CHAPTER - IV

ESTIMATES OF CAPITAL

1. Concepts and Measurement :

In the estimation of production functions and the determination of relative factor shares (to be examined in the following chapters) capital plays a very crucial role. Unfortunately, the figures for capital input are notavailable in the form conceived by economists. It is the book (written down) values of fixed capital, where depreciation does not reflect the true consumption of capital, are reported in different sources of manufacturing industries in India. In what follows, therefore, an attempt is made to estimate the value of capital in the context of Indian manufacturing. Since there is much divergence between theory and empericism as regards the concepts and measurements of capital, we first discuss some of these questions and suggest an appropriate concept and method of measuring capital.

In theory, the value of capital is defined as the discounted future income stream to be derived from it. This is a forward-looking concept; significance of a stock of capital goods lies in its earning power. Capital can also be defined as a quantity of labour time expended in the past -

i.e., the cost of producing a capital asset. This is a backward looking concept. In a state of "perfect tranquility",[1] the two concepts must give the same value, and the rate of discount which makes the two equal must be the rate of interest or the rate of return. In an ordinary world future cannot be predicted with confidence and hence the 'earning power' of a given capital stock cannot be determined with precision, neither it need turnout to be equal to cost at the end. The cost of capital being known, remains the only reference to value of capital. "To treat capital as a quantity of labour-time expended in the past is congenial to the production function point of view, for it corresponds to the essential nature of capital regarded as a factor of productions," because, "the main purpose of the production function is to show how wages and the rate of interest are determined by technical conditions and the factor ratio".[2] If we know the forward value of capital we know the future prices and costs and the rate of interest, which would make production function merely a tautology. The fact that a machine costing x rupees to-day is more productive than a machine costing the same amount in the past (suitably

1. Joan Robinson: "Some Problems of Definition and Measurement of Capital", in Collected Economic Papers, Vol.II, (Oxford: Basil Black Well, 1960).

2. Joan Robinson: "The Production Function and the Theory of Capital", in Collected Economic Papers, Ibid., p.115.

adjusted for price changes) is then explained in terms of the shift in the production function, (i.e. technical progress).

But there may be objections to the cost approach of measurement on the ground that the cost might correspond to the value of assets when it was new - what about the value of an old asset when the productive capacity has declined. If the productivity really declines, then the only way to measure it is to know the remaining productive capacity of the asset, and this throws us back to the forward-looking concept of value of capital which is based on all sorts of expectations. Any accounting practice of measuring the decline in productivity (i.e. depreciation) would be simply arbitrary and misleading. We have an authority in Leontief: "Use of depreciated coefficients implies that capital stocks decrease in effeciency in exact relation to depreciation charge. Most available evidence indicates that this is not a reliable assumption".[3]

A related concept, i.e. 'replacement cost' is very often used as a reference to the value of capital. However, 'replacement cost' concept again, has two variants :

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3. Harvard Economic Research Project: Estimates of the Capital Stock of American Industries, 1947, (Cambridge: Mass, 1953), pp.21-22. See also E.D.Domar, "The Capital Output Ratio in the United States: Its Variation and Stability" in The Theory of Capital, ed.by F.A.Lutz and D.C.Hague, (London: Macmillan, 1961), p.98.

(i) replacement cost new, and (ii) replacement cost written-down. The first one amounts to the cost of the new equipment of similar type, while the second one is based on the vague notion of decline in productive capacity and its measurement. Perhaps it would have been possible to leave this measurement problem to market forces, but it requires that a nearly perfect market for second hand goods exists. This might be so for a specific class of capital goods in specific regions, but, by and large, second-hand capital goods are sold and bought only in special circumstances when a decision to scrap a plant (based on factors of obsolescence etc.) has already been taken. Market is no guide to the value of existing old assets.

Thus, what firmly remains in our hands is cost concept (i.e. undepreciated original cost of the asset). If price adjustments and index number problems are suitably solved, it is the purchase price of asset which is known. It has already been remarked that it is this concept of capital which is more congenial to production function. Considerable empirical evidence would suggest that adjustments for the decline of productive capacity too are unwarranted. The relationship between replacement cost-new and output is more stable because efficiency of assets does not decline as fast as accounting procedures of depreciation show. In fact Barna holds: "In most industries which are capital intensive ...

the efficiency of plant tends to increase rather than decrease with life", and plants are scrapped before their efficiency actually declines."In the wide field it is obsolescence rather than wear and tear which is the dominant cause of mortality - homicide to make room for a new favourite, rather than natural death".[4] Further we have from Leontief: "Recent information indicates that the undepreciated coefficients correspond much more closely to the incremental coefficient than do the depreciated ones".[5] Hence gross capital-output ratios would be more relevant for forecasting the incremental capital requirements. Domar has another important point in favour of gross capital figures "working with net investment and net stock of capital in the conventional sense one loses sight of gross investment as a major vehicle of technological progress... Hence gross figures may be more meaningful, with some unknown deduction of a smaller magnitude than conventional depreciation to account for the deterioration of existing capital".[6]

