, also appear to be valid and justified.

(5) Since the estimates of several important industries arrived at on the basis of statistics of imports of Plant & Machinery, and the ratios, agree within narrow limits with those made by methods based upon more direct data such as can be found in the reports of the Tariff Board and other Government publications, it would follow that this method of estimating capital is statistically sound.

(6) It will be seen from the chapter on Methods (Chapter III), as well as the discussions in Chapter IV, that all our methods have been based upon certain fundamental assumptions. Such assumptions are implicit in empirical or quasi-mathematical methods of investigation. But if the results of the investigation can be verified by means of independent tests, it would follow that the assumptions implied or made in the methods employed are also reasonably justified. Since our estimates for specified individual industries, unspecified industries as well as for the aggregate of industries have been so verified, we may say with some confidence that the assumptions underlying these methods are valid.

(7) We have elsewhere emphasised the fact that in our work, we have mainly relied upon statistical data available from published sources. And yet the results show that the labour expended in subjecting even such frag-

mentary information as is available, to systematic treatment, with a well defined objective, can yield useful conclusions. This fact has led us to the belief that not only in the field of industry, but in certain other economic spheres, scientific analysis and utilization of available statistics should bring to light a variety of interesting and useful conclusions which can be stated with varying degrees of confidence. In support of this belief, we cannot do better than quote what an eminent American economist has to say:[1]

> "The passion of Americans for statistics is, as a matter of fact, accumulating vast quantities of data, which almost cry aloud for analysis, if they are to be rendered intelligible and significant. The patient accumulation of facts will in itself avail us little unless these facts are subjected to mathematical and statistical analysis to determine their inner relationships."

Elsewhere in the preface to the same book occurs the following corroboration to our belief.

> "It is of course quite true that there is a certain margin of error in most economic data, but there are many series which are sufficiently close approximations to the facts to permit of more refined analysis. In short, while we should try to improve existing statistics, we can wring far more meaning than we have from those which are now available."

In the following chapter we have discussed some of the important practical uses of the estimates arrived at in the present work. But before we close this chapter it would be in the fitness of things to point out one important limitation to the applicability of our methods of estimation to similar data in some future period. This limitation can best be described again in the words of Prof. Douglas, as follows:—[2]

> "The inductive evidence of the book, as well as the deductive reasoning, is drawn from modern econo-

[1] P. XII, Preface, "Theory of Wages", Paul H. Douglas.
[2] Ibid.

> mies characterised by competitive or quasi-competitive capitalism. Some of the principles developed might, therefore, not apply in an authoritarian or monopolistic capitalism, in a rationed communism or a liberal socialism. If a society is passing out from the stage of competitive capitalism, this study may, therefore, in part become obsolescent."

This observation, however, narrates the theoretical limitation. In a country like India with a fundamentally competitive economy so far, and now on the threshold of planning, studies like these, far from being obsolescent, might provide useful material for planning itself.

TABLE X

Final Estimates of Capital Employed in Large* Scale Manufacturing Industries of India, 1938-39

(1) INDUSTRY	(2) Value of Land and Buildings (L)	(3) Value of Plant and Machinery (M)	(4) Working Capital (W)	(5) Capital Employed. Col (2)+Col. (3) + Col. (4) (L+M+W=C)	(6) Ref. cf Table No.
	Million Rs.	Million Rs.	Million Rs.	Million Rs.	
1. Cotton Textiles	484·559	546·374	247·375	1,278·308	I
2. Jute Textiles	280·105	315·863	175·013	770·981	VI
3. Sugar	43·140	264·960	70·270	378·370	I
4. Cotton Ginning & Pressing	100·422	138·679	102·472	341·573	VI
5. Electric Power	23·442	284·998	30·502	338·942	VI
6. Iron & Steel	77·260	171·966	43·003	292·229	I
7. Cement	49·140	114·650	12·990	176·780	I
8. Cigarettes	15·008	13·578	66·700	95·286	VI
9. Paper	29·550	27·280	9·176	66·006	I
10. Flour Mills	13·576	11·565	22·565	47·706	VI
11. Woollen Textiles	11·921	15·036	6·802	33·759	VI
12. Soap	6·546	5·577	14·758	26·881	VI
13. Matches	8·763	13·143	4·339	26·245	I
14. Breweries & Distilleries	5·747	5·521	14·054	25·322	VI
15. Heavy Chemicals	3·833	2·555	1·012	7·400	I
16. Glass	0·296	0·910	0·612	1·818	I
17. **Total: Specified Industries (Items 1 to 16)**	1,158·808	1,932·655	821.643	3,907.606	

