A Multisectoral Analysis of Capital Requirements for Development Planning in Pakistan

by

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INTRODUCTION

Dynamic models of interdependence are being widely used to analyse planning problems in underdeveloped countries. Basic to such models are complex sets of technico-economic data of which input-output coefficients and capital coefficients are crucial elements. As the results obtained from these models are, of course, dependent upon such data, we think it useful to give some attention to methods of estimating technical coefficients and to the nature of the technical coefficients themselves.

In the present paper we explain how sets of capital coefficients have been obtained on a multisectoral basis for the two regions of the Pakistan economy, and we analyse the economic structure which these coefficients reveal. Elsewhere[15] we have presented regional input-output matrices for Pakistan. Both this paper and the input-output paper are parts of work directed toward providing a comprehensive and consistent set of data for multisectoral regional planning in Pakistan. In this work we use a 35-sector classification of the economy —see Table I—and work in purchasers' prices for the year 1962/63[1].

Our principal *analytic* interest is in the manufacturing sector, and especially the large-scale manufacturing sector. The outputs of manufacturing industries—unlike the output of transport services or electric energy, for example—need not be produced within the region where they are to be used. Therefore, substantial choice exists with regard to when, where, and how far to develop manufacturing industries. Such choice applies most significantly to the large-scale manufacturing enterprises. While capital coefficients do not tell the whole story,

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[1] Choice of the year 1962/63 is dictated primarily by the fact that the most recent completed Census of Manufacturing Industries (CMI) is for that year, and the CMI is our most important source of data. The form of the CMI data forces us to work in purchasers' prices, though we are quite willing to admit the conceptual superiority of working in producers' prices. For a more thorough discussion of this point and for a complete discussion of the choice of sector classification, *see* [15].

TABLE I

SECTOR CLASSIFICATION

01	Rice growing and processing
02	Wheat growing and processing
03	Jute growing and baling
04	Cotton growing and ginning
05	Tea growing and processing
06	All other agriculture, forestry and fishery
07	Sugar refining and gur-making
08	Edible oils
09	Cigarettes, bidi and other tobacco products
10	Other food and drinks
11	Cotton textiles
12	Jute textiles
13	Other textiles
14	Paper and printing
15	Leather and leather products
16	Rubber and rubber products
17	Fertilizer
18	Other chemicals
19	Cement, concrete and bricks
20	Basic metals
21	Metal products
22	Machinery
23	Transport equipment
24	Wood, cork and furniture
25	Construction of residential houses
26	Construction of non-residential buildings
27	All other construction
28	Miscellaneous manufactures and minerals
29	Coal and petroleum products
30	Electricity and gas
31	Transport
32	Trade
33	Ownership of dwellings
34	Government
35	Services, *n.e.s.*

they do give one measure which is helpful in analysing past events and in setting future priorities. However, no manufacturing industry exists either in isolation from the rest of the economy or as a homogeneous unit in itself. We have, therefore, devoted some attention to capital requirements in non-manufacturing industries and to capital requirements in small-scale and cottage, as well as large-scale, manufacturing industries.

In Section 2 of this paper the methodology of obtaining capital coefficients is explained. Apart from describing statistical sources and general methods

employed for each sector, we develop in this section a technique of obtaining real (or replacement cost) value of assets from book value of assets data shown in the Census of Manufacturing Industries (CMI). The capital coefficients we obtain are (with the exception of those for some non-manufacturing sectors) average coefficients, *i.e.*, they show the average capital cost of obtaining a unit of output or value added in the sector in 1962/63. Though such coefficients are not directly usable in a planning model—for which we would need marginal coefficients—they tell us a good deal about the structure of the economy and serve as a base for obtaining marginal coefficients. Most important, they embody certain underlying social conditions—the degree of development of human capital, for example—which should not be ignored in plan formulation.

In Section 3 we present an analysis of the capital coefficients. The analysis should be taken as a prelude to a more complete planning exercise. We concentrate on the large-scale manufacturing sectors and examine the intra-regional rankings of these industries. The basis of the analysis is the ranking based upon the direct real capital-income ratio. However, questions of capacity utilization and indirect capital requirements are also taken into account. We think the conclusions of this section provide some interesting questions for more comprehensive programming exercises and industry studies.

2. THE METHODOLOGY OF CAPITAL COEFFICIENT ESTIMATION

We have estimated both capital-output ratios (*i.e.*, capital/gross value of output) and capital-income ratios (*i.e.*, capital/gross value added) and have distinguished five sources of supply of capital goods—buildings, other construction, machinery, transport equipment, and other[2]. The coefficients are ratios of net capital to gross output and gross value added (income). Gross capital requirements cannot be tied to output through any fixed coefficient relationship since over a period of accelerating or decelerating rate of growth the ratio of replacement requirement to output would change[3].

2.1 Large-Scale Manufacturing

The basis of our estimation of the capital coefficients for the large-scale manufacturing industries is the book value of assets data contained in the Censuses of Manufacturing Industries 1962/63 [29; 32] which have been com-

[2] The only sector to which residential construction delivers capital is housing, for which a capital coefficient is shown separately in section 2.3(e) below. The "other" category consists of furniture and fixtures items which are supplied by two sectors in our sector classifications scheme, sectors 21 and 24. We have not separated this component here because we have no information on the split. However, for any planning model based upon our sectoral classification a split would be necessary. This is a relatively trivial problem since this is such a small part of total capital required in any sector.

[3] *See* Domar [4].

piled separately for the two regions[4]. Book values of assets are probably available in many countries and that they are an understatement of actual replacement costs is well known. This understatement is accounted for in Pakistan by two main factors: *i*) assets are entered on the book at purchase price while prices of capital goods have in general been rising in the period prior to 1962/63; *ii*) depreciation allowances are much greater than actual deterioration of productive value, primarily because high depreciation rates are allowed (ostensibly) as a development incentive[5].

There are, however, at least two factors which might operate in the opposite direction, *i.e.*, make the book value overstate the replacement cost. The first of these is the investment-output lag which may result in assets being on the book before they are productive. As best we can surmise from the relevant documents and from government officials, however, assets are not entered on the books until their installation (or construction) is complete. By using beginning of the year book value we think we have allowed for the short lag between completion of installation and production. The second factor is technological progress. Machines of more recent "vintage" embody more advanced technology so that the value of a machine obtained in the past should be appropriately deflated to obtain replacement cost. We have made no adjustment on this account because of our total ignorance about the magnitude of the effect[6].

Thus in order to obtain replacement cost from book values we make adjustments for two major factors, *viz.*, *a*) the discrepancy between actual physical deterioration in productive capacity and depreciation practices and *b*) the rising price of capital goods[7]. The first step in our procedure is to estimate for each type of asset in each sector as index of past real gross investment. In most cases the index was not based on actual investment expenditures but was indirectly

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[4] The CMIs for 1962/63 are the most recent ones available. While the East Pakistan CMI has been released in mimeographed form, the CMI for West Pakistan has not yet been officially released. We are grateful to the officials of the West Pakistan Bureau of Statistics for allowing us to make copies of the relevant sections of the CMI. The shortcomings of Pakistan CMIs are well known to those who compile and use them. They are subject to the many faults of data based on self-enumeration; however, we have no way of knowing the direction of bias resulting from enumeration problems. The uncertain quality of the CMI data should be taken into account in evaluating our results.

[5] Depreciation allowance on machinery is often as high as 45 per cent in the first year and 20 per cent in each subsequent year of use. A complete description of depreciation practice in Pakistan is contained in [26].

[6] Book value also differs from real value because value of unimproved land has been included and value of rented assets has been excluded; data are available which allowed us to correct for these relatively minor matters. On the other hand, we have not taken into consideration problems arising from the multiple pricing of capital goods (resulting from the import control regulations) or the possible problems resulting from "over-invoicing". We have no information which would allow us to deal with such issues.

[7] The procedure we develop has its origin in Mirrlees [18] and Khan [13].

inferred from production, output capacity, and/or machinery import data[8]. Applying allowed depreciation practices and a price index, we compute from the investment index an index of book value of assets at the beginning of 1962/63. Then, applying to the same investment index a set of assumptions describing the pattern of deterioration of productive value, we obtain an index of the real value of assets at the beginning of 1962/63. The ratio of the index of real value to the index of book value gives us a "correction factor". Multiplying the CMI book value by the correction factor gives the real value of assets. This method, an illustration of which is contained in the Appendix, should be more clear if we express it in the following formal manner[9].