However, even some unknown deductions of a smaller magnitude are not required if we take into consideration yet another point, which would mean that original cost is

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4. Tibor Barna: "On Measuring Capital", in The Theory of Capital, op.cit.,p.85.
5. Harvard Economic Research Project; op.cit.,pp.21-22.
6. E.D.Domar, op.cit.,p.99.

the best estimate of the value of capital asset as understood in theory at any point of time. It is a fact that a large amount of expenditure is incurred by business firms on repairs and maintenance, whose main object is to keep the asset in more or less a similar productive capacity. Based on a study of large number of firms Barna concludes: "It seems that most assets which are in use are maintained by considerable expenditure; the data collected indicate maintenance expenditure which are of the same magnitude as annual capital expenditure. Even though some repairs are capitalised, it is almost unavoidable that maintenance expenditure should improve the efficiency of plants".[7] By convention a large part of such maintenance expenditure is treated as current cost (i.e. current flow) and is deducted from gross value of output for the purposes of finding out gross value added. Now, since the main object of these expenses is to keep the productive capacity of capital equipment more or less intact, there is no reason why it should not be treated as re-investment. If so, than the so-called 'gross-value added' is infact net value added, and there is no need for substracting depreciation from the gross value of capital stock to find out the net value of capital stock.

We may conclude from the above discussion that 'gross-value' or 'purchase price' (suitably adjusted for price

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7. Tibor Barna, op.cit., pp.90-91.

variations) is the most useful concept and is also the closest to the concept of capital in theory.

Capital is the stock of all the goods with the firm at any moment of time - whether fixed assets like machines and buildings or circulating assets like consumable stores. The foregoing discussion about the value of capital mainly applies to the fixed assets, inventories being measured at the current cost and there being no problem of depreciation with respect to them.

2. Gross-Net Adjustments :

The Annual Survey of Industries (ASI) and the Census of Manufacturing Industries (CMI) are the two most complete sources (among all the sources) of information about the large-scale manufacturing industries in India. These two sources provide information about fixed and working capital by different categories. The relevant categories of assets are : Building and construction, plant and machinery, and tools, transport equipment and other fixed assets in the fixed capital group, and inventories of materials, stores and fuels, semifinished and finished products in the working capital group. The ASI reports written down (depreciated) book value of the fixed assets. In order to obtain their "gross" or "purchase value", an appreciation of the reported figures of fixed assets is required (whereas no such adjustment is necessary for the inventories).

Gross-net value adjustment becomes a complicated problem as it depends very much on the age-structure of capital assets and the rate of depreciation. Obviously a common ratio for all the categories of assets and all the industries would not serve the purpose. In absence of complete information on the age-structure of fixed assets in different industries, the best that could be done would be to assess for a particular year the average gross/net ratio for each industry from a good sample of the firms giving information about the purchase value of the assets and the written down value.

The required information for the year 1960 was available from about one thousand balance-sheets of the firms collected by the Reserve Bank of India. These balance-sheets were classified according to industries at three digit level of the ASI classification on the basis of their major products. Industry-wise coverage of fixed assets of these balance sheets is shown in Table IV-1. It will appear from the table that all the industries at three-digit level are not covered, while the coverage at two-digit level is more evenly distributed.

Analysis of these balance-sheets yielded gross/net value ratio for capital assets for the year 1960. These ratios were calculated separately for each of the three

Table IV-1

Net Value and Percentage of Fixed Capital Assets Covered by the Balance-Sheets, 1960.

Industry No.	Industry	Building & construction		Plant & Machinery		Other equipment	
		Net value Rs.in'000	% of ASI value	Net value Rs.in '000	% of ASI value	Net value Rs. in '000	% of ASI value
1	2	3	4	5	6	7	8
20	Food (except Beverage)	151179	34.77	254222	32.56	32561	34.76
21	Beverage	3259	33.30	6181	38.77	1324	41.91
22	Tobacco	14696	52.33	20770	91.22	6274	63.17
23	Textiles	397439	67.76	1134738	74.04	71614	89.07
25	Wood and Cork	3769	31.71	11389	39.74	870	25.11
26	Furniture & Fixtures	978	6.13	1242	12.16	235	21.10
27	Paper & paper products	95065	63.98	260726	81.87	12417	78.13
28	Printing & Publishing	13038	20.62	13230	11.98	2726	15.11
29	Leather & Fur products	644	14.57	847	11.42	127	12.28
30	Rubber Products	10155	31.97	34733	55.97	2663	34.43
31	Chemicals & Chemical products	99912	31.40	174040	27.10	23153	24.18

