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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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JOINT UNIDO-UNCTAD PROJECT ON THE INTERRELATIONSHIP BETWEEN GROWTH PATTERNS, TRADE CONFIGURATION AND INDUSTRIAL STRUCTURE (UNITAD)*.

EXPERT GROUP MEETING ON THE ANALYSIS AND PROJECTION OF TECHNOLOGICAL CHARACTERISTICS IN THE UNITAD SYSTEM OF MODELS.

(Vienna, 22-24 October 1979)

Prepared by the UNITAD team

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Note on the Provisional Agenda

1. The UNITAD Project is a joint UNCTAD and UNIDO contribution to the International Development Strategy. As indicated in its full title, its main purpose is to study through the use of models, the interrelationship between growth pattern, trade configuration and industrial structure within a broad development framework, as defined by the General Assembly in the course of its sixth special session and subsequent sessions (see in particular resolution 33)139). Of particular relevance are major UNIDO and UNCTAD broad orientations,

as defined by UNCTAD V (Manila, May 1979) and the Declaration and Plan of Action adopted by UNIDO Second Conference (Lima, March 1975).

2. A number of technology issues underly the development process to be modelled in the Project. Firstly leaving aside technology in the agriculture sector (to be considered in other fora) the building up of a technological capacity in the manufacturing sector, and more particularly in the production of equipment goods, can be said to be a development goal in itself, which should be clearly quantified in the model (e.g. through dependence indicators in key sectors).

Next, the model should be able to relate major technology issues both to their international implications and to broad development objectives. For example, the adverse financial conditions and costly trade ties implied by technological dependence should be pictured. On the domestic side, attempts should be made to relate technology to income distribution, consumption pattern and in a very specific way, to the employment problem.

One word should be said here on the activity of Transnationals. Although they are not identified as such, there are key macro-economic indicators in the analysis which can be traced back to them. It is therefore envisaged in due course to have some reflection of these activities captured in the model.

3. The main difficulty, in this exercise, is to translate concepts discussed by scientific and technological experts[1/] into the type of macro-economic variables and relationship used in models. A brief description of the structure of the Project may be in order. In its present simplified version (SIMV), the UNITAD Project consists of a "system" of eleven regional models interacting with each other - through a world trade structure embodied in a series of trade matrices (seven commodity groups, of which four manufacturing: intermediary products, consumer non-durables, equipment goods and consumer durables).

1/ See in particular the following papers:

UNCTAD: Technology planning in developing countries TD/238/Supp.1 Manila May 1979.

UNIDO: International Forum on appropriate industrial technology Anand, India 28-30 November 1978. Report of the Ministerial level meeting.

4. Six (out of eleven) regional models[1/] refer to developing regions, i.e. Latin America, Tropical Africa, North Africa and West Asia, Indian Sub-Continent, East Asia, and Centrally Planned Asia). In over-simplified terms, each regional model contains:

(a) an input-ouput table, 8 x 8 sectors, linking the output mix with an endogenously generated final demand vector. The eight producing sectors are: Agriculture, Food Processing, Energy, Basic Products, Light Industry, Equipment goods industry, Construction, Services;

(b) the final demand vector, in turn, consists of:
- a private consumption vector, which is a function of income distribution, of average income per capita and of prices;
- an investment vector, linked with the output mix through an accelerator mechanism;
- an import vector which is related to the level of activity of intermediate and final sectors and of the economy;
- an export vector which is generated by the world trade structure (through the trade matrices);
- a government consumption vector determined as a residual;

(c) a domestic saving sector (made up by household, entreprise and government), as well as financial capital movements. The sum of domestic and foreign savings is them compared with the total resource requirements needed to finance the investment activity, through which a good deal of the technical progress is injected into the productive process;

(d) the employment balance (possibly by category of skills), obtained through production functions which determine the demand for employment, and through a demographic and labour supply sub-model.

1/ The others are: North America, Western Europe, Centrally Planned Europe, Japan, other developed.

5. In such a system, the characteristics of manufacturing technology are mostly reflected:

(a) in the technical coefficients of the 8 x 8 Input-Output matrices;

(b) in the production functions relating output with capital variables (including investment), manpower (possibly subdivised by skill categories), technical progress and other factors influencing technology (such as size of market, consumer behaviour. etc...).

It is essential to observe that the purpose of the model, which is a simulation model, implies the use of econometric relations in two different ways:

(a) using coefficients estimated from observed data, one may simulate a continuation of present policies and trends;

(b) introducing normative values of control variables and parameters, one may simulate new policies reflected in these control variables and study the implications of such policies.

6. As a first step in the quantification of technological process, two sources of data were used for a detailed analysis of present characteristics:

A. A cross-section analysis carried out in UNIDO on the basis of thirty I/O tables of twenty-one sectors each;1/

B. Another source, composed of thirty-nine indicators for thirty-two ISIC sectors available for thirty-three countries and ten years, drawn from the United Nations Yearbook of Industrial Statistics.2/

Analysis A refers to material inputs while analysis B refers to "indicators" such as average size of establishments (in terms of

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1/ These tables are derived from a set of eighty I/O tables collected by Bradford University. Careful scrutiny was made on this material before selecting thirty I/O tablee for Analysis A.

2/ These data have been converted in constant 1970 US dollars (using official exchange rates, faute de mieux) by the UNITAD central team. See in Annex I the correspondence code between the eight sectors of regional models, the twenty-one sectors of Analysis A, and the thirty-five sectors of Analysis B.

employees and sometimes operators), value added and compensation of employees, and for some countries, electricity consumed and gross capital formation for the sectors.

The results of this analysis are circulated for discussion under agenda items 2 (a) and 2 (b) (see related papers).

7. As a next stage, it is suggested to discuss how to use the disaggregated data coming out of the analysis in regional models with eight sectors. This in turn can be discussed under two separate sub-items (a) and (b) according to whether trend-like projections or normative projections are attempted.

The discussion should be seen as a two way give and take process between technology experts and model builders. If, as it is attempted in this agenda, the preceding items make it possible for all participants in the meeting to become familiar with the formal structure of the model and the broad socio-economic background adopted by the UNITAD team, this item may well give an opportunity for technology experts to introduce the major policy and substantive issues they would like to embody in the final version of the model.

8. The outcome of the meeting might be twofold:

(a) to initiate a cooperation between technology experts and model-builders which will be essential in the next stages of the UNITAD Project, including the testing of technology assumptions in the model, and;

(b) to finalize a paper on technology issues for the next ACC meeting of the modelling group for the International Development Strategy. For this purpose, the papers discussed at the meeting will be revised by the UNITAD team taking into account the comments, criticisms and views voiced at the meeting.

ANNEX 1

The Classification Key between the SIMV Sectors, UNIDO Standardized Tables Sectors and the 1968 International Standard Industrial Classification of All Economic Activities (ISIC).

SIMV Sectors	21 Sectors (Analysis A)	35 Sectors 1968 ISIC (Analysis B)
1. Agriculture	1. Agriculture	Div. 1. Agriculture etc.
2. Agri- Food Processing	2. Food Products	311/2 Food Manufacturing 313 Beverage Industries 314 Tobacco Manufactures
3. Energy	3. Coal Mining	210 Coal Mining
	4. Petroleum and Gas	220 Crude Petroleum and Nat. Gas
	5. Petroleum and Coal Prod.	353 Petroleum Refineries 354 Products of Petroleum and Coal
	6. Electricity,Gas and Water	410 Electricity, Gas and Steam 420 Water Works and Supply
4. Basic Products	7. Metal Ore Mining	230 Metal Ore Mining
	8. Other Mining	290 Other Mining
	9. Paper and Paper Products	341 Paper and Paper Products
	10. Chemicals	351 Industrial Chemicals 352 Other Chemical Products
	11. Non- Metalic Min. Products	361 Pottery, China, etc. 362 Glass and Glass Products 369 Other Non- Metalic. Min. Prod.

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	12. Metals	371	Iron and Steel
		372	Non- Ferrous Metals
5. Light Industry	13. Textiles	321	Manufacture of Textiles
	14. Wearing Apparel	322	Wearing Apparel
		323	Leather and Leather Products
		324	Footwear
	15. Wood Products	331	Manufacture of Wood Products
		332	Furniture and Fixtures
	16. Printing and Publishing	342	Printing and Publishing
	17. Plastic and Rubber Prod.	355	Rubber Products
		356	Plastic Products
		390	Other Industries
	18. Metal Products	381	Metal Products
6. Equipment Goods Industry	19. Machinery	382	Machinery
		383	Electrical Machinery
		385	Professional and Scientific G.
	20. Transport Equipment	384	Transport Equipment
7. Construction	21. Construction	Div.5.	Construction

8. Services	22. Trade	Div. 6. Wholesale and Retail Trade
	23. Transport & Communication	Div. 7. Transport and Communication
	24. Other Services	Div. 8. Financing, Real Estate etc. Div. 9. Community and Private Serv.

AN ANALYSIS OF TECHNOLOGY INDICATORS (Paper I)

INTRODUCTION

Section 1	:	Methodology of the analysis
Section 2	:	Preliminary results on the structure of the manufacturing sector
Section 3	:	Analysis of various indicators
Section 4	:	Policy issues for consideration by the group of experts

1. This paper is meant to describe in a very sketchy form the analysis of technology indicators prepared in the UNITAD Project, on the basis of data derived from the United Nations Yearbook of Industrial Statistics. This source is referred to as source B as distinct from the analysis based input-output tables, called source A (see the relevant paper on analysis A). After a short methodological section, the paper will sum-

marize the main results of analysis B, and will compare them, whenever relevant, to results of analysis A. Finally a list of issues will be drawn up as a possible guide for discussions by the group of experts.

SECTION 1

METHODOLOGY OF THE ANALYSIS

2. In the original source (Yearbook of United Nations Industrial Statistics) data were available for more than hundred countries, over 20-25 years, for a classification of about 40 sectors. However, too many data were missing for a number of countries, so that a severe selection of countries was made, restricting the geographical scope of the study to 33 countries. Similarly, a selection of sectors was made, i.e. the analysis concentrated on the 28 manufacturing sectors, thereby excluding mining and utilities. Even so, it was not to be given for granted that the data retained in the analysis would be acceptable and meaningful.

3. Another source of difficulty was the fact that all data were expressed in current prices and in national currencies. National deflators by sector or group of sectors were used to convert data in 1970 national prices. Next, 1970 official exchange rates were used, faute de mieux, to convert data in 1970 $US dollars. One of the implications is likely to be an upward bias on North-American data since the dollar was over-evaluated at that time. Other biases were probably introduced by the same token, but it is difficult to interpret them.1/

The country classification

4. One of the great limitations of the analysis is the composition of the 33 countries retained in the final list under study. This includes, on a geographical basis:

1/ Purchasing power parity rates would have been far better than official exchange rates but they were available for ten countries only.

- Canada and United States
- Australia
- Denmark, Finland, Norway, Sweden (North-Europe)
- United Kingdom (West-Europe)
- Cyprus, Israël, Greece, Portugal, Spain, Turkey (South-Europe and Israël)
- Bolivia, Brazil, Colombia, Ecuador, Guatemala, Panama, Peru, Venezuela
- Egypt, Ethiopia, Nigeria, Mozambique, Tunisia
- Hong Kong, India, Irak, Korea, Philippines, Singapore.

5. A first weakness is the omission of centrally planned economies, which is due to the difficulty of comparing their price systems with that of market economies. This omission, however, appears so important for a correct interpretation of the analysis that is seems very tempting to extend the analysis, even partially, to that group of countries in the future.

6. Another weakness is the poor representation of Western Europe, and of the EEC in particular. Data were missing for "large" European countries such as France, Italy and Federal Republic of Germany. This omission prevented full use of United Kingdom data since the importance of the British market and its peculiarities would bias any average of a sub-group. (These data are however used in regression analysis).

7. Finally, India is included in the sample but most indicators are missing. There was therefore no alternative than treating India separately in the preliminary analysis (but not in regression analysis).

The sectoral indicators

8. The original variables found in the data base included, for 28 manufacturing sectors, the following data:

- Number of establishments
- Average number of persons engaged
- Average number of employees
- Wages and salaries of employees
- Gross output
- Value added
- Average number of operatives[1/]
- Wages and salaries of operatives[1/]
- Quantity of electricity consumed
- Gross fixed capital formation, total

9. On the basis of these variables, a number (around 55) of derived indicators were computed (see the complete list in the Annex). The most important of these indicators will be denoted as follows (with their serial number in the analysis):

1.	VAL	-	Value added per employee
2.	WL	-	Wage and salaries per employee
3.	NWL	-	Non wage component of value added per employee
4.	ICA	-	Ratio non operatives (=skilled)/operatives
5.	IVY	-	Ratio value added/gross output
8.	ELQ	-	Electricity consumed (in Kwh) per unit of value add

Two indicators refer to the size of establishments:

6.	TLE	-	Employees per establishment
7.	TVA	-	Value added per establishment

An important group of indicators are meant as proxies for capital indicators:

13.	CAPVA	-	Sum of gross investment/lagged value added over 10 years (year 12)
14.	CAPLE	-	Sum of gross investment/lagged number of employees over 10 years (year 12)
43.	PCOR=CAPVA/μ	-	Proxy for average capital/output ratio (see below)
44.	PKL=CAPLE/μ	-	Proxy for average capital/labour ratio (see below)
53.	PCYV	-	Proxy for capital/gross output ratio

1/ Operatives are defined as workers with their immediate supervisors.

Similar indicators were derived for each five year period; so that, in addition to annual data over a ten year period, average and incremental indicators are available for two five-year periods:

- Period 1: 1967-71   Period 2: 1972-76

These are:

11.	CAPVA1	or	CAPVA2
12.	CAPLE1	or	CAPLE2
41.	PCOR1	or	PCOR2
42.	PKL1	or	PKL2
51.	PCYV1	or	PCYV2

For the sake of comparison, these indicators are normalized to make them comparable to ten-year indicators (numerator = twice the sum of investment over five years).

The next group of indicators refers to the main absolute variables and their growth:

18.	VAC	-	Average value added (over five years)
19.	WEC	-	Average wage bill (over five years)
20.	YVC	-	Average gross output (over five years)
38.	LE	-	Average number of employees (over 5 years)
39.	INVC	-	Average gross investment (over 5 years)
46.	x,	-	Annual rate of growth of value added (computed as the exponential rate between VAC1 and VAC2)
47.	r,	-	Annual rate of growth of value added (computed as the exponential rate between YVC1 and YVC2)

Finally, an entire series from 21 to 35 is used to denote indicators 1 to 15 normalized by division of the sectoral indicator (say, 311 Food Industry) by the same indicator for manufacturing as a whole (Sector 300). Example Variable 2, average wage per worker is matched by Variable 22, wage per worker in this sector related to the national average for the manufacturing sector.

In particular the following variablee are relevant:

21.	RVAL	(variable 1 normalized)
22.	RWL	(variable 2 normalized)
23.	RNWL	(variable 3 normalized)
26.	RTLE	(variable 6 normalized)
27.	RTVA	(variable 7 normalized)
33.	RCAPVA	(variable 13 normalized)
34.	RCAPLE	(variable 14 normalized)

10. A juetification for the computation of capital indicators ie in order. In a firet step, the sum of gross inveetment over ten years was considered, for the United Statee economy, in relation to the rate of growth "r" of capital accumulation in the sector and a parameter "λ" denoting the inverse of the average life of plant and equipment in that sector. Thue one may write:

$$I_g^t = I_n^t + \lambda K_{t-1} \qquad (1)$$

with t denoting year t for grose investment (Ig) and net investment (In), and K_{t-1} denoting the capital at the end of year t-1.

If a fixed rate of growth of capital ie assumed, then $I_n^t = rK_{t-1}$

In this simplified model, the following relation obtains:

$$I_g^t = (r + \lambda)\ K_{t-1} \qquad (2)$$

The aesumption is that groee investment ie divided in fixed shares $r/\lambda+r$ and $\lambda/\lambda+r$ between net inveetment and replacement respectively. The average life of equipment for the sector, λ, can then be derived from a comparieon of:

- Sum of groee inveetment over ten years
- μ, in which μ is a function of λ and r
- K_{10} is the capital at the end of year 10, derived from outside eourcee for the United States economy. More precisely:

$$\sum_{1 \text{ to } 10} \text{INVC} = \frac{\lambda + r}{r}\ [1-(1+r)^{-10}]K_{10} = \mu K_{10} \qquad (3)$$

hence the use of CAPVA/μ and CAPLE/μ as proxiee for the capital-output and capital-labour ratioe reepectively.

The computation yielded parameters for the United States ranging between 0.04 and 0.067, i.e. an average life of capital (equipment and plant) between 15 and 25 years. This is considered acceptable by competent sources.1/2/ Each sectoral "λ_i" was then applied to the calculation of λ_i's coefficients for all countries, on the ground that there were contradictory arguments offsetting each other in favour and against the lengthening of average life of equipment in developing countries. At any rate, the error made in using the same λ_i for all countries (for a given sector) is assumed to be smaller than that resulting from the application of the simplified model above. Before it was used in the analysis, the simplified model was checked with a sensitivity analysis (with varying values for λ and r) which showed that the capital proxies were relatively robust (see final list of paramaters by sector in the annex). In general, it can be said, in this connection, that the two proxies for indicators on capital/output and capital/labour ratios appear quite reasonable for countries with very high rates of manufacturing growth such as Korea.3/ In certain sectors, in these countries, it can be safely assumed that more capital was accumulated during the decade 1967-76 than during any preceding period. Estimates for small economies, or slow moving sectors, on the other hand, may well be much weaker. This note of warning seems indispensable to interpret the absolute values of the proxies; one may hope, however, that a reasonable correlation exists between these proxies and the real capital variables so that the regression work and a cautious analysis of relative values of these proxies are meaningful.

1/ "The United Kingdom statisticians assumes lives for plant and machinery of between 16 and 50 years, and average life of buildings of 80 years, in estimating capital consumption in manufacturing. Estimates for the United States are for lengths of life between 15 and 22 years for manufacturing equipment, and 40 years for buldings" (from Technology and Under development, by Frances Stewart - MacMillan Press Ltd, 1977).

2/ French statisticians estimated life duration for equipment as ranging between 12, 16 and 20 years according to sectors, (weighted average 16 years) and 30, 35 and 40 years (weighted average 36 years) for plant. Altogether, the weighted average (plant and equipment) is of the order of 22 years. (See in Economie and Statistiques, No.114, September 1979, Paris, the article "L'Accumulation de capital fixe" by Henri Delestre).

3/ A check was made using figures from "Estimates of Korean Capital and inventory coefficients in 1968" by Kee Chun Han (Seoul, 1970).

11. To conclude, we now have a data base for the analysis including 33 countries, 28 sectors, 55 indicators for two five-year periods, i.e. altogether more than 100,000 data (derived from the 10 original variables for 10 years, from each sub-sector i.e. 92,000 original variables). These data ware used both for time series and cross-country analysis. The following paragraphs describe the preliminary results derived from the analysis, on the basis of a first scrutiny, pending completion of a multiple regression analysis which is underway.

SECTION 2

PRELIMINARY RESULTS OF THE ANALYSIS

The structure of the manufacturing sector

12. A number of experiments (including a factorial analysis reproduced as an annex) were made to classify the countries. Eventually, it was found convenient to use the structure of output (or of investment) by broad group of sectors to define country groups, separating United States, United Kingdom and India on account of their relative weights.

13. The result of the analysis is shown in table 1. The table is an attempt to suggest a double entry classification for seven country patterns and five sectors. The detailed definition of the broad sectors (by ISIC numbers) is given in the table, so that it may be sufficient to give here a broad definition of each "sector":

- There are two consumption goods sectors, numbered 1 and 2, separating in the first category sub-sectors based on the first processing of relatively scarce resources (in the sense of unequally distributed), such as beverages (tea, coffee,..), tobacco, textile fibres, wood, rubber, while the second sector includes "free-location" sectors, i.e. the processing of common resources (food) and the secondary processing industry (clothes, shoes, furniture, simple metal products). The tentative idea between this distinction was that the relative importance of the first sector might be more variable on account of different resource endowment;

TABLE 1

STRUCTURE OF OUTPUT BY GROUP OF COUNTRIES
(decreasing ranking of GDP/capita)

	USA A_1	SH ind A_2	UK A_3	S sem B_1	L sem B_2	S low B_3	India B_4
Average population (10^6 people)	213	9.5	56	16.2	54	14.3	608
Average GNP/capita* (1975 figures) $US/capita	7100	4000	3800	1680	1300	720	140
Average salary (manufacturing) $US/worker	8150	5930	3250	1650	1440	1080	430

STRUCTURE OF OUTPUT
(in % of total value added)

	USA A_1	SH ind A_2	UK A_3	S sem B_1	L sem B_2	S low B_3	India B_4
Consumption 1	18	21	20	28	30	32	32
Consumption 2	26	28	26	29	23	44	15
Capital goods	32	26	29	14	19	6	20
IP-1	12	15	12	15	15	6	16
IP-2	12	10	13	14	13	12	17
Manufacturing Value Added¹	100	100	100	100	100	100	100
in 10^9 dollars (average) (1975 figures)	360	9.4	52	1.4	8.1	0.3	5.0

* Source : World Bank Atlas.

1) Definition of sectors (ISIC serial number)
Consumption 1.(first processing of scarce resources):313/314/321/323/331/335
Consumption 2.(secondary processing):311/322/324/332/342/356/381 and 390
Equipment good industries: 382/383/384/385
Intermediary products 1(scarce resources) 341/353/354/371/372
Intermediary products 2(common resources) 351/352/361/362/369

2) Definition of country groups (for meaning, see in the text)
SH ind= Small high industrialized (6 countries)
S Sem= Small semi-industrialized (10 countries)
L Sem= Large semi-industrialized (4 countries)
S Low= Small non industrialized (10 countries)

- The capital good sectors, wrightly or wrongly, included the ISIC division 38, excluding however 381 (metal products) which is classified in consumption 2 sector even though it includes an unknown proportion of equipment goods (boilers, structural metallic goods, etc...). All that can be retained is that we have a restricted definition of capital goods; on the other hand, this includes both the production of equipment goods proper and that of consumer durables which cannot be separated easily from the viewpoint of the technology;

- Finally, a tentative distinction was made between two intermediary product sectors (numbered IP-1 and IP-2) on a similar basis than the consumption good sectors, i.e. regrouping under IP-1 the first processing of relatively scarce resources (timber, oil, all metal ores) and under IP-2 the further processing of basic products which can theoratically be located anywhere (basic chemical industry, glass, pottery, cement).

14. The main discriminatory factor, on which the classification of countries was based, appears to be the relative proportion of the capital good sectors in total manufacturing value added. Using this as a criteria led to a distribution of countries which is as follows:

- In the developed countries, separating United States and United Kingdom, we are left with a group of "small" industrialized countries with a capital good industry averaging 26 per cent of value-added, smaller than that of United Kingdom (29 per cent) and of United States (32 per cent). This group is denominated A.2 (with United States as A.1 and United Kingdom as A.3), and includes Canada (one half of the manufacturing sector of group A.2), Australia and four Scandinavian countries;

- In the remaining countries (numbered B), separating India, (as B.4), three group emerged: one includes four countries (Brazil, Korea, Spain, Turkey) with a capital good sector averaging 19 per cent (very close to the Indian figure of 20 per cent); this group was called "large semi-industrialized countries" (B.2) for reasons which will be given below. The other two groups display sharp differences, with ten countries[1] in a group called "small semi-industrialized countries" (B.1) with a capital good sector averaging 14 per cent, while the other ten countries[2], called low industrialized countries (B.3), have a capital good sector averaging 6 per cent only.