In Pakistan, depreciation is computed according to the declining balance method so that the relationship between the book value of a particular category of assets at the beginning of year t and previous investment in that category is given by:

$$(1) \quad V_t = J_{t-1} + \left[1-(d+g)\right] \sum_{i=2}^{T} (1-g)^{i-2} J_{t-i}$$

where we have the following notation for a category of assets:

V_t = book value of assets at the beginning of period t
J_t = current price gross investment in year t
g = annual depreciation allowance rate
d = additional initial year depreciation allowance rate
T = average life of the asset in years.

In general, it is not possible in Pakistan to estimate directly the series J, but we were able to estimate an index of real gross investment H and a price index P (based on 1962/63) for each category of asset. Then

$$(2) \quad J_t = kP_t H_t$$

[8] For estimation of investment indices we rely upon a number of sources. Most important among these are: *i*) machinery import statistics for industry-specific equipment, Islam [10]; *ii*) plan document review of capacity expansion for certain industries [22; 23; 28]; *iii*) reports on installed spindles and looms for the major textile industries [35]; *iv*) trends in the changes in physical output in certain sectors, computed from the data in [35] and Lewis and Soligo [16]. Usually, we obtained from one or a combination of these sources a net index for a sector and converted it to a gross index for each category of assets on the basis of the deterioration assumptions (*see* below in the text). Though the indices we obtain are rough, the results are sensitive only to the general pattern of the indices.

[9] Our method of obtaining an estimate of real value assets can be viewed as an adaption to the Pakistan circumstances of the perpetual inventory approach used by Goldsmith [6] for the United States of America and by Redfern [38] for the United Kingdom. The perpetual inventory approach requires observations on actual investment in previous years, whereas our approach allows us to work from investment indices which can be indirectly inferred. To convert the indices to actual asset values, we have an observation on book values and a knowledge of depreciation practices.

where k is some unknown constant. We may now write

$$(3)\ V_t' = V_t/k = P_{t-1}H_{t-1} + \left[1-(d+g)\right]\sum_{i=2}^{T}(1-g)^{i-2}P_{t-i}H_{t-i}$$

as an index of the book value of assets which can be directly computed from H and P.

Our next step consists of deriving an index of the real value (*i.e.*, of the replacement cost) of capital from the same index of past investment by applying a set of assumptions describing the pattern of the deterioration of productive value. The principal problem is to find a satisfactory set of deterioration assumptions. There seem to be no empirical data on which we could rely. While we could have used the straight line deterioration assumption adopted in other studies[10], we felt that this would not reflect our (casual) observation that new assets deteriorate in value much more slowly than old assets. The assumption we have chosen may be summarized as follows:

a) For some time after its installation an asset's productive value declines very slowly. We have assumed 25 per cent loss of value spread evenly over the first half of the asset's life.

b) A point is reached when the value of an asset begins to deteriorate rather rapidly. A greater amount of time is lost in breakdowns and/or maintenance; new parts are required; even when repaired the old asset is not as efficient as a new one. Finally, the asset is retired even though it maintains some productive value. We assume a 65 per cent loss of value spread evenly over the second half of the asset's life and 10 per cent of value remaining at the time of retirement [11;12].

In the absence of any relevant information for Pakistan or any other developing country, we used U.S. Treasury Department data [42] on average

10 *See*, for example, Goldsmith [6] and Redfern [38].

11 Although these assumptions may have a good deal of validity for certain types of assets, especially machinery, we admit that their applicability to buildings and certain other assets is questionable. We fall back on two justifications: first, in the absence of sufficient empirical evidence we think it desirable to apply a single set of assumptions; second, whatever error exists, we think our estimates are of the right order of magnitude. It would have been desirable to investigate the sensitivity of the results to alternative deterioration assumptions, for example, the straight line deterioration assumption. Work by Tice [41] indicates that we might have found a rather high degree of sensitivity. However, the task of calculating the implications of alternative assumptions was too great to allow any meaningful sensitivity analysis. In any case, we do not think that the rankings of the following section would be seriously affected.

12 The reader is again referred to the appendix for an illustration.

life of various kinds of assets and assumed all assets in a particular category lasted exactly the average[13].

Our assumptions allow us to write the index of the real value of a category of assets as:

$$(4)\quad K'_t = K_t/k = H_{t-1} + \sum_{i=2}^{T/2+1} \left[1-(i-1)\cdot 5/T\right] H_{t-i} + \sum_{i=2}^{T/k} \left[.75-(i-1)\,1.3/T\right] H_{(t-T/2)-i}$$

where K is the real value of assets and K′ is the index.

Now the correction factor is

$$(5)\quad F_t = K_t'/V_t'$$

For each sector we obtained correction factors for five types of assets: buildings, machines, transport equipment, office equipment, and furniture and fixtures. The CMI divides assets into three categories (1) land and buildings, (2) machinery, and (3) other assets. Though the "other" category is usually a small percentage of the total, it could not be corrected by a single correction factor since it consists of assets having different depreciation and deterioration rates. On the basis of data collected for joint stock companies [35] we were able to determine the composition of the "other" category in terms of office equipment, transport equipment, and furniture and fixtures. Using this additional information we are able to apply a separate correction factor for each of these categories. We have

$$(6)\quad V_1 + V_2 + V_3 = \overline{V}$$

where the V_i are the unknown book values of the three types of assets and $\overline{V}$ is their known sum (from CMI). From the joint stock companies data we have

$$(7)\quad K_1/K_2 = a \qquad \text{and} \qquad (8)\quad K_1/K_3 = b$$

where K_i are the unknown real values of the three types of assets. For each of the three types of assets we have independently determined

$$(9) - (11)\quad K_i = F_i V_i$$

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[13] There seem to us to be arguments on both sides of the question of whether assets' lives are longer or shorter in a country like Pakistan than in a developed country. On the one hand, assets in Pakistan are probably kept in poor repair and ill-handled so they wear out more rapidly. On the other hand, perhaps due to the shortage of capital, old assets in seeming disrepair are often in use. We are not sure where the balance of the argument lies. It is possible that the U.S. Treasury data understate the length of life in United States of America. We would hope that this possible factor partly offsets the effects of technological progress which we neglect (*see* above).

The six equations, 6 through 11, allow us to solve for the six variables—real values and book values of the three types of assets.

The capital-output ratios divided into four types of capital goods and the capital-income ratios for the large-scale manufacturing industries in East and West Pakistan are shown in Tables II-A and II-B. The steps involved in actual computation of the correction of book value coefficients and the correction factors obtained are contained in the Appendix. The correction factors can be very different for different types of assets because the discrepancy between deterioration and depreciation varies; the discrepancy is largest for machinery. Correction factors can also be quite different for the same type of asset in different industries, partly because the deterioration-depreciation discrepancy varies among sectors, but more importantly because the time pattern of previous investment varies among sectors. In general, correction factors will be larger the higher is the average age of the capital stock in a sector[14].

2.2 Small-Scale and Cottage Manufacturing

Here and in the construction of the current input-output tables, our coverage for the small-scale and cottage manufacturing is quantitatively and qualitatively much better for East Pakistan than for West Pakistan. This is primarily due to the availability of two surveys carried out by the East Pakistan Small Industries Corporation, *Survey of Small Industries in East Pakistan* (SSI) [30] and *Survey of Cottage Industries in East Pakistan* (SCI) [31].

The SSI provides information about the values of fixed assets and output for the small-scale industries on a highly disaggregated basis. As best we can determine, the assets are shown at present deteriorated values (estimated by the enumerator) which corresponds to our concept of replacement cost. Value of output is shown at producers' prices which we converted into purchasers' prices by allowing the trade and transport margins on the basis of the current input-output tables [15].

The SSI shows only two kinds of assets, machines and the rest. We further disaggregated the rest into buildings and other assets by assuming that the ratio of machineries to other assets is *roughly* the same as in the corresponding large-scale industry. Since small-scale industries seem to have little transport equipment in their capital assets, the other assets correspond roughly to furniture and fixtures held by large-scale industries.