....79

Table IV-1 (concluded)

Net Value and Percentage of Fixed Capital Assets Covered by the Balance-Sheets, 1960 (concluded)

Industry No.	Industry	Building & construction		Plant & Machinery		Other Equipment	
		Net value Rs.in'000	% of ASI value	Net value Rs.in '000	% of ASI value	Net value Rs.in'000	% of ASI value
32	Petroleum & Coal products	81660	94.98	263607	95.61	12971	33.74
33	Non-metallic mineral products	208620	87.51	328267	69.34	43830	88.54
34	Basic Metal	68616	19.42	128124	7.14	11519	8.93
35	Metal products	30339	63.84	29754	26.29	4407	39.02
36	Machinery(except Electrical)	40563	45.00	94868	52.35	17835	57.96
37	Electrical machinery	77244	73.58	89750	62.26	18292	94.15
38	Transport equipment	111269	35.17	211035	43.93	22890	31.88
39	Miscellaneous	1054	4.40	1634	4.31	280	3.32

Source: Derived from (the Reserve Bank of India, ~~collected~~) ~~about~~ one thousand balance-sheets of the joint stock companies for the year 1960, and the Annual Survey of Industries.

classes of capital assets, i.e. (i) building and construction, (ii) plant and machinery, (iii) tools, transport and other equipments. The industries for which these ratios were not available (at three-digit level), they were assumed to having the same ratio as obtained for the nearest industry, the judgement of the nearest industry being based on similarity of the product. Gross/net ratios for each of the above categories of fixed assets, are presented in Table IV-2.

The gross/net ratios of the fixed assets thus obtained, enable us to convert the net value of fixed assets as reported in the ASI into gross value fixed assets (at their purchase prices) for the year 1960. Having obtained the gross values of fixed assets for each of the three categories of the fixed assets for 1960, it is possible to build up the gross values for any other year, forward and backward, by using the gross values of the additions to capital stock. The gross value of fixed assets of a particular industry say for the year 1964, would be obtained as :

$$G_i^{64} = N_i^{60} (r_i) + A_i^{61} + A_i^{62} + A_i^{63} + A_i^{64}$$

where G = Gross value of assets

N = Net value of assets

r = Gross/net ratio for 1960

A = Additions to capital stock (gross value of additions)

Table IV-2

Gross/Net Ratios for different Categories of Fixed Capital by 3-Digit Level Industries - 1960.

Industry No.	Industry	Building-construction	Plant-machinery	Other equipment
1	2	3	4	5
205	Floor, Rice and Dal mills	1.3781	2.6730	1.5200
206	Bakery products	1.1682	1.1620	1.3941
207	Sugar & gur	1.6555	2. 2164	2.4659
208	Cocoa, chocolate etc.	1.5071	1.8693	2.0360
209	Miscellaneous Food	1.3437	1.9630	1.8582
211	Alcohol & Spirits	1.9483	2.4021	2.0384
212	Wine	1.6448	1.7923	1.8812
220	Tobacco	1.5380	1.9800	2.3875
231	Textiles	1.9432	2.3190	2.2413
232	Knitting mills	1.6667	2.7241	2.2500
233	Rope and Twine	2.2226	2.5013	2.6493
239	Ginning, Pressing, etc.	1.7290	2.6647	2.1294
251	Wood	1.3951	1.5861	2.1639
252	Wooden products	1.5649	1.4751	2.0691
260	Furniture & Fixture	1.0818	1.2399	1.2681
271	Paper and paper products	1.4501	1.6906	1.8135
280	Printing	1.2511	2.3460	2.1134
291	Tanneries	2.4860	2.8512	2.9528
300	Rubber & Rubber products	1.3178	1.7100	1.6917
311	Chemicals	1.2760	1.5382	1.6507

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Table IV-2 (concluded)

Gross/Net Ratios for Different Categories of Fixed Capital by 3-Digit Level Industries - 1960 (concluded)