TABLE X—(*Continued*)

(1) INDUSTRY	(2) Value of Land and Buildings (L)	(3) Value of Plant and Machinery (M)	(4) Working Capital (W)	(5) Capital Employed Col (2)+Col. (3) + Col. (4) (L+M+W=C)	(6) Ref. of Table No.
18. Unspecified Industries: Minimum Estimate (Table VIII)	761·963	396·036	1,805·828	2,463·827	VIII
19. Unspecified Industries Maximum Estimate. (Table IX)	995·003	517·159	1,705·205	3,217·367	IX
20. All Industries: Lower Limit of Estimate. (Item 17+Item 18)	1,915·271	2,328·691	2,127·471	6,371·433	
21. All Industries: Upper Limit of Estimate. (Item 17 + Item 19)	2,148·311	2,449·814	2,526·848	7,124·973	
22. All Industries: Average Estimate. (Average of Items 20 & 21)	2,031·791	2,389·252	2,327·160	6,748·203	
23. All Industries: Percentage deviation of Upper and Lower Limits from the Average	+5·68% —	+2·58% —	+8·58% —	+5·59% —	

* Consisting of factories governed by Section 2 (j) of Factories Act, 1934.

CHAPTER VI

USES OF THE ESTIMATES

From the foregoing chapters it would appear that judging by reasonable standards of accuracy, the estimates of capital arrived at in this work, can be regarded as reliable. But, it would at the same time be natural to enquire as to the utility of such estimates. In answer to such an enquiry it can be generally stated that these estimates have intrinsic utility in the sense that they fill up an important existing gap in the economic statistics of India, and provide information of a fundamental character, regarding industry. Apart from this, these estimates can be put to a variety of uses. Under competitive capitalism, capital is perhaps the most easily variable factor of production and, therefore, examination of industrial problems, whether by the State or individual entrepreneurs will often involve use of such estimates, for a variety of purposes. The practical uses which can be made of our estimates may, therefore, be numerous. It is, however, not proposed to discuss all possible uses of the estimates in the present chapter in any exhaustive manner. The intention is rather to indicate generally the range of uses, and give a few practical examples.

In industrial planning it is often necessary to assess the total capital requirements of a plan aimed at a given target of production. Since on the basis of our estimates, it is possible to work out for a given industry, the quantum of capital per unit production in a pre-war year, the total additional requirements of capital, under the plan, for expansion of an existing industry, can be easily obtained by multiplying the target figure by the above mentioned quantum of capital, and taking the difference between the result obtained and the capital employed in the same industry during the immediate pre-war year.

Under a planned economy it may also be necessary for the State to ensure that the aggregate quantum of

capital available in the country is utilised in a most advantageous manner. To this end, it would be important to prevent under-capitalization as well as over-capitalization, in new industries which may be started under the plan, or the existing industries which might seek expansion; for, under-capitalization would militate against the efficiency of industry, and over-capitalization would obviously result in wastage of available capital resources. The results of our investigation provide certain basic information which can be of use in dealing with such questions. For instance, from the material available in this work, it is possible to work out the ratios of capital employed to gross production, fixed capital to gross production and working capital to gross production, as well as several other ratios between the components of the capital employed. If, therefore, estimated quantitative production and ex-factory prices of manufactures of a new industry are known, we may utilise the various ratios, such as C/G, F/C, M/F etc., with a view to ascertaining the approximate amount of capital, in shape of value of land and building, plant and machinery as well as the working capital, which will be needed to work the industry with a reasonable standard of efficiency. The ratios mentioned above may also be useful to individual entrepreneurs for estimating the total capital requirements, as well as values of land and buildings, plant and machinery, and working capital; and generally, for starting their industries with adequate capital resources.