15. The interest of this classification, based on the relative weight of the capital good sectors, lies in the fact that we end up with seven categories (including United States, United Kingdom, India and four groups) with different "levels" of industrialization (measured for example by GDP per capita or the average salary in manufacturing industry)and different market sizes (measured by total manufacturing value added). In the table, the seven A and B groups have been ranged by decreasing order of average salary in the manufacturing sector. The market size is given in the last row (total manufacturing value added in billions of dollars), ranging from 360 (United States), down to 52 (United Kingdom), 9.4 (A.2), 8.1 (B.2), 5 (India), and finally 1.4 for B.1 and 0.3 (B.3). As can be seen, the market sizes of group A.2 and B.2 are close to each other, and India is not far. The potential influence of the market size is illustrated by the relatively low proportion of the capital good sectors observed for A.2 (26 per cent) in group A, the high level of India (20 per cent) in group B, and the ambiguous but low figure found for B.1 (14 per cent). This is not the final evidence that the market size plays a role in the development of the capital good sector in market economies (especially if the role of voluntary planning in India is kept in mind) but it raises a problem. At any rate, our sample of countries is not contradicting Chenery's analysis[3] that there is a threshold

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1/ Small semi-industrialized group: Colombia, Egypt, Greece, Irak, Israel, Peru, Philippines, Portugal, Singapore, Venezuela.

2/ Low industrialized group: Bolivia, Cyprus, Ecuador, Ethiopia, Guatemala, Hong-Kong, Mozambique, Nigeria, Panama, Tunisia.

3/ See Chenery and Syrquin (1975).

of 1000 $US dollars per capita (1973 prices) for the development of a certain "balanced" industrialization pattern in small countries, as against 300 $US dollars (1973 prices) for large countries. Whatever the precise meaning of this balanced industrialization concept, Chenery's analysis conveys the idea of a negative influence of market forces in small countries. Subject to confirmation of this result through multi-regression analysis, the question is why should it be so? What forces contribute to the importance of market size in the growth of the capital good sector? Does it look different, in particular, in socialist countries (hence the interest of at least a brief analysis of their manufacturing structure)? Perhaps some reply will be found in the next section.

16. The remaining part of the analysis can be summarized as follows:

- The distinction between consumption 1 and 2 sector works in the opposite way than was expected: consumption 1 sector appears to have a very close level in all group B (30 to 32 per cent) as against (18 to 20) in group A;
- The place of consumption 2 sector is very discriminatory, with the same level for group A and B.1 (26-29 per cent), low percentages for the two "large" categories (B.2: 23 per cent and India 15 per cent) and the highest proportion for group B.3 (44 per cent). Here again, both income level and market size seem to play a role;
- Finally, the role of IP.1 (scarce resource) appears fairly similar in all groups (except group B.3), while the relative weight of IP.2 (due to basic chemical industry) is much higher in India (17 per cent) compared to all other countries (between 10 and 13 per cent).

17. All in all, a multiple regression analysis will hopefully help quantifying the respective influences of market size and income level in shaping the manufacturing output in market economies. The real issue will be to explain the main differences, i.e. the respective development of consumption 2 and capital good sectors (see last section).

SECTION 3

ANALYSIS OF VARIOUS INDICATORS

18. The following paragraphs will briefly describe some of the relationships which can be observed among various indicators both across countries and in time. In addition to the interest of such relationships, this part of the paper will enable experts to familiarize with the meaning of these indicators. It should be recognized, at this juncture, that there is a gap between the concepts used by technology experts and such economic variables as output mix, factor proportion and the like used by industrial economists under the heading "technology". Obvisouly, the micro level (plant) and the macro level (sector) should never be confused. The underlying assumptions for any one sector, is firstly that there exist an homogenous output and secondly that the factor mix (labour, capital, skilled...) as well as the technical coefficients can be used to describe alternative sets of techniques open to producers of the sector. The former is simply not true when considering the extreme diversity of output at the plant level within a sector[1/], and the words "techniques","technical coefficients" used by economic theory should be recognized as part of an abstract jargon having a different connotation. The justification for this "abus de language" is perhaps, as this survey should like to explore, that there is some reflection of the true technology (micro sense) in the abstract technology (macro sense); a reflection which, under specific conditions, should make it possible to quantify at the macro-economic level, i.e. for each sector and eventually for the economy as a whole, the impact of technology policies and trends (micro sense).

19. The first three indicators (VAL, WEL and NWL) should be considered together; they are interrelated by an accounting relation:

Value added = (wage and salaries) + non wage component

1/ The best example is perhaps the food processing sector (311) which includes a "melting pot" composed of at least fifty different types of processing plants including dairy product industries, grain milling industries, sugar industries, vegetable and animal oil industries, meat product industries,etc...

hence, dividing by the number of workers:

$$VAL = WL + NWL$$

Let us denote $\overline{W}$ as the average wage and salary (including social costs), L as the number of workers, $\overline{p}$ as the average capital price and f as profits; this can be written as:

$$WL = \overline{W} \qquad NWL = \overline{p}\,\frac{K}{L} + f$$

and

$$VAL = \overline{W} + \overline{p}\,\frac{K}{L} + f$$

In current prices, the proportion WL/NWL reflects a cost structure, and/or an income distribution characteristic (the respective shares of labour and capital). In constant prices, like in this survey, VAL is often interpreted as a measure of productivity but one assumption, evidently not valid, underly any international comparison of productivity figures: there should be a common yardstick, as between countries and as between sectors, to measure the contributions of labour and capital, in particular the existence of an international market for salaries, a condition which is not met in relation to various institutional factors (trade unions, population pressure, urban/rural differences,etc....).

20. On the other hand, VAL is a relatively good instrument, as will be seen below, to discriminate high capital - high pay sectors, across all countries, from low capital - low pay sectors. This was observed by Lary[1/] so that VAL will be called in this paper the "Lary indicator" rather than a productivity.

21. The justification is that $\overline{W}_i$, average wage in sector i, often reflects, as between sectors, the average qualification of man-power (but not necessarily so as was just observed). Similarly, the non-wage component may, if there is one international price of capital and if profits are not too high, reflect the differences in capital per labour as between sectors (the term K/L in the definition of NWL).

1/ See Hal B. Lary "Imports of Manufactures from less developed countries", NBER. New York, 1968.

22. In fact, it appears that the ordering of sectors according to decreasing rank of VAL is very similar between the different countries as can be seen by using indicator 21 (RVLA) which eliminates much of the inter-country difference since the sectoral VAL is divided by the national average.

23. The rank correlation of sectors is given hereunder for the six main categories of countries taken two by two.

Rank correlation of Lary's indicator (RVAL)

	A.1	A.2	B.1	B.2	B.3	INDIA
With United States(A.1)	1	.90	.84	.83	.86	.77
With group A.2	.90	1	.88	.88	.85	.75
With group B.2	.83	.88	.94	1	.87	.82

The first two rows indicates the great similarity in the ranking of countries between the two groups A.1 and A.2 of highly industrialized countries, while the third row shows, symetrically, the similarity of developing countries, with however some difference for India (see below).

24. A further look at the classification of sectors is interesting. Three groups of sectors can conveniently be made, although the analysis will point to some sub-groups within each group.

Sectoral classification according to Lary indicator

		Sectors ISIC numbers
1.	"Light industry" sectors (RVA L $\leq$ 90 for both A.1 and A.2) RVAL 90	321/2/3/4, 332, 361, 390
2.	Medium industry sectors (90 < RVAL $\leq$ 115) for both A.1 and A.2	311, 331, 342, 355/6, 362 381/2/3/4/5
3.	Heavy industry sector (RVAL > 115) for both A.1 and A.2	313/314, 341, 351/2/3/4, 369, 371/2

25. Briefly, we have in this table some picture of the prevailing technology in highly industrialized countries: the first group includes

low pay - low capital sectors, i.e. all textile (32), furniture (332), pottery (361), miscellaneous (390). The second group includes medium "pay and capital" sectors, i.e. food processing (311), wood products (331), printing and publishing (342), rubber and plastics products (355/6), glass products (362) and the whole equipment good sectors (38). The last group, finally, includes high pay - high capital sectors, including beverages and tobacco (313/4), pulp and paper (341), most chemical products (351/2/3/4), cement (369) and ferrous and non ferrous metallurgy (371/2). What the Lary indicator does not do is to discriminate within the second group, between low pay - high capital and high pay - low capital sectors. More interesting is however the behaviour of the indicator in developing countries within each of the three groups. Two cases are analyzed below.

26. Firstly, there are sectors in which the indicator is higher (relative to the national average) in one or several developing B categories as compared to A.1 and A.2. This can be interpreted as caused by a somewhat similar absolute level of pay and capital for the sector in the developing categories concerned since this will tend to raise the indicator relative to the low national average in poor countries. We may then speak of a presumption of homothetic or uniform technology for the sector. Taking a threshold of 10 per cent difference above the highest level in A.1 and A.2, the following results emerge:

<u>Presumption of uniform output mix or technology</u>
(compared to highly industrialized countries)

<u>Light industry sectors</u>

321. Primary textile in India
323. Leather products in B.2
324. Footwear, in B.3 and India

<u>Medium industry sectors</u>

355. Rubber products in B_1 B_3 and India
381/2/3 Equipment goods in India

Heavy industry sectors

313. Beverages, all developing countries B_1 B_2 B_3 and India

314. Tobacco, all developing countries B_1 B_2 B_3 and India

341. Pulp and paper in India

351/3/4 Basic chemical industry in India

371,372 Ferrous and non ferrous metallurgy, all developing countries B_1 B_2 B_3 and India

One may note that India has a presumption of high technology for a few consumption sectors, most equipment good sectors and all heavy industry sectors (except 352 and 369), and that this applies to all developing countries for beverages, tobacco and ferrous and non ferrous metallurgy.

27. The second case, in which the Lary indicator is at the same level as or lower than the relative level observed in categories A.1 and A.2, applies to most consumption good sectors and most medium industry sectors. The presumption, here, is that the output mix within the sector or the technology is fairly different in developing countries compared to categories A.1 and A.2. Selective examples are given below:

Presumption of different output-mix or technology

		A.1	A.2	B.1	B.2	B.3	B.4
Light and medium industry	311	116	98	84	80	113	54
	332	60	77	48	50	55	50
	361	65	79	73	54	58	52
	362	100	100	84	88	90	59
Capital goods	381	91	92	81	68	83	103
	382	102	96	88	79	75	118
	383	91	92	99	91	97	148
Chemical industry	351	206	157	151	210	174	309
	352	187	131	168	153	133	199
	353	321	492	419	241	464	834
	354	150	191	113	209	108	241

The case of the food processing sector (311) is interesting since it conveys the idea of a different output mix in B.1, B.2 and India, but some "enclaves" of high technology plants in B.3. For sectors 332 (furniture), 361 (pottery, China), 362 (glass products), where a number of traditional industries exist, there is no wonder that all developing categories use a different technology. For equipment good (38) and chemical industries (35), with the Indian exception already mentioned, there is also a general presumption of a different output mix. This will be further studied with the capital indicators.

The behaviour of size indicators

28. A general note of caution is in order, when considering the size of establishments whether expressed in number of workers (TLE) or in value added (TVA). The source of data is derived from industrial surveys where the term "establishment" denotes a single plant or factory in which manufacturing operation are performed (as distinct from a company) excluding those employing less than five persons in some countries. The tail of the distribution is therefore often not included in the averages.

29. A remarkable finding is that the first indicator (TLE), expressing the average number of workers, is correlated with other indicators in selected sectors only. A significant correlation with capital indicators[1/] can be found in the following sectors:

- 313, 324, 341, 351, 353, 354, 356, 362, 369, 381, 384, 385, 390.

Again, we find out medium and heavy industry sectors in which we had a presumption of a uniform technology. The explanation might be that, when appying this technology to increasing scale, more capital and more labour are needed. In such industries, therefore capital and manpower would appear to be complementary factors but this will need a check on the capital indicators.

30. In the same vein, the same size indicator is correlated with the relative consumption of electricity per unit of output (indicators ELQ and RELQ), in the following sectors:

- 324, 332, 341, 351, 369, 371, 372, 381, 382, 385.

If electricity consumption is taken as a proxy for capital, the above correlation confirms the findings of the preceding paragraph for sectors:

1/ Correlation coefficients higher than 0.6 across countries with indicators 11 to 14, 31 to 34, 37.

- 324 (Footwear), 341 (pulp and paper), 351 (basic chemicals), 369 (cement), 381 (metal products), 385 (professional goods).

The fact that some of these sectors belong to chemical industry conveys the interpretation that electricity consumption, in some sectors, could well relate to accessory activities and not to the main output.

31. A loose positive correlation appears between the same size indicator (number of workers) and the variable WL (average wage per worker) in the following sectors:

- 322, 353, 355, 361, 371, 383, 385.

Two interpretations suggest themselves: the larger the establishment, the higher the proportion of skills and/or the higher the strength of trade unions in wage discussions. Both interpretations may hold true for 353 (oil refineries), 371 (iron and steel), 383 (electrical machinery) and 385 (professional goods).

32. On the other hand, a negative correlation size - average wage appears in sectors 321 (primary textile) and 331 (primary wood) with again two interpretations which are not exclusive from eath other: the larger the establishment, the lower the skill content and/or the strength of trade unions. This, as well as the interpretation given by positive correlations, does not contradict what is known of technology (micro sense) in the sectors concerned.

33. A rich harvest of correlations is found with the other size indicator (TVA), defined as value added per establishment, and its normalized "echo" (RTVA). The following groups suggest themselves:

(1) Weak or no correlation both with respect to value added per work (VAL) and capital indicators:

314 (tobacco), 321 (primary textiles), 371 (iron and steel). Interpretation is difficult 1/.

(2) Positive correlation with VAL and no correlation with capital indicators:

322/3 in the textile group

1/ In the three cases, high sizes are found both in A countries with high VAL, and in B countries with low VAL, especially in large semi-industrialized countries.

355 rubber products

361 pottery, china

383 electrical machinery

(3) Positive correlation both with VAL and capital indicators

A correlation with CAPLE is observed for all sectors, and with CAPVA for those with a star:

311,313* in the food group

324* in footwear

331/2 wood products and furniture

341*/2* paper and printing

351*,352*, 353,354*, 356 in the chemical group

362*,369*, 372 glass, cement, non ferrous

381*,385*, 382,384 in the capital good sector

390* miscellaneous

It will be noted that sectors with a star are almost the same as those in which a correlation was found between size in terms of workers and capital indicators(with the exception of 352). 1/ 2/

34. Some policy implication seem to suggest themselves from this analysis. The first is that, in most sectors, a large range of size, especially in terms of value added, can coexist. There may therefore be room for policies maintaining a certain size distribution. Further, in those sectors with a positive correlation of size with value added per worker, and with a low level of capital indicators, such as most consumption sectors, there may be a case for employment policies based on size.

1/ It can be shown that if TLE is correlated with CAPVA, TVA is correlated with CAPLE and conversely.

2/ For the sake of brevity, no analysis was given of correlations between TVA and ELQ, which are found in the following sectors: Positive correlation: 321, 341, 351, 372 and negative correlation 314, 369.

The behaviour of the value added coefficients

35. The value added coefficient (IVY) was defined as the ratio of value added to gross output. It has been analyzed in Analysis A[1/] in relation to economic variables and few satisfactory regressions were found, except for the following: an inverse relation was found between IVY and economic variables (GDP/capita, population, population density) for some non-manufacturing activities (agriculture, mining, trade other services) and for a mixed category (other manufacturing). A positive relation was found with population size for two manufacturing sectors (sector 36, non metallic mineral products and 33 woods products and furniture). Some attempt will be made to explain these poor results, using Analysis B.

36. Two general relations can be seen in a number of sectors and, to an extent, for manufacturing as a whole: firstly, in cross-country comparisons, a positive correlation is found between IVY and income level indicators and variables related to income level (VAL, WL, NWL and their "echos", RVAL, RWL and RNWL). This means that in the course of the growth of the manufacturing sector, the value added is increasing faster than material inputs (contrary to what is found in Analysis A for the agricultural and services sectors). On the other hand, when comparing developed countries over time, here between periods 1 and 2, the opposite relation is found. Thus, the following observations refer:

Sector 300: IVY coefficient in highly industrialized groups

	Period 1	Period 2
A.1	0.469	0.443
A.2	0.407	0.398

This is most likely due to the influence of technical progress, which increases the importance of material inputs relative to value added.

1/ See Analysis of coeeficients from input-output tables. (Analysis A) paragraphs 5.1 to 5.8, as well as 5.9 and annex A.13.

37. For developing countries in general, the two trends contradict each other so that when comparing coefficients over time, one may observe an increase, a decrease, or no change, as illustrated below:

Sector 300: IVY coefficients in developing countries

	Period 1	Period 2	
B.1	0.371	0.398	increase
B.2	0.415	0.362	decrease
B.3	0.409	0.371	decrease
B.4	0.256	0.257	no change

The stability of IVY coefficients, already noted in Analysis A, is convirmed here, the range being from 37 per cent to 44 per cent in period 2, if India is left aside. The Indian coefficient, 25 per cent, is exceptionally small, partly because of the India salary scale and probably also for accounting reasons (the book value of capital after depreciation is very low because of historical and legal reasons). In practice, it means that IVY coefficients will not be easy to project, but on the whole, the income effect, i.e. the positive relation, is likely to prevail in the next twenty years. A few results by sector are analyzed hereunder.

38. Perhaps the best way to convey an idea of the distribution of IVY coefficients is to compare their range for two country categories, i.e. for the United States and for large semi-industrialized countries (B.2). This is done in table 2. The following main trends can be observed:

(1) For sectors 311 to 342, i.e. most consumption sectors, the United States ratio is generally higher than for B.2. For most sectors, except two heavy industry and one medium industry sectors 313, 314 and 342, the range is 45 - 55 per cent for United States and 30 - 40 per cent for B.2. To note the very low values for the food consumption sector (311), in which material inputs amount to 70 to 75 per cent of gross output;

(2) For sectors from 351 to 372, i.e. most of the heavy industry sectors, IVY coefficients are found in the 45 - 60 per cent bracket for United

TABLE 2

VALUE ADDED COEFFICIENTS SECTOR BY SECTOR

FOR UNITED STATES (A.1)

AND LARGE SEMI-INDUSTRIALIZED COUNTRIES (B.2)

IVY coefficients x 100

Sectors 311 to 342			Sectors 351 to 372			Sectors 381 to 390		
	A.1	B.2		A.1	B.2		A.1	B.2
311.	27.3	22.7	351.	47.9	37.2	381.	50.9	37.9
313.	42.2	51.9	352.	58.5	43.9	382.	54.5	41.5
314.	45.5	55.5	353.	16.3	30.1	383.	54.5	40.1
321.	40.8	40.6	354.	39.1	25.1	384.	40.8	36.8
322.	49.3	34.8	355.	52.2	39.8	385.	65.5	46.6
323.	45.2	31.6	356.	52.5	39.9	390.	54.0	50.0
324.	53.0	35.3	361.	68.8	58.1			
331.	43.0	38.8	362.	61.9	54.0			
332.	51.7	45.3	369.	52.9	44.4			
341.	44.5	37.3	371.	42.7	29.0			
342.	65.4	54.3	372.	30.7	28.7			

States, and 30 - 45 per cent for B.2. Exceptions are sector 353, oil refineries, for which the United States ratio, 16,3 per cent is the lowest (1970 prices) and petrochemical industry 354, for which the B.2 ratio, goes down to 25,1 per cent. The explanation is perhaps less easy than would appear (price of the material input) and the ratio is worth being checked in 1975 prices. To note also the high ratios found for 361 and 362, pottery and glass, for which a number of archaic technologies exist, with low value material input (clay, sand);

(3) Finally, for sectors 381 to 390, i.e. mostly equipment good sectors, the range is 50 - 65 per cent for United States and 35 - 45 per cent for B.2, with a high value for 385, professional goods, in the United States - a difficult interpretation since this activity is largely in the hands of transnationals, with one part of the processing located outside the United States.

39. The key question remains: how should IVY coefficients be projected? In fact, there are a number of sensitive variables well correlated with IVY for a number of sectors. The size of plants (TVA) is perhaps the best, with total correlation classified as follows in various ISIC sectors:

<u>Correlation between plant size and value added coefficient</u> (TVA and IVY)
(cross-country analysis per ISIC sector)

	ISIC numbers of sectors
<u>Strong correlation:</u>	313, 322, 323, 324, 342, 352, 356, 381, 384, 385
<u>Good correlation:</u>	311, 314, 321, 332, 353, 354, 362, 369, 383, 390
<u>Weak or no correlation:</u>	331, 341, 351, 355, 361, 371, 372, 382

As was seen in the analysis of size indicators, indicator TVA is well correlated with income level indicators VAL, WL, and WWL. This is also found for IVY, with, however remarkable exceptions as follows:

Correlation between plant size and coefficients VAL, WL, NWL

(cross country analysis per ISIC sector)

- positive correlation: all sectors except list below
- negative correlation: 369, 371, 384
- no or loose correlation: 323, 331, 372, 382

40. A number of IVY coefficients are also correlated with capital coefficients, in general a negative correlation with CAPVA. Exceptions are the following:

- sectors 332, 341, 361, 369, 383, 384, 385.

41. All in all, subject to further multi-correlation analysis, it seems possible to project most value added coefficients using size of plants or indicators related to size (VAL, WL, NWL) on the one hand, and/or a capital indicator. However, no good methods have been found for two groups of sectors, i.e. 33 (331 wood products and 332 furniture), and 38 (mechanical and engineering industries). Why do IVY coefficients for these sectors remain so unpredictable; The question is put to the group of experts, as well as a tentative explanation: in both groups, a large variety of product mix can be found in any sub-sector, and the mix of material inputs, skill and capital can considerably vary from activity to activity within sectors.

The behaviour of capital indicators

42. This is by far the most difficult part of the analysis, not because of bad quality for the original data, i.e. gross investment by using sector, but on account of the difficulty in deriving capital indicators from gross investment figures for ten years.