Industry No.	Industry	Building-construction	Plant-machinery	Other equipment
1	2	3	4	5
312	Vegetable oils	1.6850	2.4827	1.7095
313	Paints, varnishes, etc.	1.8848	2.6083	2.2842
319	Miscellaneous pharmaceuticals & Chemical products	1.5043	1.8188	1.9680
321	Petroleum Refineries	1.3316	1.4973	1.8458
331	Bricks and tiles	1.8957	2.2284	1.8560
332	Glass wear	1.3443	1.5283	1.5013
333	Chinaclay wears	1.9037	2.1617	2.1064
334	Cement	1.3256	1.7122	1.8770
339	Miscellaneous non-metallic mineral products	1.6348	2.5093	2.3383
341	Iron and Steel	1.3297	1.5777	1.5778
342	Non-ferrous basic metal	1.4723	1.8871	1 .9982
350	Metal products	1.3290	2.0077	2.0958
360	Non-electrical machinery	1.3505	1.5564	1.5287
370	Electrical machinery	1.3386	2.0392	1.9140
381	Ships & Boat building	1.4199	1.4676	1.8063
382	Railway rolling stock	1.4789	1.9872	1.7144
383	Motor vehicles	1.7376	1.6846	1.8238
384	Repair of motor vehicles	2.5124	2.2314	1.3776
385	Motor cycles & Bicycles	1.2771	1.4159	1.4680
389	Miscellaneous transport equipment	1.2771	1.3276	1.4030
399	Miscellaneous	1.5455	2.7050	1.8143

Source: Same as that of Table III-1.

Superscripts (60,61.....) refer to the years 1960, 1961, ... respectively, and subscript i refers to a particular category of assets.

The gross value of additions (A_i) for each of the years is defined as :-

$$A_i^{64} = N_i^{64} - N_i^{63} + d_i^{64}$$

$$A_i^{63} = N_i^{63} - N_i^{62} + d_i^{63} \quad \text{and so on.}$$

Where d is the value of depreciation allowed for the year on the particular category of asset. Substituting the above values of A_i's in the gross value equation, we get the gross values for different years in the following way.

$$G^{60} = N^{60}(r)$$

$$\therefore \quad G^{61} = N^{60}(r) + A^{61}$$

$$= N^{60}(r) + N^{61} - N^{60} + d^{61}$$

$$= N^{60}(r-1) + N^{61} + d^{61}$$

Or $G^{61} = G^{60} + N^{61} - N^{60} + d^{61}$ (since $N^{60}(r)) = G^{60}$)

Similarly, $G^{62} = G^{61} + N^{62} - N^{61} + d^{62}$

$$G^{63} = G^{62} + N^{63} - N^{62} + d^{63} \text{ and so on.}$$

To obtain the gross values for the years before 1960, we apply the same method. For example :

$$\text{Since, } G^{6=} = G^{59} + N^{60} - N^{59} + d^{60}$$

$$\therefore \quad G^{59} = G^{60} - N^{60} + N^{59} - d^{60}$$

and $$G^{58} = G^{59} - N^{59} + N^{58} - d^{59}$$ and so on.

Thus, we are able to arrive at the gross value of assets for different years with the help of known variables like net value of asset and depreciation allowance which are reported in the ASI for 1959 onwards and in the CMI between 1946 and 1958.

3. Depreciation and Different Categories of Fixed Assets:

The reporting of depreciation, however, is not available for different categories of assets, they are available as the total for all the assets. In order to arrive at the gross value of the three different categories of assets separately, therefore, splitting of depreciation is required. The rates of depreciation not being uniform for all the three categories, the allocation of depreciation cannot be in proportion to the net value of the assets of different categories. Further, within each of the three broad category of assets, the rates of depreciation vary according to the type of building or machine, and in case of machines also according to the intensity of use of the machine i.e. whether machine is

used for one shift, two shifts or three shifts.[8]

A study of some of the balance sheets, where details of assets were available revealed that in general the depreciation on building and construction should be around 7%, on the composite group of plant and machinery around 9%, and on other assets around 12%. However, the average composite rate on building and construction and other assets seemed to be more stable than on plant and machinery.(This should be so because in the case of plant and machinery there is a provision of extra shift allowance). Hence it was more reasonable to fix an average rate of depreciation for 'building and construction', and 'other assets', and obtain the depreciation on plant and machinery as residual.

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8. Allowable rates of depreciation (on written down value according to income tax law (and the same are in vogue in business practices too) are :

Buildings:	For non-factory buildings:	2.5 to 5 per cent
	For Factory Buildings:	5.0 to 10 per cent
	Furniture, fittings and office equipment :	10 to 15 per cent
	Transport equipment :	20 to 25 per cent
	Machinery:	General rate is 7%. For special industries it is 9 to 15% mostly around 10%. Besides, there are certain special rates for special types of plants and machinery.

Full depreciation on the assets is allowed only if the assets have been in business use for 180 days or more. Otherwise half depreciation is allowed, and no depreciation is allowed if the assets have been in use for less than 30 days in a year.Further, in case of plant and machinery, additional depreciation on account of multiple shifts is allowed at 50% of the normal rate for each additional shift, subject to a maximum of 100% of the normal rate.