These ratios may also be useful to the management of existing factories. The ratios mentioned above and particularly the ratio of working capital to the total capital employed seem to provide certain "norms" for the industries concerned. These may, therefore, be utilised by the management of factories with a view to ensuring that their factories work at a normal pitch of efficiency. The use of such ratios for efficient management of factories is well-known. Having known the "norms" of these ratios for the industry, if the management is keen enough to watch and analyse fluctuations in the ratios, they might be in a

better position to foresee and control many kinds of trouble, which often arise owing to a variety of causes. In support of this view, we may cite the observations on this subject from a well-known book on[1] "Economic Control of Iron & Steel Works":

> "It is obvious that this ratio (***i. e. the ratio of plant costs to floating assets***)[2] determines to a great extent the business policy, e.g., in an industry such as iron and steel, where an unusually large part of the invested capital must be used for the plant, special attention is necessary that this ratio does not increase to a dangerous extent. Further, great care should be taken as regards expert maintenance and the provision of sufficient reserves for replacement of out of date machinery and equipment; for, in this industry these items play a more important rôle in the costs than in other industries; they can be kept comparatively low in the long run only if they are continuously and carefully controlled from the start by experts. There are other such ratios which are worthwhile noticing....."

Since our estimates provide the basic information about capital employed in manufacturing industry during 1938-39, and similar estimates can be attempted for a subsequent period, when such estimates become available, we can compare the two estimates with a view to obtaining some concrete idea of the capital formation in Indian industry during the period concerned.

Our estimates not only give the extent of capitalization in each of the major industries, but also provide some basis according to which it may be possible to classify individual industries into groups of heavy, medium or light industries. A comparative study of capital employed in different industries and their net production should throw considerable light on the nature of the industrial structure as a whole.

[1] " Economic Control of Iron and Steel Works " by F. L. Meyenberg-Chapman and Hall, Ltd.

[2] Italics ours.

In Table VII (page 45) we have derived the relation between gross production and labour and between capital and labour for each of the specified industries. These relations can be utilised in two different ways. If the target of gross production under a plan is available, we can, from a knowledge of the ratio C/L for the industry in question, determine the approximate labour requirements of the plan. Similarly, if the amount of capital intended to be sunk in an industry is known, we can also determine the labour requirements for that industry from a knowledge of the ratio C/L. From the point of view of ensuring fuller employment under a plan, the ratio C/L would show the employment capacity of an industry in relation to the capital already employed or the additional capital which is proposed to be invested in it.

Again, the estimates made by us may be used to obtain certain other interesting conclusions relating to Indian industry for a period following the year 1938-39. Some of these uses may be illustrated as follows:—

(1) For instance, we have estimated that the total value of plant and machinery employed in manufacturing industry of India in 1938-39 was Rs. 2,389.252 million. Assuming that during the six years of war there was no replacement of industrial plant and machinery against normal wear and tear, because of lack of indigenous production of capital goods and the absence of imports from abroad, we come to the logical conclusion that there is now, some accumulated demand for replacement of capital equipment in Indian industry. Our estimates can be used to ascertain the approximate amount of such accumulated demand. Let us make the reasonable assumption that the overall normal rate of depreciation of plant and machinery for the Indian industry as a whole is 5% per annum. On the assumption that during the war the industry worked on single shift basis, the value of this accumulated demand over the period of six years of war may be estimated at Rs. 716.780 million in terms of 1938-39 prices. Furthermore, if we can find sufficient material to ascertain the additional depreciation owing to the fact that during the war many