43. A small comparison of the main indicators can be useful, i.e.:

- VAL, the Lary indicator;
- NWL, the non wage component per worker, supposedly related to K/L.
- CAPVA and CAPLE, obtained by dividing the sum of gross investment over ten years by a lagged (two years) value added or number of workers respectively;
- PCOR and PKL, derived from the two preceding indicators, in an attempt to work out proxies for capital - output and capital - labour ratios;

A rank correlation matrix between these indicators was made by country category, and the results are summarized in the following table:

RANK CORRELATION OF CAPITAL INDICATORS

	VAL	NWL	CAPVA	CAPLE	PCOR	PKL
For USA						
NWL	1	1				
CAPVA	0.97	0.97	1			
CAPLE	0.99	0.99	0.99	1		
PKOR	0.97	0.97	0.99	0.99	1	
PKL	0.98	0.98	0.99	0.99	0.99	1
For B.1						
CAPVA	0.72	0.73	1			
CAPLE	0.82	0.83	0.93	1		
PKOR	0.74	0.74	0.90	0.88	1	
PKL	0.85	0.85	0.89	0.94	0.94	1
For B.3						
CAPVA	0.61	0.60	1			
CAPLE	0.82	0.86	0.77	1		
PCOR	0.67	0.59	0.83	0.66	1	
PKL	0.89	0.91	0.72	0.94	0.75	1

To note the high correlation of indicators for the United States, recalling however that PCOR was calibrated to come very close to COR's derived from outside sources. For B.1 and for B.3, correlations are good but lower than in the United States. The main point is that for both groups of countries, correlations of PKL with NWL are higher than between CAPLE and NWL. Again, correlations of PCOR with PKL are higher than between CAPVA and CAPLE. For B.1 and B.3 countries, therefore, it looks as if the PCOR and PKL had correlations closer to the excellent correlation coefficients found for United States, as compared with what is obtained with CAPVA and CAPLE. In other words, PKOR and PKL look as better proxies for capital - output and capital - labour ratios than CAPVA and CAPLE.1/

1/ Calculations for A.2 and B.2 are not reproduced here since they should be made on each country individually; however there is no reason to believe that results for these two groups contradict the conclusions drawn in paragraph 43.

44. The two general findings of the analysis will be stated below for manufacturing as a whole (300) and then analyzed by sectors:

(1) Capital indicators for A.1 and A.2 are significantly different for period 1 (1967-71) and for period 2 (1972-76), which seems to points to the influence of technical progress:

		NWL	CAPLE	PKL	CAPVA	PCOR
A.1	Per.1	8.632	12.490	24.106	0.65	1.25
	Per.2	11.785	13.806	26.650	0.59	1.15
A.2	Per.1	4.062	10.868	16.670	1.19	1.81
	Per.2	4.627	12.413	18.850	1.19	1.59

This is a case in which all indicators related to capital/labour have increased in time, while those related to capital/output decreased (with the exception of CAPVA for A.1 which remained at the same level). More generally, the first series of three indicators have increased for most sectors, while capital - output indicators decreased for a majority of sectors (see below);

(2) The second finding is that in most sectors, and for manufacturing as a whole, capital output indicators are higher for A.2 than for A.1, and higher for B.1 than for B.2, which points to an influence of market size. On the other hand, an income level influence can also be seen, in that capital - output indicators for B.1 are often lower than for A.2 (as for sector 300 below) and always lower for B.2 than for A.2 (as for sector 300 below)

Manufacturing as a whole
(average of two periods)
Comparison of capital - output indicators

Country group:	A.1	A.2	B.1	B.2	B.3
CAPVA	0.57	1.10	0.97	0.80	0.95
PCOR	1.10	1.45	1.42	0.88	1.35

No figures are available for group B.4 (India), on the other hand, figures relating to B.3 are not very reliable for most sectors, because of the small dimension of the sectors. The analysis below will therefore concentrate mostly on the first four groups.

45. The time comparison, if conducted sector by sector in countries A.1 and A.2, reveals a number of similar behaviour by group of sectors, which allows an "average" description for three groups of homogenous sectors, and four "erratic" sectors.[1/] Results are shown in the table below:

Ratios of Period 2/Period 1 for each indicator

Sectors	A.1			A.2		
	PCOR	PKL	NWL	PCOR	PKL	NWL
311 to 342	0.98	1.21	1.33	1.03	1.13	1.15
351 to 369*	0.90	1.13	1.36	0.89	0.97	1.06
381 to 390	0.99	1.11	1.36	1.09	1.18	1.08
353	0.85	1.19	1.49	0.62	0.72	1.24
354	1.10	1.38	1.39	0.56	0.94	1.18
371	0.68	0.87	1.43	0.98	1.19	1.25
372	0.80	0.98	1.42	0.63	0.71	1.06
Total	0.91	1.10	1.36	0.88	1.13	1.14

* except 353/4.

Taking the economy as a whole, it is striking to see that results are very similar in the two economies. In the United States (A.1), the capital - output ratio seems to have decreased by 10 per cent, with a capital labour substitution which is of the order of 10 per cent if measured with PKL, and almost the same figures obtain with A.2 countries (0.88 and 13 per cent respectively). When looking at the three groups of broad sectors, it can be seen that for the main. technical progress took place in the heavy industry sector, 351 to 369, and that low PCOR indicators are found in 3 out of 4 "erratic" sectors. It is difficult

1/ These sectors (353/4 and 371/2) have been set aside for two reasons, firstly because they do not fit any "homogenous" pattern, which may be due to poor quality of data, but also on account of their economic interest (see sector IP.1 in section 2).

to say whether this should be ascribed to neutral progress, economies of scale or embodied progress but the last two explanations are plausible since it refers to capital intensive activities. The same hierarchy of sectors obtains for group A.2, i.e. the heavy industrial sectors are responsible for the productivity gain (0.89), while the other sectors, whether consumption or mechanical and electric industries seem to have lost some ground. A remark should be made here, i.e. that, especially for the latter category. the decrease in capital efficiency might well be due to cyclical reasons, the period 1972-76 being less favorable than 1967-71 for the group of countries.
Thus, a technical progress component will have to be included in the production functions, perhaps measuring it on the United States[1/] rather than on other groups. Naturally, when dealing with developing countries, this decreasing trend for capital - output ratio is in many cases offset by a trend towards higher capital - output ratios on account of industrial growth.

46. Coming to the cross-country analysis, the general pattern found for manufacturing as a whole can be observed on 20 sectors out of 28. The "exceptions" to the rule refer to sectors 313, 321, 352 and the whole 38 division and is examined later. Three cases will be considered, according to the absolute levels of indicator PCOR in the four groups of countries:

(a) In 10 sectors, PCOR for group B.2 is higher than for A.1 (United States). This is found for:

- 311, 314, 322, 324, 331, 342, 356, 369, 372, 390.

It is of course difficult to say if this is due to statistical artifacts or to real differences but, since B.1 is always higher than B.2, the capital efficiency in United States is seemingly higher than in any other group, whether A.1, B.1 and B.2 (see table 3);

(b) In 10 other sectors, B.2 has a PCOR indicator lower than A.1, so that here, at least one group follows the neo-classical pattern according to which less of the scarce factor is used per unit of production. These sectors are (see table 3):

- 323, 332, 341, 351, 353, 354, 355, 361, 362, 371;

1/ Simply on statistical reaons, since the model for PCOR was calibrated for the United States. The implicit assumption is that the other group adopt the United States technology, which is plausible for the heavy industry sector.

TABLE 3

PCOR VALUES IN FOUR GROUPS OF COUNTRIES
(see text for the definition of patterns)

Sectors	A.1	A.2	B.1	B.2
First pattern: (PCOR higher for B.2 than for A.1)				
311	0.97	1.50	2.00	1.30
314	0.27	1.10	0.41	0.29
322	0.25	0.50	0.50	0.29
324	0.36	0.51	0.83	0.52
331	0.95	1.40	2.10	1.20
342	0.75	0.84	1.01	1.02
356	0.58	1.20	1.10	0.70
369	1.20	1.50	2.60	1.70
372	1.40	2.70	2.50	1.60
390	0.45	0.60	1.50	1.00
Averages:				
311 to 342	0.59	0.98	1.13	0.77
356 to 372	1.06	1.80	2.06	1.33
Second pattern: (PCOR lower for B.2 than A.1)				
323	0.66	0.77	0.98	0.49
332	0.57	1.80	2.10	0.49
341	1.50	2.60	1.80	0.82
351	1.70	3.50	2.20	1.40
353	3.50	5.60	5.60	0.63
354	0.74	5.20	1.80	0.51
355	1.07	1.45	1.81	1.01
361	0.97	1.20	1.10	....
362	0.86	1.70	1.20	0.86
371	1.60	1.55	0.96	0.84
Average: (except 353/4 and 371)	1.05	1.86	1.73	0.99
Third pattern: (PCOR higher for B.2 compared to B.1)				
313	1.10	1.60	0.85	1.08
321	1.30	1.50	1.08	1.10
352	0.87	0.87	0.75	0.68
381	0.87	0.67	0.86	1.20
382	0.75	0.73	0.56	0.59
383	0.64	0.59	0.69	0.61
384	0.58	1.00	0.88	1.15
385	0.48	0.43	0.60	0.59
Average: Division 38	0.66	0.68	0.72	0.83

(c) Finally, there are the eight exceptions to the rule, i.e.:

- 313, 321, 322, 381, 382, 383, 384, 385

The interesting point, in this respect, is the homogenous behaviour of division 38 (see table 3). This can be summarized as follows:

- PCOR is lower for A.2 than A.1: the capital efficiency seems higher in the former group (except 384);
- PCOR is lower in group B.1 than B.2: again, capital is more efficient for the former group (except 383);
- no general rule can be given to compare group A and B with each other.

47. The question arises therefore how to interpret these results?

- A first observation should be made when comparing A.1 and A.2, i.e. a possible cyclical influence on PCOR's in sectors other than heavy industries: on the assumption that the same technical progress in A.2 as in A.1 was offset by a decrease in the rate of utilisation, the later effect can be quantified as the ratio between 1.03 and 0.98 in sectors 311 to 342, i.e. 5 per cent, and similarly to 10 per cent in sectors 381 to 390 (see time comparison in paragraph 45). At first glance, decreasing PCOR coefficients by 5 per cent in consumption good sectors of group A.2 and 10 per cent of equipment good sectors does not affect the conclusions (it strengthens them for the equipment good sectors);
- The comparison of the three patterns defined in the preceding paragraph can be made easily on the averages for consumption and heavy industry sectors separately (see table 3):

  (i) for consumption sectors, the first pattern prevails with PCOR for United States about 60 per cent that for A.1 (0.59 against 0.98), and PCOR for B.2, 68 per cent that of B.1 (0.77 against 1.13);

  (ii) for heavy industry sectors, the PCOR for A.1 equals 56 per cent that of A.2 both in the first and the second patterns (1.05 or 1.06 for A.1, 1.80 or 1.86 for A.2). However, the two patterns differ when consider

B.1 and B.2; in the first, the PCOR for B.2 stands 25 per cent higher than that of A.1 (1.33 against 1.06), and the PCOR of B.1 stands 55 per cent than B.2. In the second pattern B.2 has a PCOR slightly lower than A.1 (0.99 against 1.05), and B.1 stands 73 higher, almost at the same level as A.2 (1.73 against 1.86);

(iii) For the equipment good sectors the pattern is fairly different, PCOR indicators grow up gently from A.1 (0.66) to A.2 (0.68), to B.1 (0.72) and finally B.2 (0.83);

An overall conclusion can be tentatively formulated as follows: if PCOR indicators are not too far from true capital - output ratios, it seems that:

(i) for consumption sectors and for heavy industry sectors, the capital productivity is sensitive both to the level of industrialisation (income level) and to the size of the market, and that, in particular, there is a serious handicap (PCOR's higher by 60 - 80 per cent) in heavy industries, as against an excess of 40 - 60 per cent for consumption good sectors. The fact that the handicap is higher for heavy industries seems to point to "diseconomies" of the scale, but it may simply be that, for various reasons, the rate of utilisation is lower in small than in large countries;

(ii) finally, for sectors following the third pattern, in particular equipment good sectors, there seems to be hardly any difference between A.1 and A.2, and B.1 is probably better off by 10 per cent or more than B.2.

48. This analysis leads to a production function containing explicitely three effects: capital/labour substitution, market size and time trend. This will be attempted through multiple correlation analysis. Meanwhile, the capital labour substitution can be seen to operate smoothly between group of countries, if taking PKL as a measure;

- For the economy as a whole, the following values obtain (normalized for B.2):

A.1	A.2	B.1	B.2	B.3
5.7	3.9	1.8	1	0.97

- For consumption sectors of the first pattern:

3.7	3.0	1.3	1	1.20

- For heavy industry sectors, first pattern:

3.4	3.5	1.4	1	0.90

- For second patterns sectors (except 353, 354, 371):

5.4	3.7	2.0	1	1.7

- For equipment good sectors (division 38):

5.8	2.9	1.1	1	1.0

It can be seen from these figures that PKL is very close for the three groups B.1, B.2 and B.3 as far as equipment good sector is concerned. The ratio K/L is about three times higher for A.2 and six times for A.1.

- For second pattern sectors, an important capital labour substitution (ratio 2 to 1) seems to prevail between B.1 and B.2.

- For first pattern sectors, whether consumption or heavy industry sectors, similar PKL's prevail, with a shorter range betweem A.1 and B.2 (3.5 to 1 instead of 5.5 to 1 in second pattern sectors).

49. In the next phase of the research, a production function will be worked out by group of sectors, following the SIMV classification, but taking into account the different patterns obtained in this analysis. The output-mix, i.e. the proportion of different ISIC industries in broad SIMV sectors might be determined either by simulating market forces with econometric relations or by simulating normative policies with industry shares as parameters.

SECTION 4

POLICY ISSUES FOR CONSIDERATION

50. This paper is summarizing the preliminary results of a technology analysis which was conducted as a first step in working out the treatment of technology issues and policies in the UNITAD model. The meeting is expected to take stock of the findings which will appear statistically well established and to advise on the next stages of the research work to be carried out by the UNITAD team and possibly by their UNCTAD and UNIDO colleagues. A first part of the meeting will therefore attempt to digest and to critically evaluate the preliminary results of both analyses A and B. The meeting may then proceed on a more substantive discussion on the treatment of technology to be made in the UNITAD model. It is essential to note that the UNITAD model is not expected to produce only deterministic solutions to technology issues as can be derived from econometric relations but also to simulate planning, or normative approaches on technology policies within broader industrialization and trade strategies. This section will illustrate the type of issues which should be clarified to orient the choice of technical coefficients and of production functions in the UNITAD model. Needless to say, the list of issues is not exhaustive and can be amended or completed.

First part: critical evaluation of the findings

51. On analysis A, the discussion is expected (i) to help taking synthetic views of the findings and interpreting them and (ii) concentrate on links between analyses A and B (see e.g. paragraphs on value added coefficients in both papers). The question how to use analysis A for projection purposes can also be examined, and in particular what degree of sectoral disaggregation should be kept in the projection of technical coefficients. However, a final reply to the latter issue should await clarification of the overall treatment of technology issues (second part of the discussion).

52. Possible issues for discussions on analysis B are the following:

(a) General evaluation of the data source (United Nations Yearbook of Industrial Statistics). Particular concepts to be checked;

(b) Evaluation of the geographical scope of the analysis. Any suggested source for socialist countries?

(c) Omissions in the analysis. For example the skill indicator ICA was not exploited on account of seemingly poor quality of data. A few conclusions seem however to emerge on the skill problem from the analysis of indicator WL (e.g. paragraphs 21, 25, 31, 32);

(d) evaluation of the methodology of the analysis, in particular capital indicators, use of official exchange rates, etc...

<u>Main technology policy issues</u>

53. On the assumption that the findings of the analysis are not due to statistical errors or omissions, four main policy issues can be suggested for discussion, with a view to clarifying the place of the technology issues in the UNITAD model. These are: the skill requirements, the development of the capital good sector, the capital requirements and finally the importance of enterprise size.

54. The need to quantify skill requirements seems obvious, especially if the Lima target implies a fast development of skill intensive sectors (e.g. ISIC division 38). Available sources of data might be discussed. How should be supply of skills be handled?

55. Analysis B on the structure of the manufacturing sector seems to confirm an important finding already identified by Chenery, i.e. the difficulty of developing the capital good sectors in small countries below a certain income threshold. The key issues are: (i) what are the technico-economic constraints behind this finding? This should be elucidated beofre coming to the next issue, i.e. (ii) should the UNITAD model take a deterministic or a normative views on this problem, and if so (iii) what policy instruments should be introduced in the model to simulate a planning approach in the development of the capital good sector.

56. The capital requirements will of course play a critical role in the model. A number of issues suggest themselves in this field, which touches upon the general strategy of industrialisation (like the preceding item on the place of the capital good sector): what priority should be given to heavy industries, i.e. highly capital intensive sectors? What role should be given to a medium

capital intensive technology for use in rural areas in which sectors, and where should policy instruments be introduced?

57. On the same general issue, the analysis shows the importance of market size in determining capital requirements of certain sectors? If these findings are considered statistically well founded, the explanation which suggests itself is that the technology used in many sectors is ill adapted to conditions prevailing in small countries. Can this be explained, and what should be done about it?

58. Finally, the issue of enterprise size is already summarized in paragraph 34 of analysis B. Questions for consideration are: how should the problem of size distribution be handled in the UNITAD model, particularly for industries in the rural sector? What policy instruments should be introduced in the UNITAD model?

59. The UNITAD team looks forward for advice, particularly from technology experts, on the main policy issues to be simulated in the UNITAD model. It is hoped that on the basis of the discussion - both the critical evaluation and the substantive part - production functions (and related trade functions) will be built as the next stage in developing the model.

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ANNEX 1

The Classification Key between the SIMV Sectors, UNIDO Standardized Tables Industries and the 1968 International Standard Industrial Classification of All Economic Activities (ISIC).

SIMV Sectors	UNIDO Industries Sectors Used in Analysis A	1968 ISIC Sectors Used in Analysis B
1. Agriculture	1. Agriculture	Div. 1. Agriculture etc.
2. Agri- Food Processing	2. Food Products	311/2 Food Manufacturing 313 Beverage Industries 314 Tobacco Manufactures
3. Energy	3. Coal Mining	210 Coal Mining
	4. Petroleum and Gas	220 Crude Petroleum and Nat. Gas
	5. Petroleum and Coal Prod.	353 Petroleum Refineries 354 Products of Petroleum and Coal
	6. Electricity, Gas and Water	410 Electricity, Gas and Steam 420 Water Works and Supply
4. Basic Products	7. Metal Ore Mining	230 Metal Ore Mining
	8. Other Mining	290 Other Mining
	9. Paper and Paper Products	341 Paper and Paper Products
	10. Chemicals	351 Industrial Chemicals 352 Other Chemical Products
	11. Non- Metalic Min. Products	361 Pottery, China, etc. 362 Glass and Glass Products 369 Other Non- Metallic Min. Prod.
	12. Metals	371 Iron and Steel 372 Non- Ferrous Metals
5. Light Industry	13. Textiles	321 Manufacture of Textiles
	14. Wearing Apparel	322 Wearing Apparel 323 Leather and Leather Products 324 Footwear
	15. Wood Products	331 Manufacture of Wood Products 332 Furniture and Fixtures
	16. Printing and Publishing	342 Printing and Publishing
	17. Plastic and Rubber Prod.	355 Rubber Products 356 Plastic Products 390 Other Industries
	18. Metal Products	381 Metal Products
6. Equipment Goods Industry	19. Machinery	382 Machinery 383 Electrical Machinery 385 Professional and Scientific
	20. Transport Equipment	384 Transport Equipment
7. Construction	21. Construction	Div.5. Construction
8. Services	22. Trade	Div. 6. Wholesale and Retail Trade
	23. Transport & Communication	Div. 7. Transport and Communication
	24. Other Services	Div. 8. Financing, Real Estate etc. Div. 9. Community and Private Serv.

ANNEX 2

Sources

The industrial data are from (3) for all the countries. The deflator of the gross capital formation from (4) and the deflator of manufacturing from (4) except those of Egypt, Hong-Kong, Israel and Mozambique which come from (5). The consumer prices are from (2) except Hong Kong which come from (1). Finally, the exchange rates are from (2).

(1) Yearbook of National Accounts
Statistical Office of United Nations

(2) IMF International Financial Statistics

(3) Yearbook of Industrial Statistics

(4) CDPPP National Accounts

(5) IBRD. National Accounts

Original 1967-76 series

1.	Number of establishments	NE	number
2.	Average number of persons engaged	LP	10^3
3.	Average number of employees	LE	10^3
4.	Wages and salaries of employees	WE	national currency
5.	Average number of operatives	LO	10^3
6.	Quantity of electricity consumed	EL	10^6 kwh
7.	Gross output at factor cost, producers values or national currency	YV	national currency
8.	Value added at factor cost, producers values or national currency	VA	national currency
9.	Gross capital formation	INV	national currency

Transformation into 1970 $US dollars

The current price series have been deflated into constant price 1970 national currency using national deflators.

Next, the 1970 national currency series have been transformed into 1970 $US dollars series by means of official exchange rates of 1970 IMF International Financial Statistics.

<u>Definition of indicators</u>

1. a/, b/ $VAL = \frac{VAC}{LE}$

2. a/, b/ $WL = \frac{WEC}{LE}$

3. a/, b/ $NWL = \frac{VAC-WEC}{LE}$

4. a/, b/ $ICA = \frac{LE-LO}{LO}$

5. a/ $IVY = \frac{VAC}{YVC}$

6. a/ $TLE = \frac{LE}{NE}$

7. a/ $TVA = \frac{VAC}{NE}$

8. a/ $ELQ = \frac{EL}{YVC}$

9. b/ $$ICOR_k = \frac{8}{5} \frac{\sum_{i=1}^{5} INVC_{t+i}}{\sum_{i=5}^{6} VAC_{t+i} - \sum_{i=1}^{2} VAC_{t+i}}$$ k=1, t = 1966; k=2, t = 1970

10. b/ $$ICLR_k = \frac{8}{5} \frac{\sum_{i=1}^{5} INVC_{t+i}}{\sum_{i=5}^{6} LE_{t+i} - \sum_{i=1}^{2} LE_{t+i}}$$ k=1, t = 1966; k=2, t = 1970

11. b/ $$CAPVA_k = 2 \frac{\sum_{i=1}^{5} INVC_{t+i}}{VAC_{t+7}}$$ K=1, t = 1966; k=2, t = 1971

---

a/ 1967-76 time series.

b/ Two indicators one for 1967-71, the other for 1972-76.

12. b/ $$CAPLE_k = 2\,\frac{\sum_{i=1}^{5} INVC_{t+i}}{LE_{t+7}}$$ k=1, t = 1966; k=2, t = 1971

13. $$CAPVA = \frac{\sum_{i=1}^{10} INVC_{66+i}}{VAC_{78}}$$

14. $$CAPLE = \frac{\sum_{i=1}^{10} INVC_{66+i}}{LE_{78}}$$

15. $$ICOR = \frac{21}{10}\,\frac{\sum_{i=1}^{10} INVC_{66+i}}{\sum_{i=1}^{3} VA_{73+i} - \sum_{i=1}^{3} VA_{66+i}}$$

16. $$ICLR = \frac{21}{10}\,\frac{\sum_{i=1}^{10} INVC_{66+i}}{\sum_{i=1}^{3} LE_{73+i} - \sum_{i=1}^{3} LE_{66+i}}$$

17. $$SUM = \sum_{i=1}^{10} INVC_{66+i}$$

18. a/, b/ $$VAC_k = \frac{\sum_{i=1}^{5} VA_{t+i}}{5}$$ k=1, t = 1966; k=2, t = 1971

19. a/, b/ $$WEC_k = \frac{\sum_{i=1}^{5} WE_{t+i}}{5}$$ k=1, t = 1966; k=2, t = 1971

20. a/, b/ $$YVC_k = \frac{\sum_{i=1}^{5} YV_{t+i}}{5}$$ k=1, t = 1966; k=2, t = 1971

21. From 21 to 37 the indicatorsare defined as the ratio of the
. indicator 1 to 17 of the considered sector, divided by the
37. value of the indicator for the whole manufacturing.