After examining each industry's case for different years, it was found in general that a rate of 7% for building construction and 12% for other assets would be more appropriate, except in the case of the following five industries, where the rates worked out as 4% and 9% for building construction and other assets respectively. These industries are: Fertilisers, Heavy Chemicals, Iron and Steel (Metal) Iron and Steel (metal products), Ships and boat building, and Railway rolling stock.

The depreciation for plant and machinery was obtained as residual. However, during certain years an adjustment in the rates in a downward direction was required in the case of certain industries. It was observed that total capital stock in these industries changed at a much higher rate than the normal rate.

Adjustments for the discrepencies arising out of transfer of some factories from one industry to another, and inclusion of new factories in a certain industry, where they were not so far included due to non-reporting, or being out of the definition of large-scale manufacturing industries so far, are difficult to make, as the details of new additions to capital stock and the extent of such transfers from year to year are not available. Whereas, the transfer of firms will affect both the industries - the industry from which a firm is taken out and the

industry into which it is included - the inclusion of new firms will affect only one industry, the industry into which the new firm is included.

According to the formula used for obtaining gross value of the fixed assets, all such transfers or inclusions are treated as net addition to capital stock to the extent of the net value of the assets of the firms so affected, while the additions should have been in terms of gross value of the assets. However, to the extent the net value of the assets transferred also include new additions, the error is reduced, because to that extent the depreciation adjustments required are also less.

4. Comparability of Data Over Time :

Applying the methodology described in the earlier sections, we obtain two gross capital series at purchase prices of the fixed assets. The first series for the period of 1946-1964 relates to 28 ASI industries which are comparable to CMI industries. Another series of fixed assets relates to the complete ASI two-digit industries for the period 1960 to 1964 (1964 being the latest year of the ASI for which complete reporting was available, (the ASI Census, although started from 1959, the full reporting is available only for 1960 and onwards).

In the case of the time series data (for 1946-1964), the problem of comparability arises because of the differences in coverage and classification of industries in the two sources mentioned above. For the comparability of the capital figures as reported in the two sources, the following adjustments were made. As already noted in Chapter II, the ASI covers as many as 63 groups of major industries including those covered by the CMI. After having listed the ASI industries which are comparable to CMI industries (see Appendix-3 of Chapter II), the difficulty arises about the CMI industries which also cover the factories employing less than 50 workers, which are excluded from the ASI coverage.So far as the period 1953-58 is concerned, the employment sizewise information is available for the net value of fixed capital (inclusive of land) and working capital (inclusive of cash) from the CMI reports. The value of net fixed capital and the value of working capital according to our requirements (i.e. the figures exclusive of land and cash respectively), therefore, call for a bit of adjustments of the available data.

Fortunately, the source of CMI reports the required breakdown of the net value of fixed capital and the value of working capital for each industry as a whole i.e. for the total of all size groups of the industry. The ratio of land to net value of fixed capital for the industry as a whole,

thus, was calculated and applied to net value of fixed capital for the size group 50 and above ao as to isolate the value of land from the total fixed capital from the required size group. Similarly, in order to get the figures of working capital exclusive of cash, cash to working capital ratio derived from the total of all size groups of each industry was applied to the figures of working capital of size group 50 and above.The value of cash so obtained was deducted from the working capital of the size group 50 and above to obtain the working capital net of cash.

To calculate the gross value of fixed capital we also require the values of depreciation in different years (see the formula discussed in Section-2). The figures of depreciation for the required size-group namely, factories employing 50 and more workers, are not separately available from the CMI reports. The depreciation figures for the required size group are combined with materials, fuel,etc. consumed and work done for factory by other concerns. However, the value of depreciation is separately available for the total of all size groups of each industry. To arrive at the value of depreciation for the size group 50 and above, the ratio of value of depreciation to the total of materials, fuels etc. (inclusive of depreciation) of all size groups was applied to the materials, fuel,etc.

(inclusive of depreciation) of size group 50 and above. This, naturally, assumes the ratio of value of depreciation to total value of materials, fuels and depreciation of size group 50 and above to be the same as that of all size groups.

So far as the period before 1953 is concerned (i.e. 1946-1952), the employment sizewise information is not available from the CMI reports. To arrive at the net value of fixed capital, working capital, and depreciation for the size group 50 and above for this period, the only course left open was to apply the ratios of the nearest year namely, 1953 for which the required values were already calculated.

Thus, we are in a position to obtain a series of gross value of fixed capital assets for 19 years i.e.from 1946 to 1964. It may be noted that the CMI coverage is narrower than the ASI coverage, and hence another series of fixed capital assets (industry wise) is obtained for the years 1960-1964 based on ASI reports (where there is no problem of data djustments).