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[14] Consider the case of two sectors (with the same depreciation and deterioration rates) having the same replacement cost value of assets, but in sector A the average age of capital is higher than in sector B. Therefore, more value will have been written off in sector A, *i.e.*, book value will be lower, and the correction factor will be higher.

TABLE II-A

REAL CAPITAL COEFFICIENTS IN LARGE-SCALE MANUFACTURING EAST PAKISTAN

	Capital-output ratios					Total capital-income ratios
	Building capital	Machinery capital	Transport equipment	Other assets	Total	
Sugar refining	.216	.794	.026	.027	1.063	3.619
Edible oils	.083	.155	.003	.003	.244	1.555
Cigarettes	.132	.146	.007	.007	.292	.573
Other food, drinks ...	.223	.350	.014	.014	.601	1.613
Cotton textiles	.302	.818	.012	.009	1.141	2.751
Jute textiles	.399	.928	.006	.011	1.344	2.462
Other textiles	.232	.894	.012	.010	1.148	7.048
Paper and printing ...	.760	1.726	.133	.137	2.756	13.798
Leather and leather products	.160	.157	.006	.006	.329	1.269
Rubber and rubber products	.132	.361	.017	.017	.527	1.851
Fertilizer	.628	5.373	.029	.030	6.060	12.661
Other chemicals ...	.222	.175	.012	.012	.421	.719
Cement and concrete ...	.177	1.054	.009	.009	1.249	2.642
Basic metal	.161	.237	.010	.010	.418	1.246
Metal products ...	.207	.308	.011	.011	.537	1.624
Machinery	.393	.517	.016	.016	.942	2.002
Transport equipment ...	.465	.235	.027	.028	.755	1.759
Wood, cork and furniture ...	.413	.558	.037	.038	1.046	2.437
Miscellaneous manufacture	.423	.633	.021	.022	1.099	2.664

TABLE II-B

REAL CAPITAL COEFFICIENTS IN LARGE-SCALE MANUFACTURING WEST PAKISTAN

	Capital-output ratio					Total capital-income ratios
	Building capital	Machinery capital	Transport equipment	Other assets	Total	
Sugar refining	.130	.488	.008	.008	.634	1.190
Edible oils	.155	.296	.002	.003	.456	1.715
Cigarettes	.168	.187	.016	.036	.407	.846
Other food, drinks ...	.254	.363	.020	.027	.664	1.335
Cotton textiles	.492	.715	.006	.014	1.227	4.870
Jute textiles	—	—	—	—	—	—
Other textiles	.209	.536	.006	.012	.763	2.340
Paper and printing ...	.214	.427	.009	.015	.665	1.667
Leather and leather products	.132	.133	.003	.005	.273	.517
Rubber and rubber products	234	.594	.008	.014	.850	2.121
Fertilizer	1.387	4.391	.041	.059	5.878	13.556
Other chemicals ...	.229	.548	.010	.015	.802	1.445
Cement and concrete ...	.453	1.321	.023	.013	1.810	3.597
Basic metals	.173	.355	.004	.006	.538	3.090
Metal products ...	.130	.325	.004	.006	.465	1.168
Machinery	.307	.499	.013	.019	.838	1.913
Transport equipment ...	.761	.851	.197	.052	1.861	5.818
Wood, cork and furniture ...	.210	.231	.007	.007	.455	.929
Miscellaneous manufacturing	.344	.473	.008	.013	.838	2.076
Coal and petroleum products	.309	.862	.018	.028	1.217	1.974

The SCI in East Pakistan provides information on the values of fixed assets and output on a reasonably disaggregated basis. Again, the value of assets is an estimation of the current deteriorated value. We have no breakdown of assets into various types, and we used the small-scale proportions to divide assets into buildings, machinery, and furniture and fixtures.

For West Pakistan our information is limited to a number of small-scale industries for which data are available from the district reports on small-scale industries in urban areas [33]. These reports are limited in their scope and degree of coverage. We have no source of information about the capital assets in cottage manufacturing. For a few small-scale industries—gur-making, edible oils, bricks—we use the East Pakistan coefficients. As in the case of the current input-output tables, the small-scale machinery and transport equipment sectors as well as the small-scale sectors of residual nature (*e.g.*, other textiles, other chemicals and miscellaneous manufactures) and much of the cottage production of goods have been neglected for want of information. The capital-coefficients for small-scale and cottage manufacturing are shown in Tables III-A and III-B.

2.3 Non-Manufacturing Sectors

a) Electricity and Gas: The basis of our estimates for electricity is data in the *Census of Electricity Undertakings, 1962/63* [36]. Depreciation rates for the government (WAPDA) owned electricity undertakings are close to our estimate of actual physical deterioration so that we accepted book value of assets as real value of capital for this part of the sector. For the relatively small private part of the sector we worked out (rough) correction of book value data along the lines used for the manufacturing sectors.

A capital coefficient for the gas subsector in East Pakistan was computed from CMI data in the general manner outlined elsewhere for CMI industries. Our estimate of the capital coefficient for West Pakistan gas is a very rough one and is based on some estimates in the First Plan [22] regarding cost of installing pipelines.

We have no information on the breakdown of capital according to source of supply. We relied upon Indian data, for hydro and thermal generation of electricity, and assumed a 50:50 split between hydro and thermal production in West Pakistan and a 40:60 split between those in East Pakistan. For gas, we used the same breakdown of capital as for thermal electricity generation.

b) Transport: The capital coefficients for the transport sector are not average coefficients for 1962/63 but are the incremental coefficients over the Second Plan period (1960/65). We constructed an investment series for the sector from the *Evaluation Report* [24] and obtained increment in value added over

TABLE III-A

CAPITAL-COEFFICIENTS IN EAST PAKISTAN SMALL-SCALE AND COTTAGE MANUFACTURING

	Small-scale manufacturing					Cottage manufacturing				
	Capital-output ratios				Total capital-income ratios	Capital-output ratios				Total capital-income ratios
	Building	Machinery	Other	Total		Building	Machinery	Other	Total	
Gur and sugar	.097	.032	.001	.130	.424	.178	.059	.001	.238	.776
Edible oils	.043	.068	.001	.112	.630	.055	.087	.002	.144	.630
Bidi	.046	.001	—	.047	.100	.046	.001	—	.047	.100
Other food, *etc.* ...	.089	.033	.001	.123	.280	.138	.051	.002	.191	.465
Cotton textiles	.065	.057	.001	.123	.364	.081	.071	.002	.154	.606
Jute textiles	.037	.021	—	.058	.104	.064	.037	—	.101	.182
Other textiles	.065	.060	.001	.126	.358	.078	.072	.002	.152	.610
Paper and printing ...	.235	.362	.029	.626	2.074	.055	.085	.007	.147	.518
Leather and leather products	.052	.014	—	.066	.189	.094	.025	—	.119	.520
Rubber and rubber products	.021	.042	—	.063	.252	—	—	—	—	—
Other chemicals ...	.179	.052	.004	.235	.677	.104	.030	.002	.136	.608
Bricks	.116	.029	—	.145	.197	—	—	—	—	—
Metal products	.206	.122	.004	.332	.976	.049	.029	.001	.079	.107
Machinery	.205	.113	.004	.322	.654	.111	.061	.003	.175	.410
Transport equipment ...	.104	.079	.009	.192	.482	.044	.033	.004	.081	.271
Wood, cork, furniture ...	.122	.062	.004	.188	.612	.082	.042	.003	.127	.473
Misc. manufactures ...	.106	.040	.001	.147	.501	.107	.041	.001	.149	.352

TABLE III-B

CAPITAL COEFFICIENTS IN WEST PAKISTAN SMALL-SCALE MANUFACTURING

	Capital-output ratios				Capital-income ratios
	Building	Machinery	Other	Total	
Gur	.097	.032	.001	.130	1.743*
Edible oils	.043	.068	.001	.112	.324
Tobacco products ...	.160	.003	—	.163	.410
Cotton textiles	.198	.158	.001	.357	2.354
Leather and leather products	.137	.060	—	.197	.368
Bricks	.116	.029	—	.200	.551
Metal products ...	.188	.149	.004	.341	1.027
Wood, cork, furniture ...	.303	.150	.004	.457	.929

* The gur capital-income ratio is so very high because the price of gur was very low in 1962/63 but the price of sugarcane was not particularly low. Therefore, value added in gur production was very small.

the period from the regional accounts in Khan and Bergan[14] after making adjustments for comparability with our current input-output table concepts. The series for public investment was built up according to types of capital and our standard deterioration assumptions were applied to convert gross to net investment. To obtain a breakdown of private investment into types of capital goods, the joint stock company data were used. The capital coefficient, b, was computed according to the formula

$$b = \sum_{t=59/60}^{64/65} J_t \Big/ \left(Q_{65/66} - Q_{59/60}\right)$$

where J is net investment and Q is value added.

c) *Trade, Government and Other Services:* For want of other independent sources of data, we based our estimates for all these sectors on the gross incremental capital-income ratio estimated by Bergan and Tims[1] according to a method very similar to the one described above for the transport sector. Their estimate is on a national basis for the entire services sector (which includes our trade, government and other services sectors). We transformed the gross capital into net and also obtained capital-output ratios from their capital-income ratio.