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a/ 1967-76 time series.

b/ Two indicators one for 1967-71, the other for 1972-76.

38. a/, b/ $$LE_k = \frac{\sum_{i=1}^{5} LE_{t+i}}{5}$$ k = 1, t = 1966; k = 2, t = 1971

39. a/, b/ $$INVC_k = \frac{\sum_{i=1}^{5} INV_{t+i}}{5}$$ k = 1, t = 1966; k = 2, t = 1971

40. $$PRODVA = \frac{CAPLE}{CAPVA}$$

41. b/, c/ $$PCOR_k = \frac{CAPVA_k}{\mu}$$ k = 1, 2

42. b/, c/ $$PKL_k = \frac{CAPLE_k}{\mu}$$ k = 1, 2

43. c/ $$PCOR = \frac{CAPVA}{\mu}$$

44. c/ $$PKL = \frac{CAPLE}{\mu}$$

45. b/ $$PRODYV = \frac{CAPLE}{CAPYV}$$

46. $$x = \left(\frac{VAC_2}{VAC_1}\right)^{1/5} - 1$$

47. $$r = \left(\frac{INVC_2}{INVC_1}\right)^{1/5} - 1$$

48. b/ $$CAPYV_k = \frac{\sum_{i=1}^{5} INVC_{t+i}}{YVC_{t+7}} .2$$ k = 1, t = 1966; k = 2, t = 19

49. $$CAPYV = \frac{\sum_{i=1}^{10} INVC_{66+i}}{YVC_{78}}$$

---

a/ 1967-76 time series

b/ Two indicators are for 1967-71, the other for 1972-76.

c/ μ is a function of r, the rate of growth of capital stock, and of λ, the physical depreciation of the capital stock. See text.

50. $$TXLE = \left(\frac{LE_2}{LE_1}\right)^{1/5} - 1$$

51. b/, c/ $$PCYV_k = \frac{CAPYV_k}{\mu} \qquad k = 1, 2$$

53. c/ $$PCYV = \frac{CAPYV}{\mu}$$

54. $$PRODTOT = p \times PRODVA + (1-p)\ \frac{1}{PCOR}$$

where $p = \frac{WL}{VAL}$

---

b/ Two indicators one for 1967-71, the other for 1972-76.

c/ μ is a function of r, the rate of growth of capital stock, and of λ the physical depreciation of the capital stock. See text.

ANNEX 3

Values of the Coefficients λ

Sector	λ	Sector	λ
300	0.040	354*	0.001
311/2	0.035	353+354	0.015
313	0.056	355	0.064
314	0.067	356	0.050
321	0.049	361	0.043
322	0.075	362	0.070
323	0.043	369	0.030
324	0.074	371	0.056
331	0.020	372	0.063
332	0.020	381	0.054
341	0.047	382	0.042
342	0.053	383	0.077
351	0.045	384	0.035
352	0.052	385	0.064
353	0.025	390	0.058

* to be revised

ANALYSIS OF COEFFICIENTS FROM INPUT - OUTPUT TABLES (Paper II)

1. Aim of the study

Input coefficients as well as other coefficients calculated from an input-output table differ between countries and change in time. Both types of differences were in the past investigated in numerous studies.

The aim of this study is to find some factors which influence the intercountry variability of input coefficients in a set of comparable input- output tables classified by the 8 sectors of the SIMV model. It is further assumed, that the 8 sector tables are result of aggregation of a set of more detailed and also standardised tables, classified by 24 industries.

The intercountry differences between the input coefficients in the 8 sector tables can be than explained by the following differences among the countries:

a) Differences in the economic level, population number and population density.

b) Differences in the economic structure at the 24 industry level, which may depend on the three above mentioned factors as well as on the endowment with certain natural resources.

2. General framework of the analysis of coefficients from input- output tables

The analysis will be carried out for the following two sets of comparable input-out tables for a number of countries:

a) "UNIDO" input- output tables classified by 24 industries

b) "SIMV" input- output tables classified by 8 sectors.

The defitions of the "SIMV" sectors and "UNIDO" industries can be found in Table 1.

Following notation will be introduced:

i,j = the SIMV sectors ($i,j = 1,2,\ldots\ldots.8$)

m,n = the UNIDO industries($m,n = 1,2\ldots\ldots24$)

a_{ij} = input coefficients of the SIMV table

b_{mn} = input coefficients of the UNIDO teble

a_{vj} = value added (input) coefficient of the SIMV table

b_{vm} = value added (input) coefficient of the UNIDO table

t_{ij} = technological coefficient of the SIMV table

x_j, x_m = gross output value in the SIMV and UNIDO tables respectively

v_j, v_m = gross value added in the SIMV and UNIDO tables respectively

s_m, s_n = shares of gross value added of the UNIDO industry m or n respectively in the gross value added of the SIMV sector i or j respectively

Explanatory variables:

y_k = gross domestic product per capita in country k

p_k = number of population in country k

Table 1.

The Classification Key between the SIMV Sectors, UNIDO Standardized Tables Industries and the 1968 International Standard Industrial Classification of All Economic Activities (ISIC).

SIMV Sectors	UNIDO Industries	1968 ISIC
1. Agriculture	1. Agriculture	Div. 1. Agriculture etc.
2. Agri- Food Processing	2. Food Products	311/2 Food Manufacturing 313 Beverage Industries 314 Tobacco Manufactures
3. Energy	3. Coal Mining	210 Coal Mining
	4. Petroleum and Gas	220 Crude Petroleum and Nat. Gas
	5. Petroleum and Coal Prod.	353 Petroleum Refineries 354 Products of Petroleum and Coal
	6. Electricity,Gas and Water	410 Electricity, Gas and Steam 420 Water Works and Supply
4. Basic Products	7. Metal Ore Mining	230 Metal Ore Mining
	8. Other Mining	290 Other Mining
	9. Paper and Paper Products	341 Paper and Paper Products
	10. Chemicals	351 Industrial Chemicals 352 Other Chemical Products
	11. Non- Metalic Min. Products	361 Pottery, China, etc. 362 Glass and Glass Products 369 Other Non- Metallic Min. Prod.
	12. Metals	371 Iron and Steel 372 Non- Ferrous Metals
5. Light Industry	13. Textiles	321 Manufacture of Textiles
	14. Wearing Apparel	322 Wearing Apparel 323 Leather and Leather Products 324 Footwear
	15. Wood Products	331 Manufacture of Wood Products 332 Furniture and Fixtures
	16. Printing and Publishing	342 Printing and Publishing
	17. Plastic and Rubber Prod.	355 Rubber Products 356 Plastic Products 390 Other Industries
	18. Metal Products	381 Metal Products
6. Equipment Goods Industry	19. Machinery	382 Machinery 383 Electrical Machinery 385 Professional and Scientific
	20. Transport Equipment	384 Transport Equipment
7. Construction	21. Construction	Div.5. Construction
8. Services	22. Trade	Div. 6. Wholesale and Retail Trade
	23. Transport & Communication	Div. 7. Transport and Communication
	24. Other Services	Div. 8. Financing,Real Estate etc. Div. 9. Community and Private Serv.

d_k = population density in country k

e_{mk} = share of exports by industry m in total exports of country k

Two basic hypotheses, complemented by a few sub- hypotheses, will be tested. The two basic hypotheses are as follows:

I. The intercountry differences in the values of input- coefficients of the SIMV tables are caused by differences in economic level(measured by per capita GDP), size (measured by number of pupulation) or population density among the countries of the sample.

II. The intercountry differences in the values of input coefficients of the SIMV tables are caused by the different weights of the UNIDO industries in the aggregagated SIMV sectors. These differences in the relative composition of the SIMV sectors will be called " output- mix".

Following sub- hypotheses were tested:

a) The values of the SIMV input coefficients are small and thus insignificant.

b) The variability of the SIMV input coefficiants is small and not worth explaining.

c) The"output mix " depends on differences in economic level, size, density of population and on natural endowment(to be measured by certain export shares) among the countries of the sample.

d) The variability of the input coefficients can be strongly influenced by intercountry differences in the value added(input) coefficients . In order to remove this effect(which reflects the impact of relative wages, taxes etc.,but not differences in input structure) the analysis will be also carried out out for so called " technological " coefficients.

The values of several variablee, listed above and related to the sub- hypothesees, are defined as follows:

a) The"output mix" is measured with the help of gross value added shares (not gross output shares) in order to preserve consistency with other investigations carried out with the help of the SIMV input-output tables :

$$(1) \qquad s_m = \frac{v_m}{\sum_m v_m} \quad ; \quad s_n = \frac{v_n}{\sum_n v_n}$$

b) the technological coefficients are defined as follows:

$$(2) \qquad t_{ij} = a_{ij} \frac{1}{1 - a_{vj}}$$

3. Data

A set of standardised input- output tables, prepared by the University of Bradford (England) was used as the main source of data. These tables,which were made available to UNIDO, were first aggregated into the 24 industry UNIDO classification and later on further aggregated into the 8 sector SIMV classification. The Bradford input- output tables were prepared in several versions. For this study a set of tables was used, which (i) are all adjusted to the output levels of 1970, (ii) the was carried out by the RAS procedure not only for the intermediate flows, but for the value added row and final demand column too; (iii) original national industry classification was not changed.
These tables were aggregated into the 24 industry UNIDO classification, in several cases the aggregation was not perfect. The quality of results of the analysis was no doubt influenced by several imperfections of the set of comparable input- output tables. These imperfections were caused by the following factors:

a) Intercountry differences in the methodology of the original national input- output tables. National tables were compiled for different years.
b) The adjustment by the RAS method, carried out at Bradford, is only an approximation to the real structure of the economy in the reference year 1970.
c) The aggregation of the Bradford tables into the classification by 24 UNIDO industries was in several cases not perfect.

The data which were used in the analysis were originally not complied for that purpose and are in many respects of low quality. It is then surprising that many results of investigation are good and can be reasonably interpreted.

The analysis was carried out for 30 countries, for which standardised tables in the UNIDO industry classification could be obtained. These countries are listed in Table 2. The table also contains values of the explanatory variables used in the regression analysis.

4. Results of the analysis

This paragraph conteins only the results of various analytical procedures and brief comments on some of their formal properties. The attempt to interpret the results is made in paragraph 5.

4.1 Size and variability of the input coefficients

Average values of the input coefficients for the 8 sectors of the SIMV table and values of the variations coefficients (standard deviation divided by the arithmetic average) are presented in Table 3.

Following general observations can be made:

a) There are no empty cells in the Table 3.
b) The differences in the magnitude of individual average coefficients are very great; the values of the coefficiente range from a_{26}= 0.00018 (deliveries of agri- food to the equipment goods industry) to a_{v8} = 0.76936 (value added coefficient in the service sector).

Table 2. Countries of the sample and the explanatory variables of the regression equations

Country	GDP per head 1000' $ 1970	Population Million 1970	Population density 1000/km^2 1970	Export shares in total exports 1970/73 (SITC-Code): Fertilers minerals 27	Metalliferous ore 28	Coal coke 321	Petroleum & products 33	Petroleum crude 331
Australia	2.054	12.552	0.0016	0.00344	0.14409	0.04542	0.00827	0.00000
Austria	1.917	7.447	0.0889	0.00774	0.00354	0.0000	0.00227	0.00000
Belgium	2.658	9.300	0.3049	0.00919	0.00954	0.00315	0.02322	0.00000
Brasil	0.517	95.204	0.0112	0.00274	0.09625	0.00000	0.00581	0.00022
Costa Rica	0.567	1.737	0.0343	0.00000	0.00000	0.00000	0.00433	0.00000
Cyprus	0.859	0.633	0.0688	0.10198	0.24766	0.00000	0.00000	0.00000
Denmark	3.160	4.929	0.1144	0.00499	0.00374	0.00000	0.01342	0.00000
Finland	2.253	4.606	0.0137	0.00000	0.00317	0.00000	0.00347	0.00000
France	2.781	50.670	0.0926	0.00545	0.1625	0.00356	0.00153	0.00000
Greece	1.133	8 793	0.0667	0.04529	0.02599	0.00000	0.00996	0.00000
India	0.099	543.182	0.1683	0.01540	0.9524	0.00000	0.00563	0.00000
Indonesia	0.077	119.467	0.0589	0.00000	0.10645	0.00000	0.32797	0.29217
Iran	0.392	28.359	0.0172	0.00266	0.00932	0.00000	0.88051	0.74580
Iraq	0.374	9.356	0.0215	0.00018	0.00000	0.00000	0.94460	0.94222
Italy	1.734	53.565	0.1779	0.00448	0.00000	0.00000	0.04884	0.00000
Jordan	0.234	2.280	0.0233	0.18475	0.00293	0.00000	0.00000	0.00000
Luxemburg	2.824	0.338	0.1300	0.00921	0.00957	0.00311	0.02321	0.00000
Mexico	0.666	50.313	0.0255	0.05202	0.02746	0.00000	0.02580	0.00000
New Zealand	2.235	2.811	0.0105	0.00000	0.00236	0.00000	0.00742	0.00000
Norway	2.884	3.877	0.0120	0.01197	0.02296	0.00000	0.01815	0.00000
Peru	0.469	13.248	0.0103	0.00000	0.18920	0.00000	0.00709	0.00642
Philippines	0.186	37.604	0.1253	0.00000	0.20761	0.00000	0.01595	0.00000
Portugal	0.717	8.628	0.0937	0.01285	0.01169	0.00000	0.02328	0.00000
Rhodesia	0.283	5.308	0.0136	0.00000	0.00000	0.00000	0.00000	0.00000
Singapore	0.914	2.075	3.4583	0.00000	0.01236	0.00000	0.23090	0.00000
South Africa	0.822	21.500	0.0176	0.06102	0.06172	0.00852	0.04304	0.00000
Spain	1.089	33.779	0.0669	0.01093	0.00951	0.00737	0.04127	0.00000
Sweden	4.107	8.043	0.0179	0.00000	0.03970	0.00000	0.00724	0.00000
Turkey	0.359	35.232	0.0451	0.02936	0.03599	0.00537	0.00125	0.00000
United Kingdom	2.194	55.480	0.2274	0.00593	0.00327	0.00361	0.02187	0.00000

Table 3. Average values of the input coefficients of the SIMV model

	Agriculture	Agri-Food	Energy	Basic Products	Light Industry	Equipment Goods	Construction	Services
1. Agriculture	1 0.096 46 (0.83)	1 0.344 29 (0.85)	s 0.009 52 (4.82)	0.026 07 (3.22)	1 0.052 70 (1.01)	s 0.000 99 (3.63)	0.007 54 (2.95)	s 0.002 95 (1.49)
2. Agri-Food Processing	1 0.058 19 (1.19)	1 0.142 68 (0.47)	s 0.001 10 (3.63)	s 0.011 52 (0.92)	s 0.004 95 (1.01)	s 0.000 18 (4.16)	s 0.000 39 (2.44)	s 0.009 13 (1.06)
3. Energy	0.014 21 (1.47)	s 0.015 97 (0.65)	1 0.125 96 (0.71)	1 0.056 96 (0.50)	s 0.018 30 (0.50)	0.024 43 (1.15)	0.012 92 (0.74)	s 0.021 96 (0.80)
4. Basic Products	0.030 62 (0.80)	0.029 05 (0.94)	0.034 25 (1.45)	1 0.498 46 (0.57)	1 0.082 13 (0.61)	1 0.101 42 (0.71)	1 0.185 91 (0.38)	s 0.010 23 (0.74)
5. Light Industry	s 0.011 70 (1.10)	0.024 93 (0.83)	s 0.013 51 (0.89)	0.029 88 (0.89)	1 0.199 55 (0.38)	1 0.069 46 (0.62)	1 0.096 62 (0.53)	s 0.019 24 (0.64)
6. Equipment Goods Ind.	s 0.014 04 (1.19)	s 0.007 26 (1.32)	s 0.011 58 (0.93)	s 0.016 31 (0.81)	s 0.010 31 (0.83)	1 0.104 43 (0.62)	0.027 50 (0.74)	s 0.016 81 (0.91)
7. Construction	s 0.007 30 (1.57)	s 0.003 59 (1.42)	0.015 19 (1.50)	s 0.009 70 (1.46)	s 0.005 43 (1.32)	s 0.004 12 (1.23)	0.037 73 (1.82)	s 0.017 24 (0.91)
8. Services	1 0.075 23 (0.84)	1 0.145 82 (0.67)	1 0.097 14 (0.82)	1 0.134 41 (0.54)	1 0.135 31 (0.64)	1 0.105 58 (0.58)	1 0.136 05 (0.64)	1 0.130 98 (0.39)
Value Added	1 0.692 02 (0.19)	1 0.228 46 (0.29)	1 0.689 64 (0.19)	1 0.514 20 (0.23)	1 0.489 73 (0.19)	1 0.587 68 (0.21)	1 0.494 05 (0.19)	1 0.769 36 (0.10)

(Table 3)

c) Certain coefficients can be considered , according to their magnitude, as large and important, other coefficients as small and less important. Since there are no general rules according to which coefficients can be classified, the following selection has been made:

i) Small coefficients are those the value of the standard deviation(product of the average value and of the coefficient of variation- which is in bracketts in each cell) is lower than 0.02. There are 28 " s" coefficients in Table 3.

ii) Large coefficients are those the value of which is greater than 0.05. There are alltogether 26 such " l " coefficients in Table 3.

iii) The remaining 18 coefficients are"middle- size"coefficients.

d) The variation of coefficients depends on their size; it is in general greater for small coefficients and smaller for large coefficients. But there are certain important deviations from this rule (e.g. for the inputs of the service sector).

e) The variation of the input coefficients on the main diagonal is rather small. This is rather important. Values of the coefficients on the main diagonal are influenced by the the methodology of statistical compilation of input- output tables and by aggregation of larger tables into smaller ones. It is often assumed that they differ strongly between countries and make the other input coefficients less comparable. This does not seem to be the case for input- output tables used in this investigation.

4.2 Dependence of the values of input-and-technological coefficients on GDP per head, size of the country and population density

Following regression equations were tested:

$$(3) \quad e_{ij} = c^{o}_{ij} + c^{y}_{ij}\, y + c^{p}_{ij}\, p + c^{d}_{ij}\, d \qquad (i= 1,2....8,v \; ; \; j=1,2...8)$$

$$(4) \quad t_{ij} = c^{o}_{ij} + c^{y}_{ij}\, y + c^{p}_{ij}\, p + c^{d}_{ij}\, d \qquad (i,j = 1,2.....8)$$

Only linear regressions were tried. Earlier have shown, that more complicated (logarithmic) equations yeild much worse results. The advantage of the linear regression is simplicity and additivity of results in columns of the input-output table.

The results are presented in Tables 4 and 5 respectively. The selection was made on the basis of the F- values. The lowest F- value accepted was equal to 2,85, which corresponds to 10 % probability in the case of one explanatory variable.

The figures in Tables 4 and 5 should be read in a way, which will be explained on the example of the input- coefficient for the input from agri-food processing to agriculture:

Table 4. Dependence of the input coefficients on GDP per head, population and density

	Agriculture	Agri-Food	Energy	Basic Products	Light Industry	Equipment Goods	Construction	Services
1. Agriculture		0.338 0.27 -0.097 d 5% 0.588 p 5%			0.081 0.19 -0.021 y 5%			0.002 0.3 0.004 d 1%
2. Agri-Food Processing	0.007 0.3 0.033 y 1% 0.036 d 5%	0.157 0.16 -0.203p 10% -0.030d 10%		0.014 0.26 -0.003 y 5% 0.033 d 10%				0.005 0.1 0.003 y 10%
3. Energy							0.012 0.20 0.007 d 5%	0.016 0.45 0.110 p 1% 0.008 d 5%
4. Basic Products	0.020 0.14 0.008 y 5%			0.155 0.10 0.032 y 10%	0.061 0.12 0.015 y 10%	0.090 0.14 0.272 p 5%	0.225 0.21 -0.029 y 5%	0.005 0.20 0.003 y 5% 0.025 p 5%
5. Light Industry	0.005 0.1 0.005 y 5%	0.023 0.15 0.013 d 5%	0.010 0.30 0.008 d 1% 0.044 p 5%	0.027 0.11 0.069 p 10%				0.012 0.24 0.058 p 1% 0.004 y 5%
6. Equipment Goods Ind.	0.006 0.16 0.006 y 5%	0.006 0.12 0.005 d 10%	0.005 0.28 0.004 y 1% 0.005 d 10%	0.018 0.14 0.008 d 5%	0.007 0.13 0.003 y 5%	0.076 0.13 0.021 y 5%	0.015 0.26 0.009 y 1%	0.007 0.52 0.128 p 1% 0.003 y 10%
7. Construction	0.000 0.27 0.005 y 1%	0.002 0.10 0.001 y 10%	0.002 0.22 0.010 y 1%	0.007 0.24 0.069 p 1%	0.000 0.48 0.051 p 1% 0.002 y 1%	0.000 0.33 0.003 y 1%		0.009 0.19 0.006 y 5%
8. Services	0.068 0.5 0.071 d 1% -0.150 p 10%	0.134 0.16 0.062 d 5%	0.088 0.16 0.052 d 5%	0.123 0.27 0.061 d 1%	0.120 0.35 0.083 d 1%			
Value Added	0.791 0.46 -0.107 d 1% -0.059 y 1%	0.280 0.12 0.046 d 10%		0.571 0.16 -0.042 y 5%				

Table 5. Dependence of the technological coefficients on GDP per head, population and density

	Agriculture	Agri-Food	Energy	Basic Products	Light Industry	Equipment Goods	Construction	Services
1. Agriculture	0.448 -0.092 y 0.16 5%	0.473 -0.131 d 1% 0.725 p 5% 0.28			0.150 -0.035 y 0.17 5%			0.009 0.015 d 0.31 1%
2. Agri-Food Processing	0.067 0.072 y 0.24 1%			0.038 -0.010 y 0.22 1%				
3. Energy						0.110 -0.031 y 0.12 10%	0.024 0.010 d 0.12 10%	
4. Basic Products					0.115 0.035 y 0.20 5%	0.202 0.723 p 0.25 1%	0.449 0.050 y 0.15 5%	0.090 0.494 p 0.22 1%
5. Light Industry		0.031 0.025 d 0.27 1%			0.403 -0.075 d 0.13 10%			0.041 0.098 p 0.14 5%
6. Equipment Goods Ind.		0.009 0.010 d 0.15 5%	0.023 0.012 y 0.16 5%		0.011 0.007 y 0.20 5%	0.172 0.046 y 0.16 5%		0.081 0.236 p 0.13 5%
7. Construction	0.003 0.014 y 0.20 5%	0.002 0.002 y 0.09 10%	0.009 0.036 y 0.19 5%	0.014 0.125 p 0.20 5%	0.000 0.094 p 1% 0.005 y 1% 0.47	0.001 0.006 y 0.38 1%	0.025 0.021 y 0.35 1%	0.056 0.600 p 0.[illegible]4 1%
8. Services		0.185 0.124 d 0.29 1%			0.244 0.132 d 0.26 1%			0.584 -0.956 p 0.26 1%