5. Price Adjustments :

It can be seen that the fixed capital series obtained as per the method described in the earlier section are at purchase prices, that is the capital value for any year is simply the summation of the fixed assets purchased in the past

at their original prices - the price in the year in which the asset was bought. In order to obtain a consistant value of capital in any year what we require is to express all the past additions to the capital in terms of that year's price. These adjustments having been done for each year of the series i.e. obtaining the gross value of fixed capital adjusted for the variations in prices, we arrive at the fixed capital series at current prices.

The adjustments for the variations in prices, however, require the age-structure of the assets for each year - out of the total value of fixed assets (at purchase prices) in 1960, for example, what part was added in 1959, 1958 and so on going backwards. These additions, then, can be adjusted by a suitable price index (with current year as the base). Then summing up these additions (adjusted for current prices) we would obtain the value of fixed assets at current prices for the required year.

Our series starts from 1946 and differences in year to year values give us the additions during the two consecutive years. The first problem, therefore, we face is to obtain an estimate of assets which were acquired before 1946. Assuming that the additions to the assets during 1946 were in the same proportion as during 1947, we obtain the addition for 1946. Subtracting this addition from 1946 total value, we get the value of assets acquired prior to 1946.

The problem, then, is to find out a suitable price inflator for the assets acquired before 1946, since, in respect of these assets we can not prepare the detailed age-structure. However, it is reasonable to assume that the assets existing in 1946 would not be generally older than about 25 years. Most of these assets must have been acquired after the first world war. In fact it is this period which registered a marked rise in Industrial activity, except the depression period of thirties when not much of capital was added. Further, it was during and after the Second World War that there was a fresh spurt in industrial activities in India. Thus, we have taken a simple average of the price indices during 1919 to 1929 and 1940 to 1945, so as to use it as price inflator for all the assets acquired before 1946. Such price index number has worked out to be 43.0 with 1950 as the base year.[9]

Antony[10] has estimated the gross value of assets for Indian industries existing in 1958-59 and acquired during the period 1901-1945. Using the same ratio, and applying

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9. The average price index number for the said periods was calculated on the basis of the price-index series provided in M.Mukerjee, National Income of India: Trends and Structure, (Calcutta: Statistical Publishing Society, 1969), p.94.

10. K.A.Antony: "Stock of Industrial Capital in India", in Papers on National Income and Allied Topics, Vol.II, ed.by V.K.R.V.Rao and others, (Bombay: Asia Publishing House, 1962).

it to our 1958 value of total assets, we estimate the value of assets acquired before 1946 and existing in 1958 as Rs.2,914,746 thousand. This means that 6,894,603-2,914,746=3,979,857 thousand Rs. worth of assets were discarded during the period of 13 years i.e. 1946 to 1958. This gives an annual rate of discarding of old assets as (thous.) Rs. of 306,142 which is about 4.47% of the value of assets existing in 1945. We assume that no discarding of the assets took place from amongst the assets acquired in 1946 and after (involving an assumption that the average life of assets is more than 20 years).

Thus, having obtained the age-composition of assets, we have simply to convert them into current prices by appropriate price index numbers.[11]

So far as the ASI series is concerned, Annual Survey of Industries (ASI) covers many industries which have mainly developed during the plans in India, and have developed quite fast. Hence for such industries we can safely presume that no assets were acquired before 1946. However, there are some industries of quite old vintage, for which this assumption can not work. Such industries

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11. It is the price index of manufacturing goods which has been used for the purpose. This price index series has been found in agreement with the price index of imported capital goods (mainly machines). See also Antony, K.A.; Ibid, p.65.

did acquire assets even before 1946. The industries which fall in the former group are found to be Tobacco, Footwear and other Wearing Apparel, Wood and Cork, Furniture and Fixtures, Printing and Publishing, Leather and Fur products, Rubber Products, Petroleum and Coal products, Metal products, Machinery (except Electrical), Electrical machinery, Transport equipment and Miscellaneous; While the industries which fall in the latter group are found to be Food, Beverage, Textiles, paper and paper products, Chemicals and Chemical products, Non-Metallic mineral products and Basic metal.

The age-structure of the assets of the new group of industries in 1960 is presumed to be the same as for the 19 years (CMI) plus ASI) series in 1960, excluding the assets acquired before 1946. For the old group of industries the age-structure is taken just the same as CMI+ASI age-structure for 1960 (including the assets acquired before 1946). Thus, for the old group of industries we assume the discarding rate to be $\frac{306,142 \text{ (both Rs. in '000)}}{16,562,941} = 0.0185$ (ratio of discarded assets to purchase value of total assets in 1960). For new group of industries no discarding is allowed for.

The adjusted capital series of fixed capital are presented in Table IV-3, IV-4 and IV-5. The capital-output and other ratios for the period 1946-1964 are presented in Table IV-6.