The breakdown of capital into supplying sectors is largely a guess. We think no great error is introduced by using the same coefficient in all these sectors in both regions.

d) Agriculture: Our estimates of capital coefficients for the agricultural sectors are very rough even by the standard of those for other sectors. We do not intend them to be used in any multisectoral planning exercise. Production functions in agriculture are much more complicated than the simple linear relations of most multisector models. We use these rough estimates here only in obtaining an estimate of the total direct and indirect capital-income ratios for the manufacturing sectors.

The machine assets were estimated on the basis of the value of implements per acre from Indian sources[7] updated for price changes and distributed among various agricultural sectors according to acreage shares. To this was added the estimated value of pumps and tractors[15]. Irrigation assets (supplied by other construction sector) were estimated by multiplying the total irrigated acreage by the estimated replacement cost (from the Third Plan[28]) of providing an acre of irrigation capacity. This was distributed among sectors according to acreage shares of irrigated land.

Since our first five agricultural sectors also include processing we made appropriate allowance for capital required for large-scale and small-scale processing. For the large-scale and small-scale parts we followed the respective methods outlined above in connection with the discussion for the manufacturing industries. For cottage processing we did not allow for any capital assets because the implements per acre data presumably include the small amount of equipment required for cottage processing which is merely an extension of the agricultural activity.

e) Construction Sectors and Ownership of Dwellings: We made no estimate of capital coefficients for the construction sectors because we have no Pakistan data to rely on and because our analysis does not require them. Direct and indirect capital-income ratios for the manufacturing sectors in the next section can still be computed since the manufacturing sectors are independent of the construction sectors (*i.e.*, they do not receive current inputs from the latter sectors either directly or indirectly). From an analysis of the estimates for India and certain other countries, we surmise that the fixed capital requirements are very low for the construction sectors; the capital-output ratio is probably between 0.1 and

[15] On the basis of information in Ghulam Muhammad [19; 20], Falcon and Gotsch [5] and Planning Commission Project Reports [25].

0.2 (see, for example, Chakravarty and Lefeber[2], and Sandee[39]) and much of it consists of machinery and metal products.

Our analysis of the next section also does not require capital coefficients for the ownership of dwellings sector. The Pakistan national income estimates are based on the assumption that the building-rental ratio is 12.5 [35]. Using this we would have a (building) capital-output ratio of 12.5 for the ownership of dwellings sector which does not seem unreasonable.

Capital-coefficients in non-manufacturing sectors are shown in Tables IV-A and IV-B.

3. AN ANALYSIS OF THE CAPITAL-COEFFICIENTS FOR MANUFACTURING INDUSTRIES

In this section we analyse the results obtained in the previous section. Having estimated capital coefficients for manufacturing industries separately for the two regions, we can say something both about past realities and future possibilities. Our discussion centres around the intra-regional ranking of industries according to capital-income ratios. While these ranking exercises do lead us to some interesting observations, they should be viewed as preliminary to, not a substitute for, a more complete planning analysis.

TABLE IV-A

CAPITAL-OUTPUT RATIOS IN NON-MANUFACTURING SECTORS EAST PAKISTAN

	Building	Other construction	Machinery	Transport equipment	Other	Total
Rice	.021	.090	.114	—	.003	.228
Wheat	.160	.264	.775	—	.026	1.225
Jute	.178	.052	.095	—	.004	.329
Cotton	.493	.127	.465	—	.028	1.113
Tea	.194	.010	.345	.006	.025	.580
All other agriculture ...	.021	.043	.054	—	—	.118
Electricity and gas ...	—	7.285	6.357	—	—	13.642
Transport	.060	1.146	.039	.949	.005	2.199
Trade	1.137	—	.199	.043	.043	1.422
Government	.907	—	.159	.034	.034	1.134
Services, *n.e.s.* ...	1.132	—	.198	.042	.043	1.415

TABLE IV-B

CAPITAL-OUTPUT RATIOS IN NON-MANUFACTURING SECTORS WEST PAKISTAN

	Building	Other construc-tion	Machinery	Transport equipment	Other	Total
Rice	.110	1.775	.218	.002	.003	2.108
Wheat	.022	2.275	.182	.001	.002	2.482
Cotton	.091	1.742	.219	.001	.002	2.055
Tea	.036	—	.005	—	.001	.042
All other agriculture ...	—	.874	.052	—	—	.926
Electricity and gas ...	—	2.805	2.360	—	—	5.165
Transport	.085	.952	.173	1.487	.013	2.710
Trade	1.105	—	.194	.041	.041	1.381
Government	.933	—	.163	.035	.035	1.166
Services, *n.e.s.* ...	1.102	—	.193	.041	.041	1.377

First we obtain rankings for the large-scale manufacturing industries on the basis of direct book value capital-income ratios, direct real capital-income ratios and full-capacity capital-income ratios. Next we compare the capital-income ratios in large-scale, small-scale and cottage manufacturing. Finally we obtain a ranking of the manufacturing sectors (each redefined to include all large-scale, small-scale and cottage parts) on the basis of direct and indirect capital-income ratios.

3.1 Real Capital-Income Ratios in Large-Scale Manufacturing

In Tables V-A and V-B capital-income ratios are shown for twenty manufacturing sectors in East and West Pakistan for 1962/63. Capital-income ratios based upon book values of assets as well as those based upon real value are shown along with the intra-regional rank of each sector (the industry with the lowest capital-coefficient being given first rank).

While differences between book value and real coefficients are large for both regions, it is somewhat greater for West (real coefficients averaging about 85 per cent larger) than for East (real coefficients averaging about 65 per cent larger). The difference between the two regions is explained by the different patterns of industrial growth which have been experienced. Whereas the manufacturing sector in West Pakistan underwent rapid development throughout the 1950's,

and especially in the early part of the decade, the rate of development in East Pakistan lagged behind until the early 1960's. On average, therefore, capital in West will be older than in East, and, as noted above, correction factors will be larger as capital is older.

TABLE V-A

BOOK VALUE AND REAL CAPITAL-INCOME RATIOS IN LARGE-SCALE MANUFACTURING

EAST PAKISTAN

Sector	Book value of assets/income		Real value of assets/income	
	Value	Rank	Value	Rank
Sugar	1.761	16	3.619	16
Edible oils	.769	4	1.555	5
Cigarettes	.378	1	.573	1
Other food, drinks	.930	7	1.613	6
Cotton textiles	1.265	13	2.751	15
Jute textiles	1.037	10	2.462	12
Other textiles	3.081	17	7.048	17
Paper and printing	9.103	18	13.798	19
Leather and leather goods	.677	3	1.269	4
Rubber and rubber products ...	.937	8	1.851	9
Fertilizer	10.199	19	12.661	18
Other chemicals	.380	2	.719	2
Cement and concrete	.820	5	2.642	13
Basic metals	.837	6	1.246	3
Metal products	1.062	11	1.624	7
Machinery	1.011	9	2.002	10
Transport equipments	1.243	12	1.759	8
Wood, cork and furniture	1.532	14	2.437	11
Miscellaneous manufacturing ...	1.697	15	2.664	14
Coal and petrol products*	—	—	—	—
Weighted average	1.498		2.777	
Unweighted average	2.038		3.384	

* Empty Sector in 1962/63.