factories worked on multiple shift basis, we can arrive at a more reliable figure of accumulated demand of capital equipment in Indian industry. Only some industries worked on a multiple shift and not all. Again, it is known that industries worked on multiple shift only during the last three years of war. We may therefore roughly state that the industry as a whole worked one and a half shift during the six years of war. The accumulated demand of capital equipment in Indian industry would therefore be of the order of Rs. 1,075.17 million, merely for purposes of replacement. That the figure of Rs. 716.780 million stated above is fairly reliable, can be checked by comparison with the figure of accumulated demand calculated on the basis of normal rate of depreciation, and imports of plant and machinery during the pre-war years. As will be seen from discussion on page 70, the annual average imports of plant and machinery required in the manufacturing industry, can be estimated at Rs. 131 million in terms of 1938-39 prices. But this average also includes the value of plant and machinery imported for purposes of expansion of industry as distinguished from replacement of machinery already in position. From the statistics of number of factories in India in 1930 and 1939 it is possible to form some idea regarding expansion of Indian industry. During this period the number of factories increased from 8,148 to 10,466, thus showing an annual average increase of 2.85 per cent. per annum. If we assume that the plant and machinery in the industry increased correspondingly, we can roughly say that during the pre-war years about 3 per cent. of plant and machinery annually imported into India were required for expansion of industry. On this basis the annual average imports of plant and machinery required solely for replacement purposes would work out to Rs. 127.07 million in terms of 1938-39 prices. Assuming again that during the six years of war the same amount of imports was needed by the industry and that practically no replacement was possible owing to lack of imports, we get Rs. 762.42 million as the demand for replacement of plant and machinery, which should have accumulated dur-

ing the six years of the war. It will be noticed that this figure compares closely with our previous estimate of accumulated demand valued at Rs. 716.780 million, the difference between the two figures being about 6.28%.

(2) In view of the fact that for a given industry the ratio $\frac{C}{L}\left(\frac{\text{Capital Employed}}{\text{Labour Employed}}\right)$ appears to be more or less constant at different places, and labour statistics for different Indian industries are available, our estimates may be used to study the territorial distribution of capital in respect of different industries. In the Table (8) (page 84) we have given the territorial distribution of capital employed in certain specific industries, and if similar distributions are worked out for the remaining industries, the manner in which the aggregate capital of Indian manufacturing industry is distributed over different regions, can also be studied.

As mentioned elsewhere in this chapter, we have here attempted only to give an indication of the possible uses to which our estimates can be put. It will also be observed that in certain cases, we have attempted to use these estimates for drawing inferences relating to a period subsequent to 1938-39. Since our estimates are made in terms of prices and industrial conditions prevailing in 1938-39, it is important to emphasize in the end that in any estimates for other periods, arrived at on the basis of our results, the changes in price levels and important developments in the conditions affecting Indian industry will have to be taken into account.

APPENDIX A

An Estimate of the value of yarn produced by Mills in India, which was not converted into cloth by Mills; but was sold to non-mill consumers, or exported, in the year 1938-39.

The total yarn production in the year 1938-39 was 1903.245 million lbs. (1)

TABLE (8)

Distribution of "Capital Employed" in certain Indian Industries according to Provinces and States: 1938-39

(All figures in million rupees.)

Industry and total labour employed	Total capital employed	"CAPITAL EMPLOYED" IN PROVINCES AND STATES														
		Madras	Bombay	Sind	Bengal	U.P.	Punjab	C. P. & Berar	Bihar	Orissa			Assam		Bangalore & Coorg.	States.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	15)	(16)	(17)
1. Jute Textiles *802,000	770.981	13.188 †(1.71%)			717.833 (93.1%)	18.503 2.4%)			18.106 (1.7%)							3.401 (1.09%)
2. Sugar *82,000	373 370	21.075 †(5.59%)	13.092 (3.46%)	0.640 (0.17%)	16.270 (4.3%)	204.774 (54.12%)	5.865 (1.55%)		74.085 (19.58%)	2.270 (0.6%)			0.151 (0.04%)			40.148 (10.61%)
3. Iron & Steel *43,200	222 229				113.969 (39%)				153.096 (54.1%)							20.164 (6.9%)
4. Cement *9,800	176 780	16.900 †(9.56%		9.652 (5.46%)			13.789 (7.8%)	25.456 (14.4%)	43.311 (24.5%)							67.672 (38.28%)
5. Paper *10,600	66.006		6.007 (9.1%)		33.782 (51.15%)	8.779 (13.3%)			8.634 (13.08%	3.498 (5.3%)						5.326 (8.07%)
6. Woollen Textiles *3,300	33.759	0.213 (0.63%	7.258 (21.5%		0.645 (1.91%)	9.588 (28.4%)	10.803 (32.0%)		1.654 (4.9%)							3.598 (10.66%)
7. Matches ... *16,600	26.245	53.54 †(20.4%	3.569 (13.6%		7.427 (28.3%)	1.661 (6.33%)	0.580 (2.21%)	0.157 (0.6%)					0.945 (3.6%)			6.352 (24.96%