Table 6. Characteristics of the equations on the dependence of the input and technological coefficients on the GDP per head, number of population and population density.

a. Distribution of determination coefficients (R^2)

Value of R^2	Number of equations for a_{ij}'s	t_{ij}'s	total
0.05 - 0.09	-	1	1
0.10 - 0.14	13	5	18
0.15 - 0.19	7	7	14
0.20 - 0.24	7	5	12
0.25 - 0.29	6	8	14
0.30 - 0.34	3	1	4
0.35 - 0.39	2	2	4
0.40 - 0.44	1	-	1
0.45 - 0.49	2	1	3
0.50 - 0.54	1	1	2
0.55 - 0.59	1	-	1
total	43	31	74

b. Distribution of probabilities of the F- values

F- value upper limit	Number of variables:for: a_{ij}'s				t_{ij}'s				total			
	y	p	d	total	y	p	d	total	y	p	d	total
- 1%	9	5	6	20	5	4	5	14	14	9	11	34
- 5%	11	4	8	23	9	5	1	15	20	9	9	38
-10%	5	3	5	13	2	-	2	4	7	3	7	17
total	25	12	19	56	16	9	8	33	41	21	27	89

c. Features of the results for particular SIMV sectors

SIMV sector	row-wise variables y	p	d	equat.	ØR²	column- wise variables y	p	d	equat.	ØR²
(i) for the a_{ij}'s										
1. Agricult.	1	1	2	3	26.0	6	1	3	7	30.6
2. Agri-food	3	1	1	4	23.0	1	2	6	7	15.4
3. Energy	-	1	2	2	33.5	2	1	3	4	23.5
4. Basic pr.	5	2	1	6	15.2	3	2	3	7	18.3
5. Light ind.	2	3	2	5	19.8	4	1	1	5	25.4
6. Equipment	7	1	3	8	22.1	2	1	-	3	20.0
7. Construct.	6	2	-	7	26.1	2	-	1	3	22.3
8. Services	-	1	5	5	29.8	5	4	2	7	30.0
Value added	2	-	2	3	24.7	-	-	-	-	-
Total	25	12	19	43	23.4	25	12	19	43	23.4
(ii) for the t_{ij}'s										
1. Agricult.	2	1	2	4	23.0	3	-	-	3	20.0
2. Agri-food	2	-	-	2	23.0	1	1	4	5	21.6
3. Energy	1	-	-	1	12.0	2	-	-	2	17.5
4. Basic pr.	1	2	1	4	21.0	1	1	-	2	21.0
5. Light ind.	1	1	2	4	17.2	4	1	2	6	23.8
6. Equipment	3	1	1	5	16.0	3	1	-	4	22.7
7. Construct.	6	3	-	8	30.2	2	-	1	3	20.7
8. Services	-	1	2	3	27.0	-	5	1	6	27.5
total	16	9	8	31	22.8	16	9	8	31	22.8

$$a_{12} = 0.007 + \underset{(1\%)}{0.053y} + \underset{(5\%)}{0.036d} \quad , R^2 = 0.37$$

In this case, c^{y}_{12} is significant at 1% and c^{d}_{12} is significant at 5 % level, while c^{p}_{12} is not significant below 10% level.
It should be noted, that the three explanatory variables (y,p,d) are not intercorrelated. The coefficient of correlation R between y and p equals to -0.2821, the coefficient of correlation R between y and d equals to -0.0467 and between p and d to - 0.0423. But even in the case of R_{yp} there is no significant intercorrelation: the value of R^2 = 0.0796, its standard error of estimate is equal to 1,08 and the regression equation has a regression coefficient which is not significant at 10% level.

A summary review of the results is presented in Table 6. Table 6 shows, that the input coefficients perform better than the technological coefficients. Three values of the value added coefficients and 40 values of input coefficients could be explained by regression equations, but only 31 values of technological coefficients. Also the average value of the R^2 is slightly higher for the a_{ij}'s than for the t_{ij}'s ; (23.4 against 22.8).Among the explanatory variables, y prevails both for the input and technological coefficients.
The number of significant equations differs by sectors. The number of significant equations is row-wise high for the equipment goods industry, construction and services, column- wise the number of significant equations is high for agriculture, agri- food processing, basic products and services.

4.3 Dependence of the values of input- coefficients for the UNIDO sectors on GDP per head, population number and density of population

The results of analysis presented in the previous paragraph have shown a relatively good performance of number of input coefficients and relatively weak performance of the technological coefficients.
The values of the input coefficients of the SIMV tables depend also on the values of the input coefficients of the UNIDO 24- industry tables. The dependence of the input coefficients of the UNIDO tables on GDP per head, number of population and population density can be also analysed by the regression analysis. The results of the analysis are presented in the Annex. In Table 8 the determination coefficients R^2, in Table 7 selected average values of the input coefficients can be found.
The results presented in the Annex and Table 7 indicate a few additional problems. The first one(which was neglected for the input coefficients of the SIMV tables for reasons to be explained now,) is the existence of negative intercepts in the regression equations. There are 49 negative intercept values (out of a total number of 229) in the Annex. These negative intercept values are the consequence of zero coefficients for certain countries. In the analysis of the SIMV input coefficients it was assumed, that the zero coefficients are " true " zero values. In

Table 7. Average values and coefficients of variation of input coefficients *)

(Industries 09- 18 of the 24 industry classification)

SITIV	UNIDO	09		10		11		12		13	
1.	01 Agriculture	.030 263	1.09	.034 837	3.59	.001 500	2.17	.019 679	5.34	.081 182	1.24
2.	02 Agri-food	.004 313	2.61	.060 730	1.84	.001 300	4.47	.000 298	3.06	.004 995	2.11
3.	03 Coal Mining	.003 174	2.38	.001 863	2.07	.006 282	1.54	.002 940	3.02	.000 595	1.89
	04 Petroleum	.001 487	3.07	.002 063	2.85	.003 794	3.09	.001 327	2.81	.001 548	4.00
	05 Petr. Products	.013 211	1.03	.019 482	1.62	.036 439	1.28	.021 407	1.31	.008 390	1.40
	06 Electricity	.029 481	0.68	.022 341	0.83	.026 123	0.62	.027 262	0.84	.015 531	0.67
4.	07 Metal ore	.000 909	3.33	.006 185	2.23	.026 251	1.88	.055 120	2.22	.000 678	4.86
	08 Oth. mining	.001 607	2.83	.015 284	2.77	.028 724	1.20	.006 039	2.77	.000 124	3.31
	09 Paper	.179 045	0.71	.022 390	0.99	.016 848	0.79	.001 514	1.27	.006 638	1.30
	10 Chemicals	.030 599	0.73	.109 869	0.81	.017 039	1.57	.009 017	1.14	.035 335	0.97
	11 Non-metals	.001 542	1.51	.010 569	1.28	.055 952	0.96	.005 405	1.24	.000 348	2.35
	12 Metals	.006 281	2.13	.008 452	1.60	.008 607	1.05	.181 601	0.96	.001 654	2.47
5.	13 Textiles	.006 840	2.18	.004 127	1.44	.002 771	2.44	.000 363	2.21	.221 742	0.53
	14 Apparel	.001 072	2.10	.000 888	2.46	.000 492	2.78	.000 892	2.57	.004 499	2.83
	15 Wood products	.013 877	1.53	.004 391	1.22	.004 008	1.02	.001 332	1.60	.002 204	1.50
	16 Printing	.006 852	1.34	.008 982	1.89	.002 137	1.61	.001 551	1.61	.003 041	1.44
	17 Plast., rubber	.002 647	1.26	.009 470	1.21	.004 660	1.72	.000 554	7.07	.005 417	1.29
	18 Metal products	.004 609	2.77	.012 411	1.33	.006 704	1.44	.029 665	3.09	.003 626	2.24
6.	19 Machinery	.009 364	1.04	.005 668	1.22	.014 694	1.02	.016 808	1.30	.005 213	0.98
	20 Transp. equip.	.001 209	1.52	.001 076	1.61	.004 859	1.72	.005 614	2.77	.001 844	2.23
7.	21 Construction	.003 813	1.42	.004 795	1.45	.014 338	2.06	.004 326	2.31	.004 483	1.60
8.	22 Trade	.065 755	1.06	.062 333	1.13	.060 842	1.22	.039 000	1.22	.062 402	1.05
	23 Transport	.026 766	0.88	.024 836	0.85	.053 175	0.88	.034 933	1.03	.019 985	1.12
	24 Services	.039 047	0.85	.052 473	0.82	.041 522	1.03	.035 213	1.48	.041 751	0.95
	Value added	.514 813	0.29	.495 002	0.33	.559 017	0.17	.425 141	0.50	.466 929	0.27

*) The first figure is the arithmetic average, the second the coefficient of variation
Regression equations were found for the figures with |, underlined figures greater than 1%

Table 7. (cont.)

	14	15	16	17	18
01	.031 282 1.77	.098 808 1.10	.000 526 3.67	.018 799 2.02	.000 515 4.99
02	.014 604 1.10	.001 024 1.76	.000 122 2.45	.002 581 2.94	.000 172 2.83
03	.000 178 2.04	.000 244 2.29	.000 058 2.62	.000 738 2.30	.001 001 3.00
04	.000 232 2.98	.000 422 3.08	.000 305 4.17	.004 583 4.34	.004 567 5.07
05	.003 188 2.21	.005 175 1.35	.002 494 1.87	.007 533 1.41	.005 210 1.22
06	.006 697 1.28	.010 344 0.71	.006 277 0.91	.012 887 0.64	.010 505 0.88
07	.000 076 3.76	.000 154 3.78	.000 077 5.45	.012 868 3.62	.005 769 3.62
08	.000 111 2.82	.000 150 3.39	.000 161 4.40	.000 381 1.96	.001 163 2.42
09	.008 255 0.85	.003 818 1.28	.135 192 0.76	.012 481 0.95	.003 660 1.11
10	.011 160 0.96	.017 192 0.85	.017 191 0.83	.061 677 0.94	.011 909 0.92
11	.001 135 3.25	.003 966 1.58	.000 358 4.77	.004 149 1.52	.002 700 1.69
12	.001 434 2.07	.009 882 1.46	.002 865 2.08	.013 040 1.13	.150 322 0.94
13	.163 671 0.68	.038 897 3.02	.001 331 1.62	.027 514 0.86	.001 145 1.51
14	.093 149 0.57	.004 195 2.73	.001 092 1.97	.004 705 2.25	.000 484 1.83
15	.002 366 1.53	.138 249 0.56	.000 501 2.26	.077 752 1.85	.004 389 0.88
16	.002 651 1.61	.001 710 1.61	.036 620 1.51	.004 586 1.32	.001 829 1.43
17	.020 049 0.87	.008 644 1.17	.004 097 1.61	.048 592 0.94	.005 186 1.34
18	.003 430 1.08	.023 462 1.78	.002 375 2.20	.010 709 1.52	.039 216 1.36
19	.003 381 1.53	.009 090 1.53	.004 899 1.49	.009 951 1.54	.013 774 1.44
20	.002 178 3.64	.002 222 1.54	.001 046 1.87	.004 857 2.73	.003 546 3.49
21	.002 336 1.62	.005 646 1.69	.002 549 1.72	.010 777 3.16	.007 081 2.72
22	.087 598 1.11	.057 935 1.13	.037 338 1.49	.079 205 1.13	.038 223 1.04
23	.013 495 1.06	.033 673 0.99	.016 951 0.98	.029 809 1.37	.018 888 1.07
24	.037 784 1.16	.035 350 0.91	.047 503 1.07	.050 703 1.13	.043 000 1.21
VA	.456 326 0.28	.489 186 0.29	.510 810 0.50	.559 762 0.29	.485 554 0.48

Table 8. Summary of the regression analysis of the input coefficients for the UNIDO industries

(Values of the determination coefficients R^2 and frequencies of explanatory variables)

SITC	UNIDO	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	No.eq.	y	p	d
1.	01 Agriculture	-	.27	-	-	-	.13	-	-	.16	-	-	-	.14	.31	-	-	-	-	-	-	-	-	-	.36	6	3	2	2
2.	02 Agri-food	.37	.16	-	-	.13	-	-	-	-	-	.91	-	-	-	-	-	.88	-	-	-	-	-	-	.13	6	3	3	2
3.	03 Coal mining	.15	-	.20	-	.10	.20	-	-	.67	.17	.15	.79	.22	-	-	.12	.46	.12	-	-	-	.09	.80	-	14	5	10	2
	04 Petroleum	-	-	-	-	.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-
	05 Petroleum p.	-	-	-	-	-	.26	.20	.07	.11	-	-	-	-	-	-	-	-	-	-	-	.10	-	.44	.38	7	4	-	5
	06 Electricity	.53	-	-	-	-	-	-	-	-	.37	.12	.31	-	-	-	-	-	-	-	-	.35	-	.16	.40	7	5	-	4
4.	07 Metal ore	-	-	-	-	-	-	.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-
	08 C. mining	-	-	.10	-	-	-	-	-	-	-	.12	-	-	-	-	-	-	-	-	-	.12	-	-	-	3	3	-	-
	09 Paper	-	-	.19	-	.10	-	-	-	-	-	.28	-	.39	.16	.89	-	.40	-	.11	.42	.43	.36	.33	-	12	10	1	3
	10.Chemicals	.14	-	-	-	-	.64	-	-	.32	-	-	.10	-	-	-	-	.11	.12	.67	-	-	-	-	-	7	3	1	3
	11 Non metals	.26	.68	.89	.92	.56	-	.65	.49	-	.45	.10	.42	.40	.74	.79	.91	-	.71	.35	.78	-	-	.89	-	18	9	16	1
	12.Metals	-	-	-	-	-	-	.07	-	-	-	-	-	-	-	-	-	.11	-	-	.11	.16	-	.16	-	5	4	1	-
5.	13 Textiles	-	.12	-	-	-	-	-	-	-	-	.44	-	-	-	-	.10	-	.10	-	-	-	-	-	-	4	2	2	-
	14 Apparel	-	.64	.10	-	-	-	-	.26	-	-	-	-	.11	.27	-	.11	-	-	-	-	-	-	-	-	6	3	2	1
	15 Wood prod.	-	-	-	-	-	-	-	-	-	.12	.24	-	-	-	-	.47	-	-	-	-	-	-	-	-	3	1	1	1
	16 Printing	.31	-	.16	-	.12	.21	.07	.10	.10	-	.31	.21	.22	-	.37	.16	.15	.35	.28	.44	.25	.19	.52	.38	20	20	1	1
	17 Plast. rub.	-	.43	.64	.92	.63	-	.80	.76	-	.56	.65	.63	-	-	.19	-	-	.25	.18	.16	.54	-	.30	-	15	5	13	-
	18 Metal prod.	.17	.11	-	-	.57	-	-	-	.12	.67	.63	-	-	.35	-	-	.45	.13	.35	.24	.25	.13	.12	-	14	9	5	5
6.	19 Machinery	.18	.42	-	-	-	.10	-	-	.21	.29	.46	.25	-	-	-	.34	.63	.27	.11	-	.24	-	.25	.18	14	12	2	7
	20 Transp. eq.	-	-	-	-	-	-	-	-	.10	.11	-	.30	-	-	.10	.12	-	-	.21	-	-	.15	.12	-	8	6	-	2
7.	21 Construction	.27	.10	.17	-	-	.18	-	-	.20	.26	.70	-	.10	.24	-	.20	.89	-	.16	.50	-	-	.12	.11	15	15	2	-
8.	22 Trade	.49	.29	-	-	-	-	-	-	.17	.20	-	-	.17	.15	-	.12	.36	-	-	-	-	-	.10	-	9	5	1	7
	23 Transport	.19	-	.79	-	-	.12	.90	.57	.19	.26	.26	.22	.41	-	.27	.25	.74	.18	.11	.23	-	.12	.13	-	18	8	4	8
	24 Services	.18	-	-	-	-	-	-	.15	.12	.19	-	.56	-	.10	-	-	.36	-	-	-	-	-	-	-	7	1	-	6
Value added		.36	.13	-	.21	-	-	.41	-	-	-	.29	-	-	-	.17	-	.46	-	-	-	-	.30	-	.71	9	3	7	4
No. of equations		13	11	3	3	8	8	8	7	12	12	15	10	9	8	7	11	13	9	10	8	9	7	14	8	229			
Frequency of variables	y	11	6	8	-	4	5	6	2	7	8	6	6	6	2	4	7	8	5	7	5	5	6	10	6		140		
	p	1	5	3	3	4	1	4	4	2	3	9	3	2	3	3	3	8	3	2	2	2	1	3	1			75	
	d	4	8	-	-	1	3	1	1	4	5	4	3	2	3	1	1	4	3	1	2	3	-	2	3				62

Table 9. Highest and lowest values of input coefficients and the number of non-zero coefficients *)

(24 UNIDO industry classification)

SIMV	UNIDO	01			02			03			04			05			06			07			08		
1.	01 Agriculture	.000	.267	30	.015	.700	30	.	.046	8	.	.006	1	.	.374	11	.	.002	9	.	.073	12	.	.041	10
2.	02 Agri-Food	.	.289	29	.045	.280	30	.	.001	1	.	.023	3	-.001	.010	9	.	.009	6	.	.004	4	.	.005	4
3.	03 Coal mining	.	.001	8	.	.004	9	.	.195	6	.	.000	2	.	.190	7	.	.138	10	.	.033	3	.	.013	6
	04 Petroleum	.	.012	4	.	.009	4	.	.002	2	.	.271	6	.	.398	7	.	.058	5	.	.009	4	.	.012	1
	05 Petr. prod.	.	.112	24	.	.025	24	.	.027	8	.	.031	3	-.545	.333	22	.	.117	24	.	.010	15	.	.104	15
	06 Electricity	.	.012	25	.	.030	29	.	.089	10	.	.018	5	-.050	.110	24	.	.338	26	.	.058	18	.	.042	17
4.	07 Metal ore	.	.020	10	.	.016	7	.	.013	1	.	.241	2	-.049	.214	8	.	.159	7	.	.452	9	.	.002	2
	08 Oth. mining	.	.003	19	.	.017	14	.	.001	3	.	.000	1	.	.275	10	.	.059	9	.	.005	4	.	.150	8
	09 Paper	.	.007	22	.	.106	29	.	.001	5	.	.001	6	-.018	.070	19	.	.006	22	.	.008	12	.	.022	11
	10 Chemicals	.	.082	27	.	.030	27	.	.022	8	.	.015	5	-.102	.145	20	.	.023	21	.	.032	14	.	.049	13
	11 Non-metals	.	.012	20	.	.020	25	.	.037	6	.	.087	5	-.004	.050	16	.	.034	17	.	.032	9	.	.032	9
	12 Metals	.	.023	16	.	.015	19	.	.041	6	.	.005	3	-.065	.027	10	.	.041	15	.	.030	12	.	.045	10
5.	13 Textiles	.	.019	25	.	.029	26	.	.001	3	.	.000	1	-.010	.003	8	.	.003	12	.	.003	6	.	.011	9
	14 Apparel	.	.027	15	.	.014	18	.	.007	7	.	.001	3	.	.002	5	.	.035	9	.	.071	6	.	.010	5
	15 Wood prod.	.	.008	23	.	.015	26	.	.014	5	.	.001	2	-.006	.009	10	.	.013	15	.	.011	11	.	.007	9
	16 Printing	.	.004	13	.	.025	222	.	.004	5	.	.009	4	.	.024	12	.	.005	17	.	.006	8	.	.010	8
	17 Plast.,rubber	.	.013	21	.	.011	25	.	.037	8	.	.087	6	-.006	.050	15	.	.005	23	.	.032	14	.	.024	11
	18 Metal products	.	.049	21	.	.051	24	.	.039	8	.	.016	4	-.059	.126	18	.	.022	19	.	.061	14	.	.025	12
6.	19 Machinery	.	.043	25	.	.026	24	.	.079	9	.	.017	6	-.029	.048	18	.	.074	15	.	.033	17	.	.032	14
	20 Transp. equip.	.	.051	26	.	.031	18	.	.004	5	.	.006	6	-.0[illegible]1	.007	12	.	.012	16	.	.081	11	.	.012	10
7.	21 Construction	.	.049	11	.	.016	17	.	.036	5	.	.147	5	-.028	.138	13	.	.135	21	.	.155	11	.	.010	10
8.	22 Trade	.	.260	27	.	.239	27	.	.035	8	.	.013	5	-.021	.833	23	.	.098	22	.	.142	16	.	.065	17
	23 Transport	.	.047	27	.	.171	27	.	.462	10	.	.067	5	-.068	.226	21	.	.033	25	.	1.915	18	.	.490	19
	24 Services	.	.089	27	.	.191	27	.	.099	8	.	.036	6	-.058	.177	21	.	.257	26	.	.291	17	.	.110	16
	Value added	.388	.906	30	.091	.428	30	.	.803	10	.	.985	8	.	2.154	24	.448	.963	30	-.981	.900	21	.	.957	19

*) The first figure is the lowest, the second figure the highest value of the input coefficient. The third figure is the number of non- zero entries(max = 30). .000 means less than .0005, . means nul.

Table 9. cont.