TABLE V-B

BOOK VALUE AND REAL CAPITAL-INCOME RATIOS IN LARGE-SCALE MANUFACTURING

WEST PAKISTAN

Sector	Book value of assets/income		Real value of assets/income	
	Value	Rank	Value	Rank
Sugar refining	.572	4	1.190	5
Edible oils	.877	8	1.715	9
Cigarettes	.497	2	.846	2
Other food, drinks	.818	7	1.335	6
Cotton textiles	2.124	17	4.870	17
Jute textiles*	—	—	—	—
Other textiles	1.194	13	2.340	14
Paper and printing	.895	9	1.667	8
Leather and leather goods	.272	1	.517	1
Rubber and rubber products ...	.956	11	2.121	13
Fertilizer	7.868	19	13.556	19
Other chemicals	.786	6	1.445	7
Cement and concrete	1.488	15	3.597	16
Basic metals	1.774	16	3.090	15
Metal products	.668	5	1.168	4
Machinery	1.077	12	1.913	10
Transport equipment	3.736	18	5.818	18
Wood, cork and furniture	.514	3	.929	3
Miscellaneous manufacturing ...	1.378	14	2.076	12
Coal and petrol products	.913	10	1.974	11
Weighted average	1.370		2.682	
Unweighted average	1.495		2.746	

* Empty sector.

While intra-regional rankings are essentially the same for the book value and real value coefficients, there are some rank changes, most significantly in East Pakistan capital goods-producing sectors. We can conclude that when book values are used in place of real values, not only will the absolute value of capital requirements be greatly understated but there will also be some bias introduced in interindustry and interregional comparisons[16].

The average real capital-income ratios[17] in large-scale manufacturing of the two regions are of the same order of magnitude, and they are not out of line with what we would expect to find for the manufacturing sector as a whole. In both regions, however, there is a very wide range in the size of the capital coefficients, and there are significant differences between the two regions with respect to absolute size and intra-regional ranking of particular coefficients.

Several points regarding the real coefficients in Tables V-A and V-B will help in interpreting past development patterns. With proper qualification these points also have some significance for setting industrial priorities. The main qualifications are that in drawing inferences from the data we have not systematically taken account of other cost elements—*e.g.*, foreign exchange, skilled labour —nor have we attempted to investigate thoroughly details in specific industries. We can claim nothing more for our conclusions than that they show us where to look, and they could easily be overturned by a more complete multisectoral analysis or by industry studies. But capital costs are important and often unambiguous, and our results should not be dismissed out of hand.

The high capital costs of textile industries—especially cotton textiles in West Pakistan—are particularly notable. These high costs are significant because cotton textiles (West Pakistan based) is the largest manufacturing sector in the country, and jute textiles (East Pakistan only) is the second largest. The former played an important role as an import-substituting sector during the industrial growth of the 1950's and has become a large exporting sector. The latter has increasingly become an important export earner, the most important among manufacturing industries. The high capital-income ratios in these sectors indicate that Pakistan has paid a high price in terms of capital to improve its foreign-exchange position. While it is quite possible that this has been a rational policy imposed by the extreme foreign-exchange bottleneck[18], our data provide evidence that some questions might be asked about these policy-favoured

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[16] *See*, Industrial Development Bank of Pakistan[8] and Islam[9] for examples of the use of book value capital-income ratios in the Pakistan context.

[17] From here on we speak only in terms of *real* ratios.

[18] For a formal explanation of the rationale behind such policy, *see*, Chenery and MacEwan[3].

industries. Further, it should be noted that though East Pakistan imports large quantities of cotton textiles from West Pakistan, capital costs are significantly lower in the former region. While the nature of the industries is a good deal different in the two regions, it might be adviseable to question the desirability of the existing interregional trade patterns[19].

Other sectors, though not nearly so large as textiles, in which foreign exchange saving seems to have been attained at a very high capital cost are the fertilizer industries in both regions and the paper industry in East Pakistan[20]. The coefficients we have obtained for these industries are especially large, but we do not doubt their general validity in describing past conditions. The very high capital costs are consistent with the fact that the government found it necessary to intervene in the development of these industries. On the other hand, part of the explanation of these high coefficients may be that these industries were developed more because of government fiat than because of direct economic forces. Further, the technical nature of production processes in these industries requires a high level of skills which can only be developed over time. If these explanations are the important ones, it is not unlikely that incremental costs will be much lower as economic conditions change and skills develop. Nonetheless, examples such as these and the textile industries make us either accept the argument that foreign-exchange saving is very capital costly or that errors have been made in trade control and industrial promotion policy.

On the other end of the spectrum, there are six industries which can be classed as having low capital-income ratios (*i.e.*, less than 2.0 and below the regional median in rank) in both regions. These are tobacco, leather and leather products, edible oils, other chemicals, metal products and other food. Each of these is of some interest (except 'other food' which is very small and heterogeneous).

Tobacco products in the years prior to 1962/63 was a rapidly growing sector, especially in East Pakistan. In addition to the low-cost growth which is indicated by the capital-income ratios, this sector has made large contributions to government revenues through indirect taxes. Questions of national health aside the combination of these factors imply that the net cost of expansion of this sector has been very low[21].

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19 That capital costs in textile industries, which are modern industries in Pakistan, are high is not out of line with experience elsewhere, *see* OECD[21].

20 It would be a mistake to contrast the East and West Pakistan paper and printing industries since their product mixes are so different.

21 However, Mahalanobis type arguments applied in the Pakistan case by Power[37] and Khan[12] might lead us to frown on even this seemingly low-cost growth of the tobacco industry as detrimental to savings.

Leather and leather products is a very small sector in both regions, but there is some reason to believe it may have a significant export potential[22]. Pakistan has been exporting large quantities of hides and skins. Low capital requirements in the leather sector indicate it might be beneficial to add more value to these raw materials prior to export.

Large parts of the supplies of edible oils, other chemicals, and metal products were imported in 1962/63 (which was not untypical). Furthermore, income elasticities of demand for the directly consumed outputs of each of these sectors are high. Thus, not only is there a large possibility for import substitution, but domestic demand for the outputs of these sectors can be expected to grow rapidly. That growth in these sectors has previously been capital cheap implies (on this criterion) they would be good candidates for expansion. This is all the more so since capital costs are low in both regions, and if each region were to concentrate in those parts of these sectors where it has special advantage, incremental costs could be even lower than the averages.

Of the industries which have very different rankings in the two regions, certain capital goods-producing and related sectors stand out. Much of the interregional difference, however, is explained by differences in product mix. The low costs of basic metals and transport equipment in East Pakistan, for example, are somewhat misleading since these are small and relatively "primitive" both in the nature of the product and of the technology.

Contrary to what may be the popular belief, capital costs of capital-goods production are not much in excess of capital costs of consumer-goods production. In East Pakistan, even after excluding the two sectors mentioned above, the capital-income ratios of the capital-goods industries are lower than the average ratio for the manufacturing sector, and much lower than the ratios for the consumer textiles and sugar. In West Pakistan, the average capital-income ratio for the capital-goods industries is only slightly higher than the average for all industries and is lower than the ratio for consumer textiles.

We must qualify the above statements by emphasizing that 1962/63 capital-goods industries cannot be taken as typical of future development. These sectors are still quite small, and their expansion will mean the introduction of many new products and techniques. Secondly, insofar as the capital-income ratios differ widely among different capital goods, the government policy of encouraging import substitution in capital goods sectors may be costly unless it is applied in a discriminating manner.

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[22] This is supported by the evidence that in years since 1962/63 there has been a phenomenal rise in exports of leather goods.

One very homogeneous industry having very different capital-income ratios in the two regions is sugar refining. West Pakistan seems to have a clear advantage in this sector[23]. The difference between the two regions is especially interesting because recent studies carried out without regional distinction have shown the sugar industry to be very inefficient (surviving because of a high level of protection)[24]. While our results do not contradict such a finding, they indicate that the situation might be quite different for the two regions. The case of sugar is an extreme one, but we think our data demonstrate the general danger of such national generalizations in Pakistan.

There is an aspect of capital requirements which has not been mentioned in the above discussion: the existing rate of capacity utilization. While none of our general conclusions based on direct capital-income ratios are altered, consideration of capacity utilization leads to a few qualifications of specific results.

It is generally recognized that underutilization of capacity is a serious problem in Pakistan manufacturing industries. There has, however, been no serious study of the issue, either descriptive or analytic. The situation is often blamed on lack of sufficient imports of raw materials and spare parts, but we have no firm basis to accept this and reject other explanations, *e.g.*, shortage of skilled labour, insufficient demand in a protected market.