*Figures represent total average daily number of workers employed in each industry during 1939.

† Figures in brackets ( ) represent percentages of labour in each

The total yarn exported in the year was 37.960 million lbs. (2)

Deducting exports, the total indigenous yarn available for consumption during the year comes to 1265.285 million lbs. (3)

Adding to this, imports during the year viz., 36.459 million lbs.,

we get the total quantity of indigenous and imported yarn available for consumption during the year to all classes of consumers.

This quantity comes to 1301.744 million lbs. (5)

The production of cloth by Mills in India during that year was 920.476 million lbs. (6)

The wastage of yarn in converting it into cloth was estimated to be about 2½%[1] in 1931. Since then however the average wastage is estimated to be about 2.084%.[2] On the latter basis it can be estimated that the total yarn including imported yarn consumed by Mills in production of cloth in that year was 940.07 million lbs. (7)

Deducting (7) from (5) we obtain the quantity of imported and indigenous yarn available for consumption by non-mill consumers. This quantity is 361.674 million lbs. (8)

This quantity can be assumed to have been consumed by the Handloom industry. According to the Tariff Board figures[1] about 9% of that quantity would be imported yarn, thus leaving the balance of indigenous yarn consumed by the handloom industry to be 328.123 million lbs. (9)

If to this quantity we add the quantity of yarn exported during 1938-39, i.e., 37.960 millior lbs., we get the total quantity of yarn produced by the Mills for sale to non-Mill consumers and for export. This quantity would be 366.083 million lbs. (10)

[1] P. 99 of the Report of the Indian Tariff Board—Cotton Textiles Industry, 1932.

[2] Ascertained by the authors on enquiry from technicians. The figure quoted is the average of several estimates.

[1] Pp. 158-59 of the Report of the Indian Tariff Board.

The quantity at (10) above, when multiplied by the average ex-factory[2] price of yarn per lb. for the year 1938-39, yields the gross value of yarn manufactured by Indian Mills in 1938-39, but not converted into cloth in Mills at Rs. 164.062 million. (11)

[See col. 4 Table IV (page 41]

APPENDIX B

An estimate of Net Output of Large scale Manufacturing Industries of British India and Indian States, during the immediate pre-war year (1938-39).

In the present context, by net output of industry we mean the quantum of national income contributed by industry. In absence of a census of production in India, net output of industry cannot be obtained directly from available statistics, and recourse has therefore to be taken to indirect methods to estimate it.

2. The present estimate is based on Dr. V. K. R. V. Rao's estimate of industry's contribution to the National Income of British India. Dr. Rao's estimate is Rs. 3,002[3] million. It relates to the year 1931-32, includes net output of industries in Burma, and excludes that of Indian States. Further, Dr. Rao's estimate covers large scale manufacturing industries,[1] mining and small scale and cottage industries. Since in the present investigation we require net output for the year 1938-39, of large scale manufacturing industry located in British India and Indian States, we have attempted to obtain the required estimate by applying appropriate corrections to Dr. V. K. R. V. Rao's figure of Rs. 3,002 million. These corrections are as follows:—

[2] The average price of yarn per lb. worked out on the basis of data available in the Fortnightly Statements of the Millowners' Association, Bombay, was approximately 86·046 pies for the year 1938-39.

[3] P. 187. National Income of British India, 1931-32, by Dr. V. K. R. V. Rao.

[1] Large-scale manufacturing industries comprise factories governed by Section 2(*j*) of Factories Act, 1934, i. e., factories employing 20 or more workers per day on an average and using power.