		09			10			11			12			13			14			15			16			17	
01	.	.243	21	.	.678	24	.	.014	18	.	.578	14	.	.352	28	.	.210	28	.	.453	27	.	.010	7	.	.137	21
02	.	.057	19	.	.604	30	.	.032	11	.	.005	9	.	.049	22	.	.055	25	.	.008	16	.	.001	8	.	.041	16
03	.	.037	9	.	.015	9	.	.028	10	.	.046	10	.	.003	9	.	.001	8	.	.002	8	.	.001	5	.	.007	8
04	.	.021	4	.	.026	4	.	.051	4	.	.018	14	.	.033	4	.	.003	4	.	.005	4	.	.007	3	.	.108	4
05	.	.050	24	.	.163	24	.	.163	24	.	.112	22	.	.049	24	.	.037	21	.	.028	23	.	.023	17	.	.054	23
06	.	.100	29	.	.064	28	.	.057	29	.	.111	27	.	.055	29	.	.044	26	.	.024	29	.	.022	23	.	.035	28
07	.	.016	8	.	.063	16	.	.174	16	.	.515	20	.	.048	3	.	.001	6	.	.003	4	.	.002	2	.	.248	11
08	.	.024	9	.	.221	14	.	.111	18	.	.088	15	.	.002	8	.	.001	8	.	.003	7	.	.004	2	.	.002	8
09	.	.457	26	.	.107	28	.	.054	29	.	.006	21	.	.038	28	.	.033	27	.	.017	23	.	.326	24	.	.040	27
10	.	.099	27	.	.331	27	.	.106	25	.	.037	25	.	.117	26	.	.042	26	.	.071	27	.	.057	23	.	.232	24
11	.	.008	17	.	.058	25	.	.233	28	.	.023	21	.	.003	12	.	.017	15	.	.031	22	.	.010	9	.	.029	23
12	.	.063	20	.	.048	23	.	.039	25	.	.577	25	.	.016	14	.	.011	17	.	.073	24	.	.030	20	.	.042	23
13	.	.081	24	.	.027	24	.	.027	19	.	.004	13	.	.390	28	.	.448	29	.	.622	23	.	.009	18	.	.073	24
14	.	.009	13	.	.010	17	.	.007	9	.	.010	13	.	.064	16	.	.230	28	.	.062	20	.	.010	15	.	.056	19
15	.	.086	22	.	.025	25	.	.012	24	.	.009	19	.	.015	22	.	.017	23	.	.316	27	.	.005	10	.	.071	24
16	.	.030	18	.	.073	21	.	.015	17	.	.011	16	.	.016	18	.	.017	18	.	.010	15	.	.255	18	.	.019	18
17	.	.013	22	.	.051	25	.	.038	24	.	.018	21	.	.028	25	.	.072	27	.	.042	26	.	.025	21	.	.180	26
18	.	.032	21	.	.075	20	.	.048	24	.	.505	21	.	.043	22	.	.015	22	.	.229	25	.	.023	17	.	.063	22
19	.	.031	20	.	.032	23	.	.052	24	.	.072	23	.	.021	24	.	.022	20	.	.064	23	.	.027	17	.	.065	21
20	.	.005	14	.	.007	14	.	.040	17	.	.071	17	.	.021	16	.	.044	16	.	.012	14	.	.008	12	.	.070	17
21	.	.019	14	.	.022	16	.	.151	19	.	.028	15	.	.029	15	.	.017	16	.	.037	16	.	.015	13	.	.187	17
22	.	.288	26	.	.243	26	.	.318	27	.	.183	24	.	.232	28	.	.380	26	.	.323	26	.	.252	20	.	.328	26
23	.	.083	24	.	.062	25	.	.199	26	.	.140	24	.	.095	27	.	.064	26	.	.139	27	.	.060	22	.	.214	27
24	.	.116	25	.	.147	27	.	.193	25	.	.241	24	.	.189	27	.	.186	25	.	.103	25	.	.212	22	.	.222	26
VA	.300	1.000	30	.243	.932	30	.279	.735	30	.	.884	28	.267	.596	30	.	.685	29	.064	.851	30	.	.969	25	.141	.837	30

Table 9. cont.

	18			19			20			21			22			23			24			Aggregation inconsistencies (number of countries)
01	.	.014	9	.	.028	15	.	.007	10	.	.113	19	.	.070	13	.	.014	18	,	.024	24	-
02	.	.003	11	.	.002	6	.	.007	9	.	.004	10	.	.023	14	.	.012	15	.	.048	26	-
03	.	.015	9	.	.008	9	.	.046	8	.	.000	5	.	.002	4	.	.035	8	.	.004	8	5
04	.	.127	3	.	.066	4	.	.068	4	.	.006	3	.	.005	3	.	.071	4	.	.005	5	5
05	.	.023	19	.	.202	24	.	.060	22	.	.032	23	.	.054	20	.	.194	22	.	.016	22	6
06	.	.039	24	.	.070	28	.	.022	26	.	.009	23	.	.042	13	.	.015	20	.	.024	27	-
07	.	.110	8	.	.048	11	.	.047	7	.	.091	10	.	.000	2	.	.048	7	.	.002	9	10
08	.	.010	12	.	.008	13	.	.004	8	.	.114	16	.	.010	4	.	.045	10	.	.001	8	10
09	.	.015	22	.	.023	25	.	.004	20	.	.010	19	.	.024	26	.	.004	21	.	.013	26	4
10	.	.034	24	.	.088	28	-.019	.004	26	.	.031	28	.	.021	21	.	.019	23	.	.015	28	-
11	.	.022	20	.	.036	24	.	.041	24	.	.252	29	.	.005	16	.	.018	17	.	.007	25	-
12	.	.495	23	.	.264	26	.	.281	26	.	.114	26	.	.046	10	.	.005	15	.	.004	16	3
13	.	.007	16	.	.018	24	.	.020	23	.	.021	15	.	.010	21	.	.004	[illegible]	.	.009	21	3
14	.	.004	13	.	.058	19	.	.011	18	.	.006	10	.	.009	14	.	.023	18	.	.024	[illegible]	3
15	.	.013	11	.	.107	27	.	.029	25	.	.112	29	.	.017	21	.	.006	21	.	.011	23	-
16	.	.009	15	.	.019	17	.	.008	17	.	.005	16	.	.040	20	.	.015	20	.	.029	21	5
17	.	.024	22	.	.050	26	.	.159	26	.	.049	24	.	.009	21	.	.046	27	.	.012	25	3
18	.	.214	23	.	.109	24	.	.223	23	.	.100	25	.	.006	17	.	.031	19	.	.006	20	5
19	.	.093	20	.	.196	27	.	.443	27	.	.059	26	.	.052	20	.	.039	24	.	.022	26	1
20	.	.068	17	.	.049	19	.	.286	26	.	.018	18	.	.028	19	.	.115	27	.	.013	23	2
21	.	.103	13	.	.026	16	.	.015	16	.	.213	14	.	.063	19	.	.121	20	.	.056	26	-
22	.	.137	24	.	.148	28	.	.222	25	.	.365	24	.	.156	21	.	.204	24	-.000	.077	24	3
23	.	.064	22	.	.061	25	.	.047	23	.	.083	27	.	.153	26	.	.324	27	.	.147	26	2
24	.	.213	23	.	.189	26	.	.136	24	.	.230	27	.	.307	27	.	.118	25	.	.314	28	1
VA	.	.885	26	.400	.890	30	.	.937	29	.308	.678	30	.	.996	28	.	.949	28	.	1.000	29	-

the analysis of the input coefficients in the UNIDO 24 industry classification the zero values can be not only " true "zeros, but can also results because of errors in date compilation or inconsistencies in the aggregation of the input tables from national classification schemes in the 24 industry UNIDO classification.

Information allowing to asses the reliability of date in the 24 industry classification is provided in Table 9. For each cell one finds the information on the highest and lowest value of the coefficient and on the number of zero entries. One can see , that in certain cases negative values of coefficients appear in the 24 industry tables and that the number of zero elements is sometimes rather high. The high number of zero elements influences the average values of the coefficients for the sample of countries and causes often the negative value of the intercept.

It must be , however, stressed, that from the point of view of the theory of input- output analysis the values of input coefficients should be non-negative. Actual negative values are obviously wrong, negative values which would result from the application of the regression equations should be, ex definitione, replaced by zero.

The number of non- zero elements in the value added row of Table 9 also indicates the quality of data. Some industries in certain countries were lost during the processing by the RAS method. These losses are very high in industries 03- coal mining and 04- petroleum and influence negatively the analysis for the energy sector.

The very last column of Table 9. provides information about number of countries, for which the aggregation of the tables in original national industry classification into the 24 industry classification was not perfect. Inconsistencies in the aggregation could also have influenced the results of the regression analysis.

4.4 Dependence of the values of the input and technological coefficients on the output mix.

Following regression equations were tested:

$$(5) \qquad a_{ij} = c^{o}_{ij} + \sum_{n \notin j} c^{n}_{ij} s_{n} + \sum_{i \in m} c^{m}_{ij} s_{m}$$

For the coefficients on the main diagonal(for which i= j) a distiction between the second and third term of the equation cannot be made. The equations for the valued added (input) coefficients do not include the third term.

$$(6) \qquad t_{ij} = c^{o}_{ij} + \sum_{n \notin j} c^{n}_{ij} s_{n} + \sum_{i \in m} c^{m}_{ij} s_{m}$$

In this case, the equations for value added coefficients do not exist.

In both equations the output mix is measured by value added shares s_n and s_m respectively, which were defined by equation (1) in paragraph 2.

The results are presented in Tables 10 and 11 respectively. The selection was made according to the F-values. The lowest F- value accepted was equal to 2.85, which corresponds to 10% probability in the case of one explanatory variable.
The figures in Tables 10 and 11 should be read in a way, which will be explained on the example of the input coefficient for the input of energy into the equipment goods industry:

$$a_{36} = 0.082 - \underset{(1\%)}{0.043}\, a_6 - \underset{(5\%)}{0.059}\, a_{19} \qquad R^2 = 0.29$$

The value of the coefficient decreases with a_6, i.e. with the share electricity, gas and water industry in the energy sector and also with a_{19}, i.e. with the share of machinery in the equipment goods sector.. The first coefficient is significant at 1% level, the second one at 5% level.

A summary of the results is presented in Table 12. The output mix explains the variability of the input coefficients for the SIMV input- output tables not much better than GDP per head, number of population and population density. Three values of value added coeffificients , 37 values of input coefficients and 38 values of technological coefficients could be explained by regression equations. One should, however, bear in mind that three SIMV sectors(as well as value added) are identical to the UNIDO industries(agriculture, agri-food processing and construction) and that this type of analysis is <u>ex ante</u> not applicable to 12 input and to nine technological coeffficients. The average values of the R^2 are 25.6 for the input and 25.1 for the technological coefficients.

The results for the technological coefficients are somehow "sharper" then for the input coefficients, the number of explanatory variables is smaller, but the frequency of coefficients significant at 1 % level higher.
There are also differences in coverage by the SIMV sectors, The coverage is very good for the basic products , light industry and services.

What is more important, the frequency of the particular value added shares in the equations is rather different. First of all, the a_m's are slightly more frequently represented thet the a_n's: 27 against 25 for the input and 29 against 22 for the technological coefficiente. That means, that the composition of the input is somehow more important than the composition of the output.
These figures, as well as coverage by the 24 UNIDO industries, can be found in Table 13. The coverage is, ex definitione, nul for industries 1,2 and 21. It is also nul for industry 20, but $a_{20} = 1 - a_{19}$. One can see in the very last column, that the coverega is very high in the sector 4- basic products (7.9 cases per industry) and in sector 8- services(6 cases per industry) and relatively low in sectors 3- energy and 6- equipment goods.

Table 10. Dependence of the input coefficients on the output mix.

	Agriculture	Agri-Food	Energy	Basic Products	Light Industry	Equipment Goods	Construction	Services
1. Agriculture				0.030 [0.21] 0.528 B9 1%	0.002 [0.32] 0.200 B13 1%			
2. Agri-Food Processing			0.000 [0.30] 0.008 B4 1%	0.018 [0.15] -0.035 B12 5%				-0.001 [0.14] 0.189 B24 5%
3. Energy			0.108 [0.12] 0.352 B3 10%	0.065 [0.49] 0.181 B3 1% -0.030 B6 5%	0.028 [0.26] -0.057 B16 5% -0.022 B14 10%	0.082 [0.29] -0.043 B6 1% -0.059 B19 5%	0.019 [0.14] -0.011 B6 5%	0.047 [0.27] -0.048 B24 1%
4. Basic Products	0.017 [0.14] 0.125 B9 5%	-0.005 [0.27] 0.129 B12 1% 0.063 B7 5%	-0.006 [0.22] 0.071 B6 1%	-0.019 [0.43] 0.643 B12 1% 0.593 B10 1% 0.283 B7 5%	0.065 [0.41] 0.153 B18 1% -0.159 B11 1% 0.126 B12 5%	-0.085 [0.37] 0.403 B12 1% 0.321 B10 1% 0.177 B7 5%	0.192 [0.41] -0.598 B9 1% 0.226 B10 5%	-0.001 [0.54] 0.043 B9 1% 0.014 B23 1% 0.019 B12 5%
5. Light Industry	0.001 [0.33] 0.066 B18 1%	0.014 [0.14] 0.070 B18 5%	-0.001 [0.41] 0.068 B18 1% 0.014 B5 5%	0.074 [0.47] -0.114 B14 1% -0.073 B8 1% -0.063 B12 5%	0.278 [0.15] -0.511 B15 5%	0.124 [0.31] -0.174 B14 1% -0.176 B16 10%	0.058 [0.28] 0.241 B16 1%	0.028 [0.17] 0.042 B18 5%
6. Equipment Goods Ind.			0.009 [0.15] 0.047 B3 5%	0.007 [0.13] 0.045 B11 5%				0.008 [0.31] 0.047 B23 1%
7. Construction				-0.015 [0.23] 0.044 B7 1% 0.074 B10 1%				-0.002 [0.21] 0.038 B24 5%
8. Services		0.179 [0.11] -0.175 B23 10%	0.072 [0.22] -0.127 B4 1% 0.139 B22 10%	0.116 [0.11] 0.184 B8 10%	0.099 [0.11] 0.287 B17 10%	0.060 [0.19] 0.153 B22 5%		
Value Added			0.667 [0.14] 0.184 B4 5%	0.725 [0.44] -0.470 B12 1% -0.462 B10 1%	0.387 [0.17] 0.676 B15 5%			

Table 11. Dependence of the technological coefficients on the output mix

	Agriculture	Agri-Food	Energy	Basic Products	Light Industry	Equipment Goods	Construction	Services
1. Agriculture				-0.044 0.843 S9 [0.25] 1%	0.013 0.355 S13 [0.31] 1%			
2. Agri-Food Processing			-0.001 0.045 S4 [0.37] 1%	0.044 -0.095 S12 [0.23] 1%				-0.008 0.089 S24 [0.17] 5%
3. Energy			0.593 -0.348 S6 [0.22] 1%	0.175 -0.087 S6 [0.16] 5%		0.122 -0.095 S6 [0.10] 10%	0.038 -0.022 S6 [0.15] 5%	0.227 0.226 S24 [0.21] 1%
4. Basic Products	0.166 -0.300 S11 [0.11] 10%	-0.006 0.181 S12 1% 0.079 S7 5% [0.31]	-0.004 0.185 S6 [0.23] 1%	0.259 0.667 S12 [0.21] 5%	0.014 0.319 S18 1% 0.273 S12 1% -0.283 S11 1% [0.53]	-0.019 0.866 S12 1% 0.777 310 1% 0.434 S7 1% -0.324 S19 1% [0.54]	0.407 -1.209 S9 1% 0.388 S10 10% [0.36]	-0.013 0.138 S12 1% 0.154 S10 1% -0.057 S24 1% 0.069 S7 1% 0.101 S9 1% [0.73]
5. Light Industry	0.009 0.193 S18 [0.25] 1%	0.021 0.094 S18 [0.12] 10%	-0.006 0.243 S18 1% 0.038 S5 5% [0.49]	0.102 -0.263 S14 1% 0.130 S7 1% [0.34]		0.249 -0.390 S14 [0.20] 5%	0.117 0.496 S18 [0.36] 1%	0.053 0.150 S13 [0.12] 10%
6. Equipment Goods Ind.			-0.025 0.117 S19 [0.28] 1%	0.007 0.135 S11 [0.28] 1%	0.012 0.078 S16 [0.12] 10%			0.036 0.239 S23 [0.32] 1%
7. Construction				-0.027 0.090 S7 1% 0.134 S10 1% [0.23]	0.018 -0.036 S14 [0.10] 10%			-0.010 0.168 S24 [0.21] 5%
8. Services	0.145 0.349 S22 [0.14] 5%	0.260 -0.274 S23 [0.13] 5%		0.422 -0.649 S12 [0.20] 1%	0.472 -0.477 S13 1% -0.525 S18 5% [0.23]	-0.095 0.423 S22 5% 0.465 S19 5% [0.24]		0.603 -0.307 S23 [0.10] 10%

Table 12. Characteristics of the equations on the dependence of the input and technological coefficients on the output mix

a. Distribution of the determination coefficients (R^2)

Value of R^2	Number of equations for: a_{ij}'s	t_{ij}'s	total
0.10 - 0.14	10	9	19
0.15 - 0.19	6	3	9
0.20 - 0.24	5	11	16
0.25 - 0.29	5	5	10
0.30 - 0.34	5	4	9
0.35 - 0.39	1	2	3
0.40 - 0.44	5	-	5
0.45 - 0.49	2	1	3
0.50 - 0.54	1	2	3
0.55 - 0.59	-	-	-
0.60 - 0.64	-	-	-
0.65 - 0.69	-	-	-
0.70 - 0.74	-	1	1
total	40	38	78

b. Distribution of probabilities of the F- values

F- value upper limit	Number of variables for: a_{ij}'s	t_{ij}'s	total
- 1%	28	33	61
- 5%	25	13	38
-10%	7	8	15
total	60	54	114

c. Features of the results for particular SIMV sectors

SIMV sector	a_{ij}'s row-wise cases	ØR^2	a_{ij}'s column-wise cases	ØR^2	t_{ij}'s row-wise cases	ØR^2	t_{ij}'s column-wise cases	ØR^2
1. Agricult.	2	26.5	2	23.5	2	28.0	3	16.7
2. Agri-food	3	19.7	3	17.3	3	25.7	3	18.7
3. Energy	6	26.2	7	22.3	5	16.8	5	31.8
4. Basic pr.	8	34.9	9	26.9	8	37.8	8	23.7
5. Light ind.	8	28.2	6	23.7	7	25.4	5	25.8
6. Equipment	3	19.7	4	29.0	4	25.0	4	27.0
7. Construct.	2	22.0	3	27.7	3	18.0	3	25.7
8. Services	5	14.8	6	27.3	6	17.3	7	26.6
Value added	3	25.0	-	-	-	-	-	-
Total (Av.)	40	25.6	40	25.6	38	25.1	38	25.1

Table 13.
Frequency of value added shares as explanatory variables for the a_{ij} and t_{ij} coefficients

SIMV Sector	UNIDO industry	a_{ij}'s: i	j	i=j	v_j[2]	total	t_{ij}'s: i	j	i=j[1]	v_j	total	total: i	j	i=j	v_j	total	ø
1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	3	1	1	1	-	3	-	-	-	-	-	1	1	1	-	3	
	4	-	2	-	1	3	-	-	1	-	1	-	2	1	1	4	(3.5)
	5	-	1	-	-	1	-	1	-	-	1	-	2	-	-	2	
	6	3	1	-	-	4	4	1	-	-	5	7	2	-	-	9	
4	7	2	1	1	-	4	3	2	-	-	5	5	3	1	-	9	
	8	-	2	-	-	-	-	-	-	-	-	-	2	-	-	2	
	9	3	1	-	-	-	2	1	-	-	3	5	2	-	-	7	
	10	2	1	1	1	5	3	1	-	-	4	5	2	1	1	9	(7.9)
	11	1	1	-	-	2	2	1	-	-	3	3	2	-	-	5	
	12	4	2	1	1	8	4	2	1	-	7	8	4	2	1	15	
5	13	-	1	-	-	1	1	2	-	-	3	1	3	-	-	4	
	14	2	1	-	-	3	2	1	-	-	3	4	2	-	-	6	
	15	-	-	1	-	1	-	-	-	-	-	-	-	1	-	1	(4.5)
	16	1	1	-	-	2	-	1	-	-	1	1	2	-	-	3	
	17	-	1	-	-	-	-	-	-	-	-	-	1	-	-	1	
	18	5	1	-	-	6	4	2	-	-	6	9	3	-	-	12	
6	19	-	1	-	-	1	1	2	-	-	3	1	3	-	-	4	(2.0)
	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	22	2	-	-	-	2	2	-	-	-	2	4	-	-	-	4	
	23	1	3	-	-	4	1	1	1	-	3	2	4	1	-	7	(6.0)
	24	-	3	-	-	3	-	4	-	-	4	-	7	-	-	7	
Total		27	25	5	3	60	29	22	3	-	54	56	47	8	3	1[illegible]4	

1) Main diagonal
2) Value added

Table 14. Regression equations for value added shares (s_m, s_n)

UNIDO industry	Intercept	GDP per head	Population	Pop. density	Export share	R^2
1. Agriculture	-	-	-	-	-	-
2. Agri-food	-	-	-	-	-	-
3. Coal mining	-	-	-	-	-	-
4. Petroleum & gas	0.055	-	-	-	1.061 (1%)	0.74
5. Petr. & coal pr.	-	-	-	-	-	-
6. Electricity etc.	0.426	0.110 (5%)	-	-	-	0.15
7. Metal ore mining	0.073	-	-0.291 (5%)	-	1.870 (1%)	0.48
8. Other mining	0.125	-0.036 (5%)	-	-	1.312 (1%)	0.31
9. Paper & products	0.049	0.042 (1%)	-	-	-	0.41
10.Chemicals	0.239	-	0.360 (10%)	-	-	0.11
11.Non- metallic p.	-	-	-	-	-	-
12.Metals	0.120	0.048 (1%)	0.368 (5%)	-	-	0.22
13.Textiles	0.353	-0.064 (1%)	-	-0.075 (5%)	-	0.32
14.Wearing app.	0.288	-0.040 (5%)	-0.508 (5%)	-	-	0.22
15.Wood products	-	-	-	-	-	-
16.Printing & publ.	0.040	0.037 (1%)	-	0.043 (1%)	-	0.47
17.Plastic & rubber	0.115	-	-	0.051 (10%)	-	0.10
18.Metal products	0.082	0.057 (1%)	-	-	-	0.32
19.Machinery	0.479	0.053 (5%)	-	-	-	0.15
20.Transport equip.	0.521	-0.053 (5%)	-	-	-	0.15
21.Construction	-	-	-	-	-	-
22.Trade	0.399	-0.059 (5%)	-0.608 (5%)	-	-	0.19
23.Transport & com.	0.130	-	1.463 (1%)	-	-	0.58
24.Other services	0.588	-	-1.041 (1%)	-	-	0.29

But also the frequency of particular UNIDO industries in the regression equations is rather uneven. In the energy sector the frequency is rather high for industry 6- Electricity gas and water, which appears very often as the row element and influences the values of coefficients for the energy input into the other sectors. In the basic products sector the frequency is very high for industry 12- Metals and also for industries 7- Metal ore mining and 10- Chemicals. All these industries are important row elements. In the light industry sector the frequency is high for industry 18- Metal products, again an important row element. On the contrary , an important column element is industry 24- Other services in the service sector.

4.5 Dependence of the output mix on GDP per head, population number, population density and endowment with natural resources.

The output mix, i.e. the industry composition of the value added of particular sectors is again probably dependent on the level of economic development, size of the country and- also- on the endowment with natural resources.
The first three variables were allready used in the regression analysis for the input and technological coefficients of the tables in the STMV sectoral classification and for the input coefficients of the tables in the UNIDO industry classification.
The endowment with natural resources will be applied to certain industries only and will be measured by the exports shares in total exports. In particular, following export shares will be used:

SITC 321- Coal and coke .... Industry 3- Coal mining
SITC 331- Petroleum crude....................... Industry 4- Petroleum and gas
SITC 33 - Petroleum and petroleum products .... Industry 5-Petroleum and coal products
SITC 28 - Metalliferous ore..................... Industry 7- Metal ore mining
SITC 27 - Fertilizers and minerals............. Industry 8- Other mining

The values of these shares for the 30 countries of the sample are presented in Table 2.
The analysis of the intercorrelation of the export shares with the other explanatory variables gave the following results(regression coefficients R):

SITC	y	p	d
27	-0.2594	-0.0692	-0.1088
28	0.3061	0.1718	-0.1058
321	0.1358	0.1718	-0.1058
33	-0.2918	-0.0393	0.0910
331	-0.2842	-0.0262	-0.0795

The only correlation coefficient which cannot be neglected is that for the relation between between the export share of SITC- 28 (Metalliferous ore) and GDP per head. It equals to 0.3061, the regression equation reads as follows:

$exp_{28} = 0.072 - 0.019\ y \quad ; R^2 = 0.0937$ (St. error = 0.0661)

F value is equal to 2.895 and just at the limits of significance at 10% probability. This interrcorrelation could have some influnce on the regression equation for the share of industry 7.