In the absence of more information we have made a rather crude estimate of the rate of capacity utilization in each sector in order to answer two questions: *i*) In which industries are exceptional capital costs—high or low—explained by unusual rates of capacity utilization? *ii*) Which industries would change significantly in their intra-regional rank were all industries to operate at "full capacity"?

To obtain a capacity utilization rate for each sector we computed from CMI data average number of shifts per firm per year worked in each industry. We assumed full capacity to be 730 shifts per year, except where the average was greater than 730 in which case we assumed full capacity utilization. This measure of capacity utilization is obviously very rough, especially since we have no way of knowing the correlation between firm size and shifts worked. Further, assuming two shifts per day to be full capacity is totally arbitrary. Nonetheless, we do not think these drawbacks lead to any serious bias in the general picture we obtain.

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[23] *See*, footnote 30 below for qualification, however.

[24] *See*, Soligo and Stern[40] and Lewis and Geisinger[17].

The results of our estimation of underutilization rates allow us to compute full capacity capital-income ratios for the large-scale manufacturing sectors in the two regions. These ratios are presented in Table VI. On average these capital coefficients are about 40 per cent lower for East and 30 per cent lower for West than those in Tables V-A and V-B.

None of the industries which we singled out in the previous section as having very high costs significantly improves in ranking. Absolute coefficients do decline, but, aside from other textiles and East Pakistan fertilizer, the decline is no greater than the average. This result is not particularly surprising; in fact, it may be viewed as encouraging. We would expect (and hope) that high capital cost industries would be making greater use of their capital.

On the other hand, the very favourable ranking of some sectors is partly explained by their high rates of capacity utilization. Most notable are edible oils, West Pakistan sugar and paper and printing, and East Pakistan tobacco. There is likely something about these sectors which ensures that they will operate at higher than average utilization rates. For example, they may be less dependent upon imported inputs or more in tune with the requirements of their markets than other sectors. Only if the causes of underutilization were to be removed for the economy in general, a somewhat unlikely event for the near future, would these industries lose their priority position.

The machinery sector in East Pakistan and the rubber sector in West show very significant improvements in their ranking, but due to their very small size we do not think much significance can be attached to these changes. (If anything, the case of machinery enforces our argument that certain sectors are by their nature subject to underutilization, since we would expect our explanation of underutilization to apply especially strongly to machinery production in East Pakistan).

We see no reason to alter our observations of the previous section on the basis of adjustments for capacity utilization rates, though knowledge of capacity utilization rates does help us in explaining some of our particular results. Whatever the causes of underutilization of capacity it seems clear that different industries are affected very differently, and in appraising the performance of industries we should not abstract from this fact.

3.3 A Comparison of Capital Requirements in Large-Scale, Small-Scale and Cottage Manufacturing

It is interesting to compare the variation in capital requirements with the variation in the scale of operation in any particular industry. Here our analysis

TABLE VI

FULL CAPACITY CAPITAL-INCOME RATIOS IN LARGE-SCALE MANUFACTURING

Sector	East Pakistan		West Pakistan	
	Value	Rank	Value	Rank
Sugar	2.714	16	.928	9
Edible oils	.855	10	1.715	14
Cigarettes	.550	6	.550	4
Other food, drinks	.532	5	.654	6
Cotton textiles	2.613	15	3.701	18
Jute textiles	2.093	13	—	—
Other textiles	2.890	17	1.030	11
Paper and printing	11.452	19	1.250	12
Leather and leather products ...	.508	3	.191	1
Rubber and rubber products ...	.648	7	.806	7
Fertilizer	6.457	18	13.556	19
Other chemicals	.309	2	.578	5
Cement and concrete	2.483	14	3.273	17
Basic metals	.523	4	1.298	13
Metal products	.747	8	.397	3
Machinery	.300	1	.823	8
Transport equipment	.827	9	2.444	16
Wood, cork and furniture	1.024	11	.372	2
Miscellaneous manufactures ...	1.385	12	.934	10
Coal and petrol products	—	—	1.974	15
Unweighted average	2.048		1.920	

must be confined to East Pakistan for which we have reasonable information for each of the three types of operation[25].

Table VII shows the capital-income ratios for the three types of operation in East Pakistan. As is expected, capital requirement in small-scale manufacturing is always less than in the corresponding large-scale manufacturing. However, capital requirements in cottage manufacturing, though always less than in large-scale manufacturing, are in many cases (notable are textiles, gur and leather products) greater than in small-scale manufacturing.

One should interpret these findings carefully. Frequently, the difference in capital requirements between large-scale and small-scale industries of a given sector is accounted for by the difference in product mix. To give some extreme examples the large-scale paper and printing industry is dominated by paper-making while the small-scale and cottage part of the sector is engaged in book-binding, making paper products and printing; large-scale cement, concrete and building materials sector is dominated by the production of cement while its small-scale counterpart makes bricks; for large-scale sugar we have small-scale and cottage production of gur; and so on. Even for the textiles sectors the product mixes are different: while small-scale and cottage processing largely consists of weaving, the large-scale production includes more complicated processes.

On the other hand, the greater comparability of the small-scale and cottage industry data and the relative homogeneity of products between these sectors probably means that the smaller capital requirements for certain very important small-scale industries than for corresponding cottage industries do imply the inefficient utilization of capital under very small size of operation.

Another point to note is the smaller share of machinery and larger share of buildings in the capital assets of small-scale industries as compared to those of their large-scale counterparts. Since machines are much more foreign-exchange intensive than buildings, this implies that a correction for the undervaluation of the foreign-exchange component of capital would lower the ratios of small-scale coefficients to the large-scale coefficients.

3.4 Indirect Capital Requirements in Manufacturing

In analysing the capital structure of the manufacturing sectors we have so far worked only in terms of direct capital requirements. But production in one

[25] It is desirable to emphasize the limitations of the comparison made in this section. That the small and cottage industries data are compiled by an agency different from the one that compiles the CMI data means that the two sets may not be strictly comparable. In case of the small-scale and cottage industries surveys, the values of assets are direct estimates of current deteriorated value, but they are inevitably subjective estimates made by the interviewer and/or the manager. Although this is conceptually comparable to our real value or replacement cost, the latter concept is difficult enough to baffle the enumerator so that the subjective estimates may be subject to quite large errors. On the other hand, the data for small-scale and cottage manufacturing seem to be more comparable with one another.

TABLE VII

CAPITAL-INCOME RATIOS IN MANUFACTURING

EAST PAKISTAN

	Large scale	Small scale	Cottage manufacturing
Sugar and gur ...	3.619	.424	.776
Edible oils	1.555	.630	.630
Cigarettes and bidi ...	.573	.100	.100
Other food, drinks ...	1.613	.280	.465
Cotton textiles	2.751	.364	.606
Jute textiles	2.462	.104	.182
Other textiles	7.048	.358	.610
Paper and printing ...	13.798	2.074	.518
Leather and leather products	1.269	.189	.520
Rubber and rubber products	1.851	.252	—
Fertilizer	12.661	—	—
Other chemicals ...	.719	.677	.608
Cement, concrete and bricks	2.642	.197	—
Basic metals	1.246	—	—
Metal products ...	1.624	.976	.107
Machinery	2.002	.654	.410
Transport equipment ...	1.759	.482	.271
Wood, cork and furniture ...	2.437	.612	.473
Miscellaneous manufactures	2.664	.501	.352

sector requires inputs from other sectors, and the production of these inputs both requires capital and generates income. If we disregard the indirect requirement of capital and generation of income, the ranking exercise carried out above may be misleading[26].

In computing indirect capital requirement we are faced with some problems. The regional input-output tables for which we have inverse matrices do not distinguish between large and small-scale production and do not distinguish among intra-regional, interregional, and foreign supplied inputs[27]. Even if our tables did distinguish between large and small-scale production activities, we would have no way of knowing whether inputs were obtained from the large or small parts of supplying sectors. Also, a specification of inputs by location of supply for 1962/63, would be of little use in determining future patterns of interregional and foreign supply.