(a) Deduct Rs. 142.934[2] million, which was the net output in 1931-32, of all industries (inclusive of mining industry) in Burma.

(b) Deduct Rs. 117.203[3] million, which was the net output in 1931-32, of Mining Industry in British India, exclusive of Burma.

(c) Deduct Rs. 350[4] million, which is our estimate of annual net output of Handloom Industry.

(d) Deduct Rs. 350[4] million which is our estimate of annual net output of other small scale and cottage industries of India.

3. When the above corrections are carried out, we get a figure of Rs. 2,041.863 million or say Rs. 2,042 million, as the net output of large scale manufacturing industries in British India excluding Burma, in the year 1931-32.

To this figure we must apply the following additional corrections in order to get the required estimate:—

(i) Add 23.3% to cover estimated increase in production between 1931-32 and 1938-39, as revealed by figures of labour employed in large-scale manufacturing industries during these periods. This gives Rs. 2,518 million as the net output of large-scale industries of British India in 1938-39, expressed in 1931-32 prices.

(ii) Add to the above figure 5% for increase in prices between 1931-32 and 1938-39, as indicated by the index of

[2] Appendix K. National Income of British India, 1931-32, by Dr. V. K. R. V. Rao.

[3] P. 186, Ibid. The figure stated here is exclusive of Rs. 62 million which was the estimated net output of Mining Industry of Burma, in 1931-32.

[4] Census (1931) figures show that nearly 14·6 million persons were engaged in all forms of industrial production as principal earners; and of these, some 13·2 million were engaged in production carried on by small-scale and cottage industries. Handloom industry engaged nearly 6 million persons and produced goods worth Rs. 700 million [cf. Cotton Industry Annual (1948), p. 21, by M. P. Gandhi]. The net output of Handloom industry has been taken at half the gross value of production, viz., Rs. 700 million; since, for every pound of handloom cloth, on an average, nearly half the value can be ascribed to cost of cotton used. The net output of Handloom industry is thus estimated at Rs. 350 million. The remaining 7·2 million persons were therefore engaged in other forms of small scale and cottage production. We have taken an identical figure as the net output for these 7·2 million workers, mainly because the number of workers is practically the same as in case of Handloom industry, and judging by the popularity of Handloom industry, net output per worker in other types of small scale and cottage industries should be slightly lower than in the Handloom industry.

wholesale prices, with 1931-32 as the basic year. This gives Rs. 2,644 million as the net output of large-scale industries of British India in the year 1938-39, expressed in prices of the same year.

(iii) Add 17% to cover the net output of industry in Indian States. This addition is based upon the proportion[1] of factory labour employed in Indian States to that in British India in 1939. The estimate of net output of large scale manufacturing industry of British India and Indian States in 1938-39, thus comes to Rs. 3,093.48 million or say Rs. 3,100 million.

(iv) Add 7% to the figure under (iii) above, to account for probable underestimation owing to non-inclusion in the net output, of minor items such as Rates & Rents, Local Taxes, Insurance, Selling and Miscellaneous expenditure, etc., which should be theoretically included in the estimate of net output under a census of production. From the figures relating to census of production in Great Britain at p. 129 of "National Income & Outlay" by Colin Clark, it appears that this correction would be of the order of 7%. An examination of the admittedly meagre data relating to costing of products, available in Tariff Board Reports, shows that the correction should be about 10% of the sum of wages, salaries, profits and commissions, in case of certain major industries, such as cotton textiles, sugar, paper, matches, and cement. We have however preferred to take 70% as the overall correction, since in less organised industries most of the net output should be accounted for by the sum of wages, salaries and profits. The overall percentage correction would therefore be comparatively low. Applying 7% correction to Rs. 3,100 million, we have the final estimate of the net output of Indian manufacturing Industry in 1938-39 at Rs. 3,317 million or say Rs. 3,300 million expressed in prices of that year.

[1] The proportion is derived from figures of labour employed in Industry, which are available in Statistical Abstract of British India, 1942.