We observe that with the adjusted capital series the capital-output ratio (Table IV-6), is around 6.5 for the period 1946-1952, and around 5.2 for the next 12 years (i.e. 1953 onwards).Within each of these two periods the ratio is more or less constant. On the other hand, the book value unadjusted series of capital give very low and increasing capital output-ratio throughout. While the behaviour of capital-output ratio in relation to economic development is subject to many complicated and sometimes mutually opposite factors,[12] it is more or less agreed that "by its very nature, the average capital coefficient is a sluggish animal".[13] Average coefficient will tend to move towards the marginal value very slowly since the addition to capital stock any time is but a small fraction of the existing stock. As for the size of capital coefficient, no outright judgement could be passed because the studies available use varied concepts of capital.However, various estimates cited by Domar (op.cit.) for the United States economy for the period 1869 to 1955 for a concept of capital comparable to ours, show the value of capital coefficient ranging between 5 and 7 with long--term stability in it. Similarly, a detailed study by Haffmann[14]

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12. See,for example , Harvey Leibenstein: Economic Backwardness and Economic Growth,(New York: John Wiley,1957),Ch.11.

13. E.D.Domar, Op.cit.,p.100.

14. W.G.Hoffmann: "Long-term Growth and Capital Formation in Germany", in The Theory of Capital(Op.cit.).

for German economy, for the period 1850 to 1910, also shows a stable capital-output ratio around 5.

The observed difference between the average capital--output ratio (Table IV-6) for the two periods, namely, 1946-1952 and 1953-1964, could be partly accounted for by the significant changes in industry-mix between the two periods, and partly due to lack of strict comparability of the data for the period before 1953.

While there may be differences of opinion about the details of methodology of adjustments to arrive at a suitable series of capital stock, it is abundantly clear that the use of unadjusted (book value) figures would be highly misleading.

Table IV-3

Value of Capital in Manufacturing 1946-1964 (Rs. in '000)

Year	Net(book)value of fixed capital	Gross value of fixed capital at purchase prices	Gross value of fixed capital at current prices	Value of inventories at current prices	Total adjusted value of capital stock(4)+(5)
(1)	(2)	(3)	(4)	(5)	(6)
1946	134,4025	709,1368	1168,7968	185,7130	1354,5098
1947	143,7944	729,3748	1274,7683	207,5232	1482,2915
1948	156,4038	753,8019	1546,8611	260,4540	1807,3151
1949	181,4195	792,6128	1561,5868	252,1846	1813,7714
1950	206,2535	832,6068	1576,7728	276,8035	1853,5763
1951	216,6076	858,8009	1848,4448	336,8355	2185,2803
1952	242,7132	902,6629	1615,8802	333,6478	1949,5280
1953	261,3820	940,5619	1536,2229	308,1316	1844,3545
1954	286,2261	986,4872	1557,0840	331,3931	1888,4771
1955	325,9200	1050,3246	1565,4809	355,5144	1920,9953
1956	383,4705	1136,6625	1702,5549	416,0492	2118,6041
1957	461,2497	1249,1546	1817,4146	470,8923	2288,3069
1958	543,5660	1373,2936	1895,2763	449,2906	2344,5669
1959	629,8336	1516,4715	2025,8503	536,3214	2562,1717
1960	705,7427	1656,2941	2312,7254	567,4800	2880,2054
1961	826,1829	1858,2996	2569,6068	713,6551	3283,2619
1962	1392,7191	2552,3030	3223,3270	845,2308	4068,5578
1963	1525,3160	2817,0755	3476,5238	851,0704	4327,5942
1964	1663,6027	3109,2210	3836,8811	967,0449	4803,9260

Note: Data source and method of estimation are discussed in Chapter IV.

Table IV-4

Gross Value of Fixed Capital at Purchase Price for ASI Two-Digit Industries 1960-1964

(Rs. in '000)