What we have done here is to compute direct and indirect capital-income ratios for each manufacturing sector small and large-scale production combined, assuming all inputs are domestically produced. These direct and indirect capital-income ratios are presented in Tables VIII-A and VIII-B along with the direct capital-income ratios for each complete manufacturing sector. The overall direct coefficients will, for many sectors, be quite different from the large-scale coefficients of Table I[28]. However, the differences between direct and direct-and-indirect coefficients and the resulting changes in rank should be roughly the same.

The general result of taking account of indirect capital requirements is, of course, to reduce the variance among different industries. Since the industries with low direct requirements must rely on supplying sectors with higher

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[26] It should be noted that the direct and indirect capital-income ratio may be either greater or less than the direct capital-income ratio since it is a weighted sum of the direct capital-income ratio and capital-income ratios in supplying sectors. If b_j is the direct capital-income ratio and b'_j is the indirect-and-direct capital-income ratio, then:

$$b'_j = \sum_i b_i \, c_i \, r_{ij}$$

where c_i is the income-output ratio and the r_{ij} are elements of the $(I-A)^{-1}$ matrix (where A is the Leontief matrix of current input coefficients).

[27] The input-output tables are available in Khan and MacEwan[15]. In our input-ouput work we have distinguished between large and small-scale production and among various locations of supply. But lack of computing facilities in Pakistan has made it possible for us to obtain only an inverse of the aggregate matrix prior to writing of this paper.

[28] It will be noted that the difference between the direct large-scale coefficients, Table I, and the direct overall (*i.e.*, large and small scale) coefficients, Table III, is larger for East than for West. This is partly explained by the fact that large-scale industry is less important in the former region, but is also a result of the better coverage we have been able to obtain for East Pakistan small industry.

TABLE VIII-A

CAPITAL-INCOME RATIOS IN LARGE-SCALE, SMALL-SCALE AND COTTAGE MANUFACTURING COMBINED

EAST PAKISTAN

Sector	Direct capital-income ratios		Direct and indirect capital-income ratios	
	Value	Rank	Value	Rank
Sugar and gur	1.524	15	.972	7
Edible oils	.932	10	.733	2
Cigarettes and bidi	.401	1	.666	1
Other food, drinks	.454	3	.886	5
Cotton textiles	1.068	12	1.456	14
Jute textiles	2.281	17	1.972	17
Other textiles	.942	11	1.269	13
Paper and printing	10.276	18	6.060	18
Leather and leather products... ...	.439	2	.816	3
Rubber and rubber products ...	1.763	16	1.827	16
Fertilizer	12.661	19	8.474	19
Other chemicals	.714	6	1.069	9
Cement, concrete and bricks ...	.465	4	.940	6
Basic metals	1.127	13	1.568	15
Metal products	.558	5	1.063	8
Machinery	.927	8	1.170	11
Transport equipment	1.277	14	1.248	12
Wood, cork and furniture	.928	9	.869	4
Miscellaneous manufactures ...	.740	7	1.117	10
Coal and petrol products	—	—	—	—
Unweighted average	2.085		1.799	

TABLE VIII-B

CAPITAL-INCOME RATIOS IN LARGE AND SMALL-SCALE MANUFACTURING COMBINED

WEST PAKISTAN

Sector	Direct capital-income ratios		Direct and indirect capital-income ratios	
	Value	Rank	Value	Rank
Sugar and gur	1.332	6	1.537	4
Edible oils	1.108	4	1.716	7
Cigarettes and bidi	.665	2	1.219	2
Other food, drinks	1.335	7	1.601	5
Cotton textiles	4.456	17	3.102	17
Jute textiles	—	—	—	—
Other textiles	2.340	15	2.327	15
Paper and printing	1.667	9	1.770	8
Leather and leather products... ...	.424	1	.848	1
Rubber and rubber products ...	2.121	14	1.983	9
Fertilizer	13.556	19	8.015	19
Other chemicals	1.445	8	1.659	6
Cement, concrete and bricks ...	1.996	11	2.251	14
Basic metals	3.090	16	2.801	16
Metal products	1.132	5	2.015	10
Machinery	1.913	10	2.150	13
Transport equipment	5.818	18	3.833	18
Wood, cork and furniture	.929	3	1.286	3
Miscellaneous manufactures	2.076	13	2.079	12
Coal and petrol products	1.974	12	2.073	11
Unweighted average	2.599		2.330	

requirements and *vice versa*, the very sharp distinction between industries is somewhat reduced. But since the degree of backward linkage can vary so much among industries, there are also some changes in rank which are worth noting.

For East Pakistan the changes in rank are explained mainly by the fact that East Pakistan agriculture uses very little capital and industries closely linked to agriculture have relatively small indirect capital requirements[29]. By comparison, those industries which rise in rank are ones which require manufactured inputs. In terms of describing the past, the indirect capital requirements of these users of manufactured goods may be overstated, since many manufactured inputs were imported. And in terms of projecting future possibilities, the indirect requirements of industries closely linked with agriculture may be understated since the incremental capital coefficients for agriculture are probably higher than the average.

In West Pakistan the effect upon ranking of considering the indirect requirements is more complex since agriculture is quite capital (irrigation) intensive. The industries where indirect requirements most significantly change ranking are edible oils, cement and bricks, metal products and machinery, all of which appear less desirable, and rubber products which improve in ranking. But for none of these does the shift in rank seem significante nough to cause us to modify our remarks above except perhaps in the case of metal products which now look much less favourable[30].

Perhaps the most important result of computing indirect capital requirements is that in neither region do the positions of the industries at either end of intra-regional rankings change significantly. Therefore, both our general conclusion regarding the high cost of previous foreign-exchange savings and our specific conclusions regarding which industries might offer favourable growth possibilities are left intact.

4. SUMMARY AND CONCLUSIONS

In this paper we have presented a comprehensive set of capital coefficients for each of the two regions of Pakistan which could be used in multisectoral interregional planning exercises. We distinguish 35 using sectors and six capital

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29 Note that the East Pakistan small-scale transport equipment sector involves much boat-making which requires wood, an agricultural product.

30 A final comment should be added with regard to the West Pakistan sugar industry which, according to Table VIII-B, improves in rank when indirect requirements are taken into account. We think this improvement is an error resulting from aggregation of sugarcane growing with certain other much less capital intensive agriculture. Given the lower cost of cane growing in East Pakistan, the overall sugar production advantage of West Pakistan would be less than what we have indicated above.

supplying sectors (three types of construction and machinery, transport equipment and furniture and fixtures). We also make an analysis of the past economic structure and future possibilities that these coefficients reveal.

For large-scale manufacturing we have explained a method by which we have estimated capital coefficients on the basis of book values of assets and indices of past investment. The method may have some applicability for some other countries, since it relies upon data which will often be available. While book value of assets data are important elements in the estimation procedure, the capital in our estimates is replacement cost value. Our coefficients are, therefore, much larger than coefficients based upon unadjusted book value data. Further, use of book value coefficients will not only lead to an understatement of capital requirements but may also lead to biases in intersectoral and interregional comparisons.

The real capital-income ratios obtained in this paper show in both regions a very wide range of capital requirements among large-scale manufacturing industries. Certain industries which have been favoured because of their contribution to foreign-exchange savings and/or earnings stand out as having high capital costs. Most important of these are the textile industries. We are led to believe that either the capital cost of improving Pakistan's foreign-exchange position has been necessarily very high or some policy errors have been made.

We also observe that a number of industries which seem to have large growth potential have low capital costs in both regions. The possibility of capital saving through emphasizing expansion of these sectors should warrant more thorough analysis.

Our observations are based primarily upon direct capital-income ratios, but we also calculate direct full-capacity capital-income ratios and direct-and-indirect capital-income ratios. Consideration of these other aspects helps in explaining some of our results, and leads us to make some qualifications, but does not greatly alter our conclusions.

These conclusions, however, can be taken only as tentative, since we have made no effort to make complete cost calculations. Any complete analysis would necessarily take explicit account of the foreign-exchange earnings and saving capacity of different industries and would employ a shadow price for foreign exchange significantly higher than the official exchange rate. Were we to measure the cost of imported inputs (current and capital) and the benefits of exports with a reasonable foreign-exchange shadow price, we would obtain a different set of industrial priorities than those implied in this paper. The set of priorities would be further altered were we to deflate output prices in some sectors to adjust for

the inflated prices resulting from protection. Employing such price adjustments we would probably obtain a more accurate set of social cost priorities.