The results of the regression analysis for the 24 UNIDO industries are presented in Table 14. No results could be- ex definitione- obtained for the industries 1,2 and 21, no results were obtained for industries 5- Petroleum and coal products, 1'- Non-metallic products and 15- Wood products. Only linear regression equations were tried.

The most frequent explanatory variable is GDP per capita. The size of the country has an important role in shaping the output mix in the service sector. Out of the five export shares only three appear in the regression equation, the export shares seem to be not the best indicator of endowment with natural resources.

4.6 Brief summary

The results of various analytical calculations were presented in Tables 3 - 13. These data provide the basis for the investigation of factors influencing the values of input coefficients in input- output tables in the SIMV sectoral classification. Regression equations were used for the investigation of the input and technological coefficients of the SIMV tables, for input coefficients of input- output tables in the 24- industry UNIDO classification and for the output composition of the SIMV sectors by the UNIDO industries. Only linear regression equations were applied. The results are valid only for the set of data used, i.e. for standardized input output tables for 1970 for 30 countries. These tables were created on the basis of the data bank of the Bardford university. The reliability of these data is not known. These data also have no direct relation to the regional input- output tables to be used in the SIMV world model.

5. Evaluation of the results of the regression analysis

Evaluation of the results will be carried out by SIMV sectors, both column- and row- wise.

5.1 Agriculture

Sector of agriculture in the SIVM classification is identical to the same industry in the UNIDO classification.

The input coefficients in the column of agriculture are of different size. Four are large coefficients: a_{11}, a_{21}, a_{81} and a_{v1}; three coefficients are small: a_{51}, a_{61} and a_{71}. The variability of most input coefficients (also of the small ones) is relatively small (Table 3).

The values of the input coefficients depend of GDP per head- five coefficients (a_{21}, a_{41}, a_{51}, a_{61} and a_{71})increase with the GDP per head, the value added coefficient a_{v1} obviously decreases with GDP per head. Density of population has a positive impact on a_{21} and a_{81}, negative on a_{v1}. The size of the country has negative impact on a_{v1} only (Table 4).

A shift from input coefficients to technological coefficients is made easy by the fact that there is a good regression equation for a_{v1}. It brings important changes in the results, since it provides a regression equation for the intermediary deliveries within the agriculture , i.e. for t_{11}. On the other side most regression equations for the other coefficients, except for t_{21} and t_{71}) are no more significant (Table 5).

A look at the regression equations for the UNIDO industries gives only a partial explanation of the regression equations for the coefficients in the SIMV sectoral classification. The regression equation for a_{41} (basic products) might be due to regression equations for inputs into agriculture form industries 10 and 11 (chemicals and non- metallic minerals), in the light industry there is only ine significant,but not very useful result (the intercept as well as the regression coefficient are close to zero) for industry 16 (printing and publishing). The regression equations for the three service industries which form the service sector are good, it seems that in particular trade plays important role (Tables 10, 11 and 12).

The attempt to explain the values of the input coefficients by the output mix of the sectoral inputs into agriculture gave poor results. Significant regression equations were found only for a_{41} and a_{51} as well as for t_{41} and t_{51}. Both coefficients are small. The input and technological coefficient for the input from the light industry to agriculture seems to depend on the share of industry 18 - Metal products, the input from the basic products sector on industries 9- Paper and paper products and 11- Non- metallic minerals alternatively. Relatively good regression equations are available for s_9 and s_{18}, no equation for s_{11} (Table 14).

To sum up : The results would allow to project the values of following coefficients: a_{v1} , a_{21} and a_{81} as well as t_{11}. The remaining coefficients are not very important and most of the regression equations problematic.

The input coefficients from agriculture into other sectors are important in two cases only: for the inputs into the agri- food processing (a_{12}) and into the light industry (a_{15}). The rest is of less importance.

The first coefficient depends on the size of the country and population density, the second one on the GDP per head. Population density explains also the value of the small input coefficient for the service sector a_{18}. The results for the technological coefficients are rather similar (Tables 4 and 5).

Looking at the regression equations for UNIDO industries one can see, that the input from agriculture into the light industry can be explained by inputs into the textiles and apparel (industries 13 and 14) and the input into the service sector by the input into industry 24- other services (Tables 10,11, and 12). And among the regression equations explaining the input and technological coefficients one finds a_9 (paper) explaining the input into the basic products and a_{13} (textiles) explaining the input into the light industry.

To sum up: The inputs from agriculture to other sectors are important in two cases only: for the agri- food processing and for the light industry. The former input coefficient depends on the size of country and population density, the latter on GDP per head and is also linked with the inputs of agricultural raw material into the textile industry (which is one of the components of light industry sector). Explanation was also found for the input from agriculture into the basic products sector (due to the inputs into the paper industry) and for services, but both coefficients are rather small.

5.2 Agri- food processing

The sector of agri- food processing in the SITV classification is identical to the same industry in the UNIDO classification.

The input coefficients in the column of agri-food processing are of different size. Four coefficients are large : a_{12}, a_{22}, a_{82} and a_{v2}, three are small: a_{32}, a_{62} and a_{72}.

The values of the input coefficients depend predominantly on the size of the country and population density. This applies to the value added coefficient (with positive coefficient for d, but low F value) and for the input from services (also positive coefficient for d and better value of F). On the contrary the coefficients of d for the inputs from agriculture and the intra- industry input are negative. The size of the country appears(number of population) only in the equations for a_{12} and a_{22} with opposite signs:there seems to be a shift in favour of inputs from agriculture at the expense of intra- industry inputs caused by the increase in the size of the country (Table 4).

A shift from input coefficients to technological coefficients did not bring profound changes: only the regression equation for a_{22} (with both values of F rather low) disappeared (Table 5).

Detailed regression equations by the 24 UNIDO industries bring very little additional information. The input from services seems to depend on the input from trade, but the regression equation includes three explanatory variables(y,p,d) and the F value of d is the lowest one (Annex).

The analysis of the dependence of the input coefficients on the output mix does not bring much additional clarity too. One can see the input from services to be dependend on the share of transport and communication , but the F value of the coefficient is low and the equation disappears for the technological coefficients (Tables 10 and 11).

To sum up: Regression equations for four large input coefficients were found. The explanatory variables are density of population and the size of the country respectively, the results are rather difficult to interpret.

Row-wise there are only two important inputs from the agri- food processing sector into agriculture and the intra- sectoral input. The other input coefficients are small, the agri- food sectors delivere most of the output to final demand. The variation of some of the input coefficiente is rather large (Table 3).
The explanation of these small coefficients (the two large coefficients , a_{21} and a_{22} have been already dealt with) was found for the inputs into sector basic produces (both for the input and technological coefficient). This input decreases with GDP per head (Tables 4 and 5). The regression equations for the 24 UNIDO industries bring no improvement, there is only one equation for the componente of the sector basic products:for non- metallic minerals. The determination coefficient is very high - 0.91- but the number of countries with non - zero elements in this cell is only 9 (out of 30) and the explanatory variable is not y, but p (Tables 8,9 and the Annex).
The regression equations explaining the input coefficients by output mix bring three results (for rather non- important coefficients*): the input into the energy sector is linked to the output share of s_4 (petroleum and gas), the input into the basic products sector is linked to s_{12} (metels) and the input into the service sector to s_{24} (other services). The results of regression analysis for the input and technological coefficients are rather similar (Tables 10 and 11).
To sum up: except for the link of the agri-food processing to agriculture and the intra- sectoral inputs the explanation of the inputs from agri-food processing to the other SIMV sectors is rather poor But these inputs are not very important.

5.3 Energy

The energy sector is composed of four industries: coal mining, petroleum and gas, petroleum and coal products , electricity, gas and water (Table 1).
Two industries of the energy sector seem to be very negatively affected by the processing of the input- output tables at Bradford. Non- zero values of value added (as well as of other intermediate inputs) are available for 10 countries only in the case of 03- coal mining and for 8 countries only in the case of 04- petroleum and gas (in spite of the fact, that these industries are contained in the original national classifications of the input- output tables). This ommission cannot be explained by inconsistencies between the original national classifications and the UNIDO 24 industry classification- such inconsistencies were found for four countries only (Table 9). This deficiency of the data affects negatively the analysis of the output mix and the regression analysis of the input coefficients at the 24 industry level.
It should not suprise, that the explanation of the composition of the sector by industries(of the output mix) is not good. No regression equations have been found for the shares s_3 (coal mining) and s_5 (petroleum and coal products). The share s_4 (petroleum and gas) depends on the share of exports of these products in total exports(i.e. on the proxy for natural endowment). Only s_6 (electricity, gas and water) is reasonably explained; it increases with GDP per head, but the equation

is no doubt negatively affected by the ommissions of the coal mining and petroleum and gas in 20 and 22 countries of the sample respectively.

In the column of the energy sector there are the following three large coefficients: a_{33}, a_{83} and a_{v3}. The other coefficients are small, their variation often large. The explanation of the input coefficients by GDP per head, size of the country or population density did not perform well. Out of the three large coefficients the value added coefficient and the intra- sectoral inputs could not be explained, regression equation was found only for the inputs from the service sector: the coefficient increases with population density. But the corresponding technological coefficient could not be explained by the regression analysis.

Relatively good is the regression equation for the small coefficient of the input from construction (Tables 3 and 4).

The regression analysis of the dependence of the input coefficients on GDP per head, size of the country and population density at the 24 industry level gave no better results. Missing information for large number of countries could explain the poor results for industries 03- coal mining and 04 petroleum and gas- and also the negative intercepts in the regression equations. But the results are hardly better for industries 05 - petroleum and coal products and even for 06- electricity, gas and water (Tables 7,8,9 and the Annex).

An attempt to explain the input coefficients by output mix gave slightly better results. The coefficients a_{23}, a_{33}, a_{43}, a_{53}, a_{63}, a_{83} and a_{v3} are dependent on the shares s_3 , s_4, s_5 or s_6 respectively. But one should be very careful in the interpretation of these results. The first two shares appear most frequently and this might be due to the fact, that two thirds of their values are equal to zero. Parallel analysis for the technological coefficients gave different results (Tables 10 and 11).

To sum up: the data on the energy sector are strongly biased by the low quality of the input- output tables used for the analysis. Consequently are the results of the analysis of the dependence of the input coefficients on either GDP per head, size of the country and population density or on the output mix rather poor. This, however, does not prove, that such interrelations do not exist in the real world.

There are only two important inputs of energy into the other sectors: the intra- sectoral input, which was already dealt with, and the energy input into the basic products sector (a_{33}). The variability of all coefficients in the energy sector row is small (Table 3).

The important input coefficient for the input of energy into the basic products sector is explained by GDP per head, size of the country as well as by population density (Tables 4 and 5). This is not suprising, since a parallel analysis at the industry

industry level has explained most of the input coefficients at the intersection of rows of industries 03 - 06 (energy sector) and of columns 07 - 12 (basic products sector). Very well explained are in particular the links between industries 03 and 06 (coal and electricity) on the one side and 10, 11 and 12 (chemicals, non-metallic minerals and metals) on the other side (Table 8 and the Annex). The variability of the electricity input coefficients into industries 09- 18 is exceptionally low (Table 7). These findings are supported by the analysis of the influence of the output mix. The energy input into basic products, equipment goods and construction depends on the electricity share s_6. The output mix of the receiving sectors plays, however, also a rather strong role.The importance of the electricity share s_6 comes out even stronger from the analysis for the technological coefficients (Tables 10 and 11). One can also see, that the electricity share s_6 appears very frequently in the regression equations for the role of the output mix (Table 13).It is positively correlated with GDP per head (Table 14).

To sum up: in spite of the low quality of data on the energy sector, and in particular industries 03- coal mining and 04- petroleum and gas, the energy inputs into other sector seem to be relatively well defined. This is overwhelmingly due to the industry 06- electricity. Electricity input coefficients in the other industries have a very low variability, the share of electricity in the energy sector influences the values of energy inputs into other sectors and is linked to the GDP per head.

5.4 Basic products

The basic products sector is composed of six industries: metal ore mining, other mining, paper and paper products, chemicals , non- metallic mineral products and metals.In 10 countries of the sample there were classification inconsistencies for the first two industries (09 sns 10), which probably negatively influenced the results of the analysis. (Table 3 and 9).
The regression equations for the industry composition of the sector are relatively good. They show a positive dependence on GDP per capita for paper and paper products as well as for metals and a negative dependence for other mining. The size of the country influences positively the share of chemicals and negatively the share of other mining. The export share (used as proxy for natural endowment) influences the shares of the two mining industries. Only the explanation of the share of non- metallic mineral products is missing (Table 14).
In the column of the basic products sector there are four large input coefficients: a_{34}, a_{44}, a_{84} and a_{v4}. The variability of most input coefficients is small (Table 3).

The results of the analysis of the dependence of the input coefficients on GDP per head, size of the country and population density are rather weak. The value added coefficient is negatively correlated with GDP per head, the intra- sectoral inputs are positively correlated with GDP per head(but the F- value is rather low) and the inputs from the service sector are positively correlated with population density. The last two results, however, do not come out in the analysis of the technological coefficients(Tables 4 and 5).

The energy input into the basic sector was touched upon above in paragraph 5.3. The reasons for the weak results for the other large coefficients can be understood if one looks at the regression analysis at the 24 industry level In the case of intra-sectoral inputs, only the inputs from non- metallic minerals could be well explained. The value added coefficient could be explained only for industry 07- metal ore and industry 11- non- metallic minerals. On the other side, the regression analysis for the transportation inputs into the industries of the basic products sector gave very good results. These inputs depend predominantly on the size of the country and on population density. (Tables 7,8,9 and the Annex).

The analyis of the dependence of the input coefficients in the column of the basic products sector has shown that two sectoral shares influence the intra- sectoral inputs and the value added coefficient. These are s_{10}- chemicals and e_{12} - metals. The impact on these two input coefficients is complementary, both shares are positively correlated with the intra- sectoral inputs and negatively with the value added coefficient. It could be very well a consequence of differences of the statistical treatment of intrasectoral flows in national input- output tables as well as of the aggregation of national tables of different size into the SIMV classification framework.The analysis of the technological coefficients has shown only the influence of e_{12} on the intra- sectoral flows. (Tables 10 and 11). Nevertheless, the shares of chemicals and metals, i.e. s_{10} and s_{12} appear rather frequently in the regression equations . Both are positively correlated with GDP per head, and the share of chemicals is also positively correlated with the size of the country (Table 14).
To sum up: the results of the analysis of the inputs into the basic products sector did give much satisfactory results. Good explanation was found only for the inputs from services and for the value added coefficients. The investigation of the role of the output mix has indicated the importance of the shares of chemicals and of metals respectively.

In the row of the basic products sector there are four important inputs: a_{44}, a_{45}, a_{46} and a_{47}; i.e the intra- sectoral inputs and inputs into the light industry sector, equipment goods industry sector and into construction. The variation of the coefficients in the basic products row is relatively small (Table 3).
The input into the light industry is linked with GDP per head (but the F- value of the regression coefficient is rather low); the input into the equipment goods sector is linked to the size of the country; the input into construction is negatively correlated with GDP per head. The parallel analysis of the technological coefficients has shown in the last case dependence on population density ;what makes the interpreation of the inputs into construction rather difficult(Tables 4 and 5).

The regression analysis at the 24 industry level shows, that the inputs from the basic products sector to other sectors are predominantly determined by inputs from the following two industries: 09- paper and paper products and 11- non- metallic mineral products. The first case reflects the demand on packing material, the inputs depend positively on GDP per capita. The second case reflects inputs from the cement industry(building maintenance), the level of the inputs is positively correlated to the size of the country. Both relations can be economically easily understood (Table 8). It is also interesting to note, that the variability of the inputs from 09 to other industries is relatively small (Table 7).
In the explanation of inputs from the basic products sector to other sectors by output mix the same two shares as in the explanation of the input structure of the basic producs sector prevail. These are s_{10} - chemicals and s_{12}.- metals. Parallel analysis for the technological coefficients confirmed this relation (Tables 10 and 11).

To sum up: the inputs from the basic products sector to other sector , and in particular the important inputs, can be rather well explained by GDP per head, size of the country on the one side and the output mix on the other side. In the former case the relation is mainly given by the inputs from the paper and non- metallic minerals industries, in the latter case, the shares of chemicals and metals play the main role.

5.5 Ligh industry

The light industry sector is composed of six UNIDO industries: textiles, wearing apparel, wood products, printing and publishing, plastic and rubber and metal products. The explanation of the composition of this sector is rather good. Four industry shares are depended on the GDP per head; two positively- printing and publishing and metal products-,two negatively- textiles and wearing apparel.A negative dependence on population number was found for the share of wearing apparel. Population density enters three regression equations: with negative sign for textiles, with positive sign for printing and publishing and plastic and rubber. Contrary to the role of the GDP per head is the role of the size of the country and of the population density not easy to understand (Table 14).

There are five important inputs into the light industry: a_{15}, a_{45}, a_{55}, a_{85} and a_{75}; i.e inputs from agriculture, basic products, services, the intra- sectoral inputs and value added. The remaining three inputs are small, the variation in general low (Table 3).

Only three important inputs could be explained by GDP per head, size of the country or population density. No explanation was found for the value added coefficient and for the intra- sectoral inputs. The explanatory variable for a_{15} and a_{45} is GDP per head, for a_{85} tha population density. These relations were confirmed by the analysis for the technological coefficients (Tables 4 and 5).

The analysis at 24 industry level helps to understand better the results at the 8 sector level. The inputs from agriculture are shaped mainly by inputs into industries 13- textiles and 14- wearing appparel (see also paragraph 5.1). The inputs from the basic products sector are shaped mainly by inputs from 09- paper and paper products and 11- non- metallic mineral products.(See also paragraph 5.4). The inputs from the service sector are shaped mainly by trade and transportation margins, i.e. by industries 22 and 23. It is however difficult to understand, that no regression equation was found for the intrasectoral inputs a_{55}, since at the industry level 16 input coefficients (out of 36) could be explained by GDP per head, size of the country or population density. Particularly good is the explanation of coefficients in the row and column of 16- printing and publishing and in the column of 18- metal products (Tables 7,8,9 and the Annex).

Some additional information of the input structure is provided by the analysis of the influence of the output mix. In the output mix, the share of 15- wood products, plays a strange role. It is positively correlated to value added coefficient and negatively to the intra- sectoral inputs. This complementary impact(which can also be due to methodological differences in the treatment of flows on the main diagonal), is of little analytical use, since no regression equation has been found for the explanatory variable, i.e. for a_{15}. The equation for the inputs from agriculture only confirms the decisive role of the textiles- a_{13}. The input from the basic products sector is shaped by metal processing, it depends both on the share of the delivering industry 12- metals as well as the share of the receiving industry 18- metal products.

Row- wise there are only three important inputs from the light industry sector: a_{55}, a_{56} and a_{57}; i.e. the intrasectoral inputs, inputs into the equipment goods sector and into construction (Table 3).
None of these important coefficients could be explained by GDP per head, size of the country or population density, but the regression analysis gave good results for the other, small coefficients in the row of the light industry sector. Analysis of technological coefficients did not bring any substantial improvement (Tables 4 and 5).
The explanation of these poor results can be seen in the pattern of the results of the investigation at the 24 industry level. The six industries of which the light industry sector is composed fall clearly into two groups: One group consists of industries 13- 15 (textiles, wearing apparel and wood products), delivering mainly for the final demand. The explention of their intermediate inputs into the other industries is rather poor. The other group consists of industries 16- 18 (printing, plastic & rubber and metal products). Their intermediate inputs into the other industries(and in particular the inputs from printing and publishing)

are rather often explained by the regression equations. These inputs depend mainly on GDP per head (for printing and publishing and metal products) or on the size of the country (plastic, rubber). In the latter case the result is probably influenced by the inclusion of ISIC 390- other industries, into industry 17- plastic and rubber (Tables 1,7,8,9 and the annex).

The investigation of the dependence of inputs from the light industry sector on the output mix gave rather clear results. The two most important shares are those of metal products- s_{18} and of wearing apparel -s_{14}. They both depend on GDP per head, the former positively and the latter negatively. The share of wearing apparel is also negatively correlated with the size of the country (Tables 10, 11, 13 and 14).

To sum up: It was possible to explain a few inputs into the light industry sector, in particular those from agriculture and from basic products. At the industry level these inputs are shaped mainly by inputs of agricultural raw materials into textiles and by inputs of metals into metal products. The inputs from the light industry to other sectors are non- homogenous. They can be very well determined for three out of the six industries forming the light industry sector and very badly for the other three industries. The two industries which shape these inputs are 16- printing and publishing and 18- metal products.

5.6 Equipment goods

The sector of equipment goods consists of two industries: 19- machinery and 20- transportation equipment (Table 1). The share of the latter industry decreases with GDP per head (Table 14).

There are five important inputs into the equipment goods sector: a_{46}, a_{56}, a_{66} and a_{v6}; i.e. inputs from basic products, light industry, services, the intra-sectoral inputs and value added (Table 3).

The attempt to explain the input structure by GDP per head, size of the country or population density gave rather poor results. Only the intra- sectoral inputs (among the important coefficients) could be explained by GDP per head, the result was confirmed by the analysis for the technological coefficients (Tables 4 and 5).

The analysis at the 24 industry level allows to see the reasons for these disappointing results. For both industries 19 and 20 no explanation of value added coefficient was found. The inputs from the basic products sector could be explained for industries 09- paper and paper products, 10- chemicals and 11- non- metallic minerals. The inputs from the light industry sector could be explained for half of the industries only, the results confirm the finding about the non- homogenity of the output of this sector. Among the inputs from

from the service sector, only the transportation inputs were explained (Tables 7,8,9 and annex).

The analysis of the impact of the output mix has shown, that three important inputs into the equipment goods sector can be explained by the output mix of the delivering sectors. Inputs from the sector of basic products depend on the shares s_{10} and s_{12} (chemicals and metals- see also paragraph 5.4), inputs from the light industry on s_{14} and s_{16} (wearing apparell and printing and publishing- see also paragraph 5.5) and inputs from the service sector on s_{22} (trade). The parallel analysis for the technological coefficients brings similar results, the only change is the role of the share s_{19} (machinery), which explains the inputs from basic products and service sectors (Tables 10 and 11).

To sum up: the explanation of the input structure of the equipment goods sector by GDP per head, size of the country or population density is rather weak, but the explanation by the output mix of certain delievering sectors gives relatively good results.