I.No.	Industry	1960	1961	1962	1963	1964
1	2	3	4	5	6	7
20	Food	246,5449	271,9905	299,5070	326,9519	368,8048
21	Beverage	6,0447	6,7880	8,3216	9,3164	12,3825
22	Tobacco	11,1996	12,1512	13,0302	14,1988	15,3069
23	Textiles	496,5894	558,4932	631,5972	729,3409	781,6086
24	Foot wear & other wearing Apparel	1,7058	1,9692	2,4729	2,5999	2,9377
25	Wood and Cork	6,9469	6,4467	8,5843	9,5170	11,1023
26	Furniture & Fixtures	3,1354	4,4162	5,6556	6,7840	7,3611
27	Paper & paper products	78,2662	83,4792	102,0611	119,9759	144,9452
28	Printing & Publishing	37,6236	41,9986	47,0347	51,7435	58,1250
29	Leather & Fur Products	3,5182	3,6175	3,6434	3,8154	4,3139
30	Rubber products	16,7455	20,5076	32,6931	36,8935	43,7383
31	Chemicals & Chem. Products	212,3228	295,0248	321,1289	384,4740	434,9498
32	Petroleum & Coal products	59,9166	64,3538	92,9237	108,6352	124,3957
33	Non-metallic mineral products	128,8092	141,8714	154,3518	174,0048	206,1134
34	Basic metal	679,4234	705,4355	1283,2270	1407,8362	1459,1469
35	Metal Products	31,4025	37,3720	46,1480	53,6258	58,4841
36	Machinery(except Elec.)	44,5994	59,9073	85,8202	111,3336	153,4370
37	Electrical machinery	47,1648	56,9324	83,2210	110,9975	140,4886
38	Transport equipment	147,3987	164,1840	191,6532	217,0111	279,0994
39	Miscellaneous	15,1557	17,5607	20,6980	26,9533	32,8230

Source: Calculated on the basis of the data derived from the Annual Survey of Industries. The methodology has been discussed in the mainbody of the chapter.

Table IV-5

Gross Value of Fixed Capital at Current Prices for ASI Two-Digit Industries 1960-1964
(Rs. in '000)

I. No.	Industry	1960	1961	1962	1963	1964
1	2	3	4	5	6	7
20	Food	344,2506	384,6432	413,0124	444,6293	501,0389
21	Beverage	8,4402	9,5500	11,1054	12,2177	15,6949
22	Tobacco	13,0744	14,6743	15,6689	17,0823	18,8474
23	Textiles	693,3878	785,3976	860,3029	966,8940	1051,2250
24	Foot wear & other wearing Apparel	1,9914	2,3535	2,8758	3,0477	3,5027
25	Wood and Cork	8,1098	7,8991	10,0989	11,1894	13,2051
26	Furniture & Fixtures	3,6603	5,1226	6,4024	7,6309	8,5014
27	Paper & Paper products	109,2831	119,2410	138,0710	157,4189	187,6350
28	Printing & Publishing	43,9218	50,4747	55,9082	61,4906	70,2372
29	Leather & Fur Products	4,1071	4,4101	4,4707	4,7125	5,3923
30	Rubber products	19,5487	24,2802	36,6568	41,4300	49,8683
31	Chemicals & Chem,Products	296,4663	392,0405	419,3577	487,2908	554,3171
32	Petroleum & Coal products	69,9466	77,8522	107,0351	124,4190	144,9649
33	Non-metallic mineral products	179,8563	200,7276	213,6518	235,4512	275,2862
34	Basic metal	948,6789	1015,8815	1595,6753	1738,9304	1850,1111
35	Metal Products	36,6593	44,4466	53,5726	61,8874	69,1260
36	Machinery (except.Elec.)	52,0653	69,9550	96,4186	123,4386	170,2897
37	Electrical machinery	55,0602	67,5581	94,3786	123,6298	157,8758
38	Transport equipment	172,0732	197,3911	226,4145	255,3101	327,2180
39	Miscellaneous	17,6928	20,9751	24,2776	30, 9122	37,9709

Source: Same as Table IV-4.

Table IV-6

Capital-Output - Labour Ratios: 1946-1964.

Year	Total adjusted capital-gross value added Ratio	Total unadjusted capital(book value)- net value added Ratio	Gross profit - total capital (adjusted) ratio (in percentage)	Total capital (adjusted) per employee(capital in 1950 prices) Rs.	Output per employee (output=gross value added at 1950 prices) Rs.
1	2	3	4	5	6
1946	6.55	1.63	8.46	13790	2104
1947	6.33	1.57	7.51	12772	2018
1948	5.95	1.43	8.52	12284	2063
1949	6.95	1.75	5.61	12352	1777
1950	6.85	1.89	6.35	12981	1895
1951	6.65	1.77	7.37	12930	1944
1952	6.47	2.03	6.25	13025	2012
1953	5.72	1.88	7.51	13081	2286
1954	5.30	1.84	8.61	12641	2387
1955	4.84	1.83	10.03	12547	2592
1956	4.82	1.94	10.13	12415	2578
1957	5.26	2.33	8.74	13054	2481
1958	5.12	3.39	9.66	14061	2746
1959	4.93	2.52	10.44	14516	2944
1960	5.13	2.56	9.59	14830	2889
1961	5.06	2.71	10.21	15319	3030
1962	5.46	3.62	9.42	18046	3305
1963	5.30	3.47	9.85	18741	3535
1964	5.20	3.42	9.86	18955	3643

Note: Gross Profit is defined as P = V-W where V is gross value added and W is wages, salaries, and benefits.