Though these issues could have been partially dealt with in the sort of analysis presented here, we feel they are better handled in the context of an interindustry programming model and in detailed industry studies. Our purpose here has been to lay groundwork for such exercises.

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Appendix

SUMMARY AND ILLUSTRATION OF THE CONVERSION OF CMI BOOK VALUES TO REPLACEMENT COST VALUES OF ASSETS

It should be useful to give a step by step description of our method of converting CMI book values of assets data to replacement cost values. The method proceeds as follows:

1. Book values of *a*) buildings and land; *b*) machinery, and *c*) other assets and rent paid during the year are tabulated from the CMI.

2. For each sector for each of five types of assets—buildings, machinery, office equipment, transport equipment and furniture and fixtures—a correction factor is computed on the basis of *a*) an index of past investment, *b*) a price index, *c*) depreciation allowances, *d*) deterioration assumptions. For example, consider the following hypothetical case: Suppose *i*) machinery in a given sector has a life of six years; *ii*) the depreciation allowance on outstanding value including all special concessions is 45 per cent for the first year and 20 per cent for each subsequent year (except that the balance is written off entirely when the asset is retired); *iii*) the indices of past investment, the price index of machinery, deterioration pattern and depreciation pattern are as shown in Columns (1) and (5), (4), (2) and (6) respectively of the following tables. Note that it does not matter whether we begin with the constant price index or the current price index of past investment since either one can be converted to the other with the price index. Further note that an actual investment series does not appear in the table since, as stated in the text, we usually have none.

For investment undertaken in each previous year we compute, as shown in the table, first, the deteriorated value at the beginning of 1962/63, and, second, the amount of value on the books at the beginning of 1962/63. We sum these values for all previous years—the sums of Columns (3) and (7)—and the ratio of these sums yields the correction factor, 1.49 in this example. The actual correction factors obtained are shown in Appendix Tables A-2 and A-3.

3 a) The correction factor for production machinery is applied directly to the book value of machinery to obtain real values of productive machinery.

3 b) The correction factor for buildings is applied prior to adding the value of rented assets and is applied simultaneously with a procedure to eliminate the value of unimproved land. After correction the value of rented assets is

TABLE A-1

A HYPOTHETICAL EXAMPLE

Year	Gross investment index at 1962/63 prices	Per cent deteriorated by beginning of 1962/63	Index of productive value remaining at beginning of 1962/63 at 1962/63 prices	Price index (1962/63=100)	Current price gross investment index	Per cent depreciated by beginning of 1962/63	Index of value on books at beginning of 1962/63
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1955/56	20	100.0	0	80	16	100.0	0
1956/57	40	68.3	12.7	85	34	77.5	7.7
1957/58	40	46.7	21.3	90	36	71.8	10.1
1958/59	50	25.0	37.5	90	45	64.8	15.8
1959/60	60	16.7	50.0	95	57	56.0	25.1
1960/61	80	8.3	73.3	100	80	45.0	44.0
1961/62	100	0	100.0	95	95	0	95.0
			294.8				197.7
			Index of productive value at the beginning of 1962/63				Index of book value at the beginning of 1962/63

$$F = \frac{294.8}{197.7} = 1.491$$

(3) = (1) − (2) × (1)/100
(5) = (1) × (4)/100
(7) = (5) − [(6) × (5)/100]

TABLE A-2

CORRECTION FACTORS FOR LARGE-SCALE MANUFACTURING IN EAST PAKISTAN, 1962/63*

	Machinery	Building	Transport equipment	Furniture	Office equipment
Sugar	2.53	1.82	1.11	1.08	1.25
Edible oils	2.16	1.62	1.10	1.14	1.30
Cigarettes	1.66	1.45	1.10	1.02	1.30
Other food, drinks ...	1.80	1.60	1.10	1.10	1.30
Cotton textiles	2.49	1.83	1.11	1.11	1.16
Jute textiles	2.66	2.03	1.11	1.07	1.30
Other textiles	2.50	1.80	1.11	1.11	1.15
Paper and printing ...	1.76	1.55	1.11	1.02	1.26
Leather and leather products	2.00	1.80	1.10	1.05	1.25
Rubber and rubber products	2.20	1.80	1.10	1.05	1.25
Fertilizer	1.42	1.33	1.10	1.00	1.11
Other chemicals ...	2.02	1.66	1.10	1.14	1.30
Cement	5.42	2.13	1.05	1.62	1.25
Basic metal	1.57	1.43	1.10	1.00	1.25
Metal products... ...	1.57	1.43	1.10	1.00	1.25
Machinery	1.57	1.43	1.10	1.00	1.25
Transport equipment ...	1.55	1.40	1.10	1.00	1.25
Wood, cork, furniture ...	1.65	1.62	1.10	1.13	1.30
Miscellaneous manufactures	1.59	1.47	1.00	1.10	1.25

* Book value multiplied by correction factor equals replacement value in 1962/63 prices.

TABLE A-3

CORRECTION FACTORS FOR LARGE-SCALE MANUFACTURING INDUSTRIES IN WEST PAKISTAN, 1962/63*

	Building	Machinery	Other equipment	Furniture	Transport equipment
Sugar	1.66	2.30	1.30	1.14	1.05
Edible oils	1.62	2.16	1.30	1.14	1.10
Cigarettes	1.61	1.88	1.29	1.13	1.10
Other food	1.63	1.75	1.30	1.14	1.10
Cotton textiles	1.91	2.91	1.38	1.15	1.10
Other textiles	1.66	2.20	1.30	1.14	1.10
Paper and paper board ...	1.79	2.30	1.30	1.14	1.00
Printing	1.74	1.86	1.29	1.13	1.09
Leather and leather products	1.90	2.14	1.30	1.14	1.09
Rubber and rubber products	1.78	2.66	1.35	1.22	1.10
Fertilizer	1.45	1.90	1.26	1.13	1.13
Other chemicals ...	1.66	2.02	1.30	1.14	1.10
Cement	1.81	2.84	1.33	1.14	1.10
Basic metals	1.63	1.87	1.30	1.13	1.08
Metal products... ...	1.63	1.87	1.30	1.13	1.08
Machinery	1.70	1.95	1.30	1.13	1.08
Transport equipment ...	1.55	1.89	1.30	1.13	1.08
Wood, cork, furniture ...	1.62	1.65	1.30	1.13	1.10
Miscellaneous manufactures	1.47	1.59	1.25	1.10	1.00
Coal and petrol products ...	1.60	2.16	1.30	1.14	1.10

* Book value multiplied by correction factor equals replacement value in 1962/63 prices.

added*. The procedure for eliminating the value of unimproved land is as follows:

Let U and B denote book values and u and b real values of unimproved land and buildings, respectively. Since no depreciation is allowed on unimproved land, we have:

$$u = U$$

and if f is the correction factor for buildings, we have:

$$b = fB$$

If C is the CMI value of land and buildings:

$$B + U = C$$

Now let

$$r = u/(u + b).$$

We determine r roughly from the joint stock companies[35] data as being on average .035. Then since we have C and determine f independently we may solve for u, U, b and B. This allows us to subtract out the value of unimproved land from the CMI book value of land and buildings.

3 c) Using joint stock companies data[35] and the method explained in the text (similar to that used immediately above), the correction factors for office equipment, transport equipment and furniture and fixtures are applied to the CMI value of other assets while this value is simultaneously divided into the three components. The real values of these three components are thereby obtained.

4) Value of machinery is taken as the sum of the values of productive machinery and office equipment since these components of capital originate in the same sector (*see* Table I). However, for East Pakistan where self-generation of electricity is very important, we eliminate from capital the value of machinery used in production of electricity and show an input of electricity from the electricity sector. We estimate the value of generators by applying the non-hydro capital-capacity ratio (Rs. 1,000 per KW) to the generating capacity in each industry. No such correction was undertaken for West Pakistan since *a*) self-generation is not so important and *b*) sufficient data were not available.

5) Since book values are based on purchasers' price, the values of assets obtaied are at purchasers' price. CMI output, however, is shown at producers' price. The value of output was adjusted to purchasers' price on the basis of trade and transport margins in the input-output tables[15].

* Value of rented assets is determined from rent paid by assuming that the ratio of the former to the latter is 8.5. Value of rented assets is almost always a very small portion of building assets.