APPENDIX C

Behaviour of the Constant k of the Production Function in different industrial structures.

In Prof. Douglas' production function, P is the value of net output of industry during a given year, L is the labour employed in the industry during the same period, and C the value of Capital employed, at the end of the same year.

Hence, for given values of P, and C, the value of constant k can be obtained by differentiating the function with respect to C, and solving the resultant equation for k. The mathematics involved can be stated as follows:—

$$P = b L^k C^{1-k}$$

$$\therefore \frac{dp}{dc} = \frac{(1-k)\, b\, L^k}{C^k} = (1-k)\frac{P}{C} \qquad \text{(i)}$$

$$\left(\text{and} \quad K = 1 - \frac{\frac{dp}{dc}}{P/C} \right) \qquad \text{(ii)}$$

Since the marginal productivity of capital (i.e. dp/dc) can be assumed to be constant over a short period, and since k is a constant for a given industrial structure, it follows that (P/C) should also be constant for the same structure over the same period. In technologically advanced countries the marginal productivity of capital would be relatively low, and therefore the ratio P/C will also have a lower value than in relatively less advanced countries. To take the extreme case, let us assume that every unit of capital invested yields unit net output. This can be true in a country where the process of industrialisation has just begun, and resources of capital, labour and materials have yet to be fully employed. In such a case, both dp/dc and P/C will be near unity; and hence k will be near zero. Let us then consider an ideally industrialized country. In such a country, because the maximum level of production has been attained, fresh additions to the existing stock of capital will not result in any correspond-

ing increase in the total net output. In this event, the ratio P/C must have a value other than 0; and as C tends to its maximum, dp/dc will tend to zero, and therefore k will tend to unity.

The foregoing arguments bring out three points into relief:—

(i) That the constant k varies between 0 and 1, according to the character of the industrial structure to which it relates.

(ii) It has a higher value in industrially and technologically advanced countries.

(iii) The higher the value of k, the lower is the marginal productivity of capital.

APPENDIX D

Relationship between the constants b and k in the Production equation: $P=b\,L^k C^{1-k}$

Rewriting the production equation $P=b\,L^k C^{1-k}$ (i) in a slightly different form, we have,

$$b = \frac{P}{L^k\,C^{1-k}} = \left(\frac{P}{C}\right)\cdot\left(\frac{C}{L}\right)^k \qquad \text{(ii)}$$

For given values of P, C and L, the relationship between b & k is of an exponential type. We can make use of this relationship to determine the value of b, corresponding to K=0.4025. It is known that in case of Canada for the year 1937, corresponding to $K=K_1=0.43$* $b=b_1=15.4$.* We can also find C/L=5250, for the same year from data in Canadian Year Book, 1942 p. 363. Theproblem then is to determine the value of $b=b_2$ corresponding to another value of $K=K_2=0.4025$.

* Journal of American statistical Association. Vol, 38, No. 222.

Substituting the above value in equation (ii) above, and taking logarithms, we get,

$$\text{Log } b_1 = \text{Log}\left(\frac{P}{C}\right) + K_1 \text{ Log}\left(\frac{C}{L}\right)$$

$$\text{i.e. Log } (15\cdot4) = \text{Log } \frac{(P)}{(C)} + 0\cdot43 \text{ Log } (5250) \qquad \text{(iii)}$$

$$\text{and Log } (b_2) = \text{Log } \frac{(P)}{(C)} + 0\cdot4025 \text{ Log } (5250) \qquad \text{(iv)}$$

From the above equations, we obtain—

$$\text{Log } (15\cdot4) - \text{Log } (b_2) = 0.0275 \times \text{Log } (5250)$$
$$\text{Or Log } (b_2) = \text{Log } (15\cdot4) - 0\cdot0275 \times \text{Log } (5250)$$
$$= 1\cdot1875 - (0\cdot0275) \times (3\cdot7202)$$
$$= 1\cdot1875 - 0\cdot1023 = 1\cdot0852.$$

$\therefore$ Corresponding to $K_2 = 0\cdot4025$, $b_2 = \text{Antilog } 1\cdot0852 = 12\cdot17$

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