The inputs from the equipment goods industry to other sectors are not important (only the intra- sectoral input coefficient a_{66} is large). Nevertheless, most of the small coefficients in the row of the equipment goods sector(and also most small correspon-ding technological coefficients) can be very well explained by regression equations. The most frequent explanatory variable is GDP per head. This reflects the growing importance of equipment maintenance in the process of economic development (Tables 4 and 5).

Parallel analysis at the industry level shows, that this applies mainly to industry 19- machinery (Tables 8,9 and annex).

The attempt to explain the inputs from the equipemnt goods sector into the other sectors gave good results only for energy(the explanatory share is the s_3 , i.e. coal, which is a dubious indicator- see paragraph 5.3), basic products (the explanatory variable is s_{11} , which cannot be explained by GDP per head, size of the country or population density) and services (the explanatory variable is s_{23}- transport). Only the last interrelation makes sense (Tables 10,11 and 14).

To sum up: the deliveries from the equipment goods sector to other sectors are not very important, but can be easily explained by the GDP per head. They reflect the increase of the importance of repairs and maintenance of plant and machinery in the process of economic development.

5.7 Construction

The sector construction in the SIMV classification is identical to the industry 21- construction in the UNIDO classification.

There are four important inputs into construction: a_{47}, a_{57}, a_{87} and a_{v7} ; i.e. inputs from basic products, light industry , services and value added.(Table 3).

Only one important input coefficient could be explained by regression to GDP per head: a_{47}. It is negatively related to the per capita income, this relation was confirmed by the analysis for the technological coefficients (Tables 4 and 5). Parallel analysis at the 24 industry level shows, that this is due to similar regression for inputs from other mining and paper, but suprisingly, not from non- metallic minerals. The inputs from industries forming the light industry sector show the non- homogenity again (see also paragraph 5.5) the inputs from the equipment goods sector are determined for 19- machinery (Tables 7,8,9 and annex).

The results of analysis of the role of the output mix are equally poor. Again, explanation of a single important coefficient , of a_{47} was found. Its value is again strongly determined by the share of paper and paper products- s_{10}. This relation is not easy to interpret (Tables 10 and 11).
To sum up: the explanation of the input structure of the sector construction is rather poor. Only one important input, that from the basic products sector, could be explained, but even this explanation is not easy to interpret.

The inputs from construction into the other sectors are, in general, not important. Even the intra- sectoral inputs are , compared to other sectors, rather small, but this is probably the consequence of the lack of more detailed classification of the construction sector in most input- output tables (Table 3).

Nevertheless, most inputs from construction into the other sectors could be well explained by the regression analysis, and in particular by the level of GDP per head. Parallel analysis for the technological coefficients confirms these results (Tables 4 and 5). Analysis of the same relation at the industry level runs in the same direction (Tables 7,8,9 and annex). The explanation is the same as for the equipment goods sector, the results show the increasing importance of building maintenance at higher levels of economic development.

The attempt to explain the inputs from construction by output mix gave much worse results (regressions are, of course, ex ante excluded for a_{71}, a_{72} and a_{77}). The delieveries to the basic products sector depend on the share s_7 - metal ore mining and s_{10} - chemicals(the former share is rather dubious due to large number of aggregation inconsistencies (Table 8); the inputs into the service sector on s_{24} - other services (Tables 10 and 11).
It is easy to sum the results: the inputs from the construction sector to other sectors are not very important, but can be easily explained by regression to GDP per head.

5.8 Services

The service sector is composed of three industries: 22- trade, 23- trasportation and communication and 24- other services. The composition of the service sector can be quite well explained by the size of the country: the share of transportation and communications is increasing with the size of the country at the expense of the shares of trade and other services. The share of trade is also negatively related to the GDP per head (Table 14).

The only two important inputs into the service sector are the intra- sectoral inputs and the value added, all other inputs are small, but have a relatively low variation. The value added coefficient is almost a constant (Table 3).

But the regression analysis allows to explain the values of the small input coefficients only, the prevailing explanatory variables are size of the country and GDP per head.Parallel analysis for the technological coefficients brings a good explanation for the intra-sectoral inputs and stresses the importance of the size of the country as explanatory variable (Tables 4 and 5).

Regression analysis at the industry level helps to understand the result at the sectoral level. Transport and communications is both responsible for the good results for the intermediate inputs and for the bad result for the value added. In the latter case an assumption of constancy could be good hypothesis(Tables 8,9 and annex)

An attempt to explain the inputs into the service sector by output mix gave similar results: good equations for the small coefficients, bad equations for the two important coefficients. Only the technological coefficient for the intra- sectoral flows can be explained (but the F value is rather low). The output mix is in most cases represented either by a_{23} - transport and communications or by a_{24} - other services (Tables 10 and 11).

To sum up: the important inputs into the service sector cannot be explained, the less important inputs can be easily explained by GDP per head, size of the country as well as by the shares of transport and communications or of other services.

All inputs of the service sector to the other sectors are important, the average values of the input coefficients in the service sector row are in the interval between 0.075 (agriculture) to 0.135 (light industry). Their variation is rather small (Table 3).

Five of these input coefficients can be explained by regression analysis, the predominant explanatory variable is population density. A parallel analysis of technological coefficients gave, however, much less satisfactory results. (Tables 4 and 5).

The reasons of the results of the analysis at the sectoral level can be found in the results of the investigation at the industry level. The best explanation was found for the inputs of 23- transportation and communication (18 coefficients out of 24). These coefficients are strongly dependend both on GDP per head and the population density (Tables 7,8,9

The attempt to explain the inputs from the service sector gave results, which are only partly good. The shares of 22 (trade) and 23 (transportation and communication) prevail, the share of 24(other services) plays no role either for the input or for the technological coefficients (Tables 10 and 11).

To sum up: the inputs from services to the other sectors can be relatively well explained by the population density, less well by the output mix. In both cases the transportation and communication plays an important role.

5.9 Value added

All value added coefficients are important coefficients. Their average values range from 0.228 (agri- food processing) to 0.769 (services). Their variation is very small (Table 3).

The small variation might be one of the reasons, why the attempte to explain the value added coefficients by various regression equation gave results which are not very satisfactory and which also make the use of the technological coefficients difficult (values of technological coefficients can be detemined only if the value added coefficients are known.).

The results of calculations were already dealt with in paragraphs 5.1 - 5. 8, but will be briefly summarized again.

a_{v1} (agriculture) : the value of the coefficient is decreasing with GDP per head and also with population density (Table 4).

a_{v2} (agri- food processing): the value of the coefficient is increasing with population density (Table 5).

a_{v3} (energy): the value of the coefficient is increasing with the share of industry 4- petroleum and gas (Table 10). The value added coefficient of industry 4 depends on the size of the country (Annex).

a_{v4} (basic products): the value of the coefficient is decreasing with GDP per head (Table 4) and also with the shares of industries 10 - chemicals and 12- metals. The value of the coefficient at the industry level could be determined only for industries 7- metal ore mining and 11- non- metallic mineral products (Annex).

a_{v5} (light industry) :the value of the coefficient depends on the share of industry 15- wood products (Table 10). The share of industry 15 in sector 5 could not be explained (Table 14). At the industry level, the value added coefficients could be explained only for industries 15- wood products and 17-plastic and rubber products. They depend both on the size of the country, the latter coefficient depends also on population density (Annex).

a_{v6} (equipment goods industry): No explanation of the value added coefficients both at the sectoral and industry level was found.

a_{v7} (construction): No explanation of the value added coefficient was found.

a_{v8} (services): No explanation of the value added coefficient at the sectoral level was found. At the industry level, value added coefficients for 22- trade and 24 - other services could be explained., They both depend(negatively) on the size of the country, the latter coefficient depends also(negatively) on GDP per head.(Annex). The very small variation of a_{v8} allows the hypothesis, that the value added coefficient is almost constant.

6. Very tentative conclusions

The variability of input- output coefficients was investigated for a sample of 30 countries which differ in the level of economic development (measured by GDP per capita) size (measured by the number of population)and population density (Table 2) National input- output tables, adjusted at the Bradford University to the 1970 output levels, were the only source of data. These tables were aggregated first into a 24- industry framework and , in the next step, into a 8- sector SIMV framework (Table 1). Details about the adjustment procedures carried out at Bradford are not known, the quality of data is probably not very good (at least of the data on two industries of the energy sector).

In spite of the problematic data quality the investigation provided several interesting and reasonabl results. Since, however, a similar investigation for a similar set of data was never carried out, it is difficult to assess how good and important these results are.

The input coefficients of the 8- sectors SIMV input- output table are of different size and can be divided into the following three groups: into 26 " large", 18 " medium size"and 28 " small" coefficients (Table 3.). The large coefficients are concentrated in three parts of the SIMV table: On the main diagonal, in the row of the service sector and in the value added row. The remaining large coefficients allow to locate the following important intersectoral relations: (i) between agriculture and agri-food processing- a_{12} and a_{21};(ii) between agriculture and the light industry- a_{15}(in fact a link to industry 13- textiles); (iii) between energy and basic products- a_{34}; (iv) between basic products on the one side and light industry(in fact a link between metals and metal products), equipment goods and construction on the other side- a_{45}, a_{46} and a_{47}.

The following results are of certain interest:

A. The variability of the input coefficient is decreasing with their size. It is very low for the value added coefficients, and in particular for the value added coefficient of the service sector, which can be held for constant. The variability of input coefficients at the 24 industry level is very low for the inputs of industry 06- electricity into the other industries- the electricity input coefficients can be held for a kind of " technological constant". This is also true, but to lesser degree , for inputs from industries o9- paper and paper products and 10- chemicals (Tables 3 and 7).

B. A number of coefficients can be explained by GDP per capita, size of the country or population density. This is in particular true in the following cases:

1. GDP per capita:

(i) The need for maintenance and repairs of fixed capital is increasing with GDP per capita. Consequently, the inputs from sectors equipment goods(and in particular from industry 19- machinery) into other sectors are increasing with GDP per capita.

(ii) The inputs from the sector basic products to other sectors are increasing with GDP per capita. This is mainly due to industries 09- paper and paper products and 12- metals. Inputs from these industries into the other industries increase with GDP per capita, the same is true for the shares of these industries on the output mix (Tables 8 and 14).

(iii) The intermediate inputs into agriculture increase, the value added(input) coefficient decreases with GDP per capita (Table 4).

(iv) The pattern of the light industry sector changes: the shares of industries 16- printing and publishing and 18- metal products increase, the shares of industrise 13- textiles and 14- wearing apparel decrease with GDP per capita. The inputs from the former two industries into the other industries increase with GDP per capite (Tables 8 and 14).

2. Size of the country:

(i) The inputs into the service sector increase with the siee of the country. This is mainly due to the inpute into 23- transportation. The pattern of the output mix also changes, the share of trasporation increases with the size of the country at the expense of both 22- trade and 24- other services.(Tables 4,8 and 14).

(ii) The inputs from the industry 11- non- metallic minerals (mainly cement) into other industriee increase with the size of the country. The same is true, to a lesser degree, for industry 13- plastic & rubber(inclusive other manufacturing). The letter relation cannot be so easily interpreted (Table 8).

3. Population density

(i) The inputs from the service sector into most other sectors increase with population density. This relation holds also for the three industries of which the service sector is composed. (Tables 4 and 8).

C. A number of coefficients depend on the output mix. The following cases are of interest:

(i) In the energy sector, the share of 06- electricity influencee the inputs from the energy sector into other sector. This might be due to the relative stability of the energy input coefficients.(Tables 7,10 and 14).

(ii) In the basic product sector, the share of 12- metals has strong impact both on the inputs into and the outputs from this sector(Tables 10 and 14).

(iii) In the light industry sector , the share of 18- metal products has a strong impact on the inputs from the sector to other sectors(Tables 10 and 14).

Annex - Regression equations for the input coefficients for the 24 UNIDO industries

Agriculture, Agri- food processing

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	01	-	-	-	-	-
02		0.007	0.033 (1%)	-	0.036 (5%)	0.37
03		-0.000	0.000 (5%)	-	-	0.15
04		-	-	-	-	-
05		-	-	-	-	-
06		0.001	0.002 (1%)	-	-	0.53
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		0.015	0.008 (5%)	-	-	0.14
11		-0.001	0.001 (1%)	0.008 (10%)	-	0.26
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		-0.000	0.000 (1%)	-	-	0.31
17		-	-	-	-	-
18		-0.002	0.003 (5%)	-	-	0.17
19		0.002	0.004 (5%)	-	-	0.18
20		-	-	-	-	-
21		0.000	0.005 (1%)	-	-	0.27
22		0.029	-	-	0.066 (1%)	0.49
23		0.010	-	-	0.008 (1%)	0.19
24		0.010	0.009 (5%)	-	-	0.18
01	02	0.338	-	0.588 (5%)	-0.097 (5%)	0.27
02		0.157	-	-0.203 (10%)	-0.030 (10%)	0.16
03		-	-	-	-	-
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		-	-	-	-	-
11		0.001	0.001 (5%)	0.020 (5%)	0.005 (1%)	0.68
12		-	-	-	-	-
13		0.006	-0.002 (10%)	-	-	0.12
14		0.001	-	-	0.004 (1%)	0.64
15		-	-	-	-	-
16		-	-	-	-	-
17		0.000	0.001 (1%)	0.020 (1%)	-	0.43
18		0.009	-	-	0.007 (10%)	0.11
19		0.001	0.001 (10%)	-	0.006 (1%)	0.42
20		-	-	-	-	-
21		0.002	0.001 (10%)	-	-	0.10
22		0.107	-0.026 (1%)	-0.190 (1%)	0.044 (10%)	0.29
23		-	-	-	-	-
24		-	-	-	-	-

Annex (cont) Coal mining , Petroleum and gas

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	03	-	-	-	-	-
02		-	-	-	-	-
03		-0.010	0.013 (5%)	0.152 (1%)	-	0.20
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-0.000	0.000 (10%)	-	-	0.10
09		-0.000	0.000 (5%)	-	-	0.19
10		-	-	-	-	-
11		-0.002	0.001 (1%)	0.068 (1%)	-	0.89
12		-	-	-	-	-
13		-	-	-	-	-
14		-0.000	0.000 (10%)	-	-	0.10
15		-	-	-	-	-
16		-0.000	0.000 (5%)	-	-	0.16
17		0.000	0.063 (1%)	-	-	0.64
18		-	-	-	-	-
19		-	-	-	-	-
20		-	-	-	-	-
21		-0.001	0.004 (5%)	-	-	0.17
22		-	-	-	-	-
23		-0.006	-	0.072 (1%)	-	0.79
24		-	-	-	-	-
01	04	-	-	-	-	-
02		-	-	-	-	-
03		-	-	-	-	-
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		-	-	-	-	-
11		-0.003	-	0.153	-	0.92
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		-	-	-	-	-
17		-0.003	-	0.153	-	0.92
18		-	-	-	-	-
19		-	-	-	-	-
20		-	-	-	-	-
21		-	-	-	-	-
22		-	-	-	-	-
23		-	-	-	-	-
24		-	-	-	-	-

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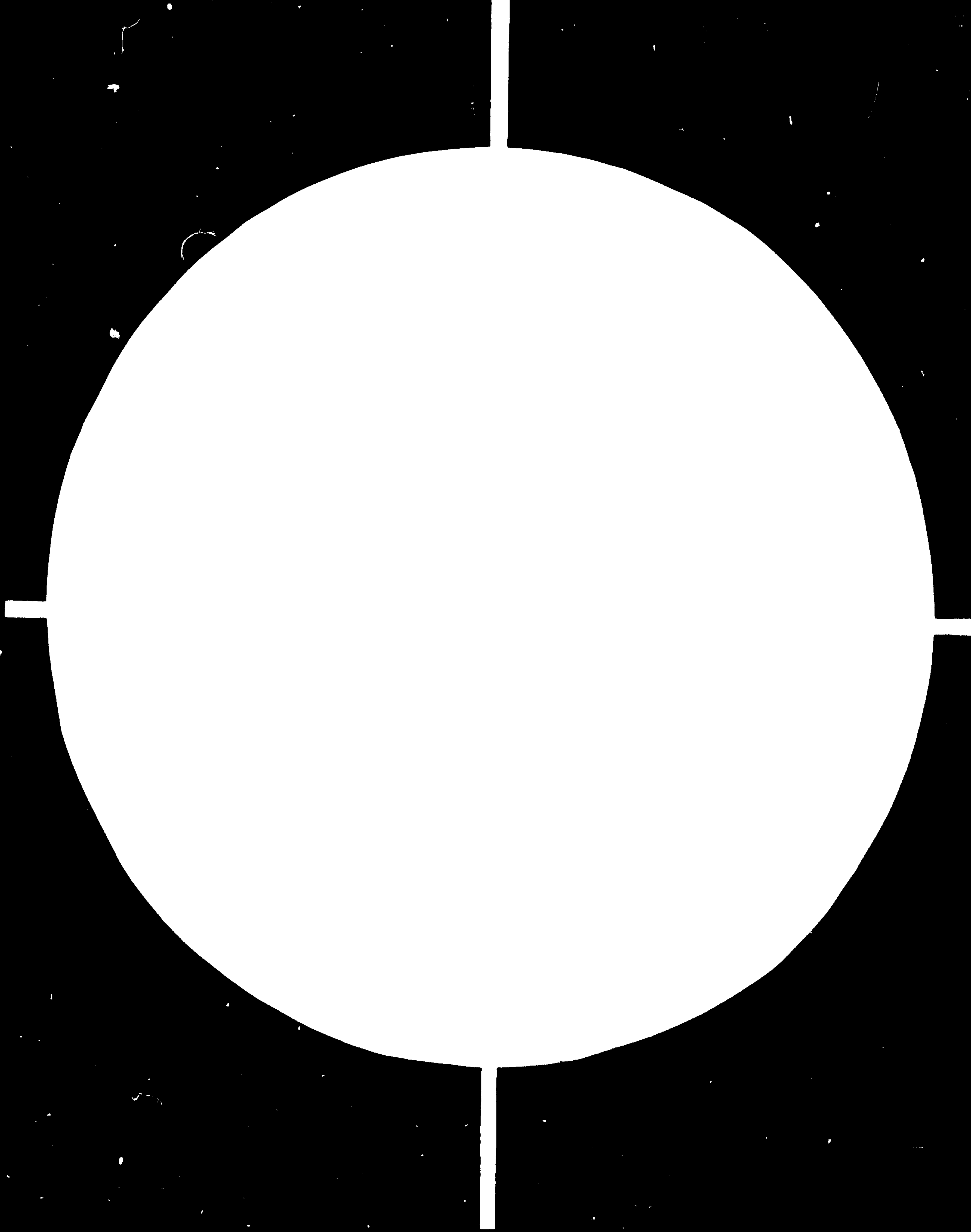

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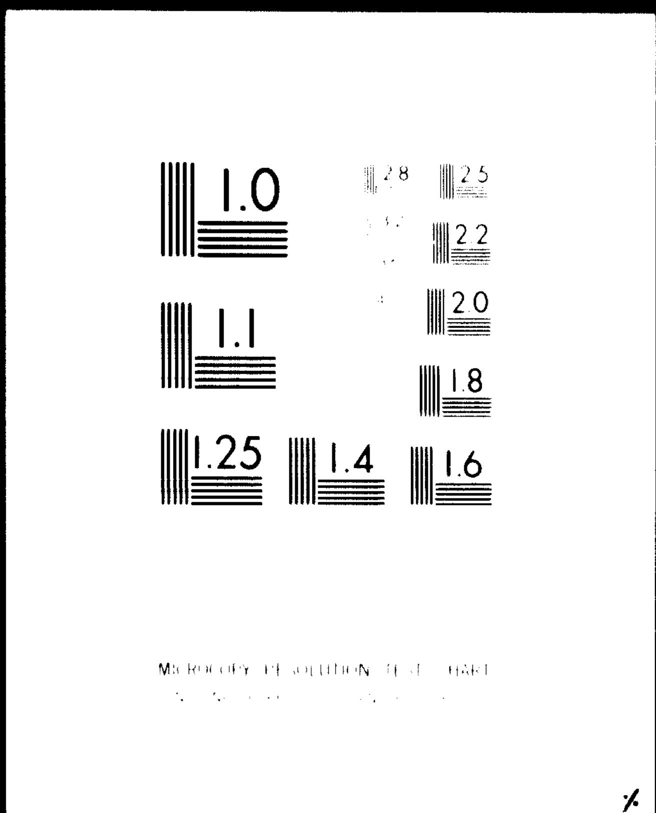

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Annex (cont.) Petroleum and coal products, Electricity, gas and water

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	05	-	-	-	-	-
02		-0.000	0.001 (10%)	-	-	0.13
03		0.002	0.009 (10%)	-	-	0.10
04		0.030	-	0.532 (1%)	-	0.31
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-0.002	0.004 (10%)	-	-	0.10
10		-	-	-	-	-
11		0.001	-	0.080 (1%)	-	0.56
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		-0.000	0.002 (10%)	-	-	0.12
17		-0.000	-	0.084 (1%)	-	0.63
18		-0.001	-	0.208 (1%)	0.017 (1%)	0.57
19		-	-	-	-	-
20		-	-	-	-	-
21		-	-	-	-	-
22		-	-	-	-	-
23		-	-	-	-	-
24		-	-	-	-	-
01	06	-0.000	0.000 (10%)	-	-	0.13
02		-	-	-	-	-
03		0.018	-	0.200 (5%)	-	0.20
04		-	-	-	-	-
05		0.051	-0.012 (5%)	-	0.361 (5%)	0.26
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		0.002	-	-	0.006 (1%)	0.64
11		-	-	-	-	-
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.001	0.000 (5%)	-	-	0.21
17		-	-	-	-	-
18		-	-	-	-	-
19		0.014	-	-	0.009 (10%)	0.10
20		-	-	-	-	-
21		0.004	0.012 (5%)	-	-	0.18
22		-	-	-	-	-
23		0.008	0.003 (10%)	-	-	0.12
24		-	-	-	-	-

Annex (cont.) Metal ore mining , Other mining

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	07	-	-	-	-	-
02		-	-	-	-	-
03		-	-	-	-	-
04		-	-	-	-	-
05		0.031	-0.011 (5%)	-	-	0.20
06		-	-	-	-	-
07		-0.003	0.021 (10%)	-	-	0.07
08		-	-	-	-	-
09		-	-	-	-	-
10		-	-	-	-	-
11		-0.004	0.003 (1%)	0.082 (1%)	-	0.65
12		0.002	0.002 (10%)	-	-	0.07
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.000	0.000 (10%)	-	-	0.07
17		0.000	-	0.005 (1%)	-	0.80
18		-	-	-	-	-
19		-	-	-	-	-
20		-	-	-	-	-
21		-	-	-	-	-
22		-	-	-	-	-
23		-0.048	-	3.326 (1%)	-	0.90
24		-	-	-	-	-
01	08	-	-	-	-	-
02		-	-	-	-	-
03		-	-	-	-	-
04		-	-	-	-	-
05		0.028	-0.006 (10%)	-	-	0.07
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		-	-	-	-	-
11		0.001	-	0.094 (1%)	-	0.49
12		-	-	-	-	-
13		-	-	-	-	-
14		0.000	-	0.010 (1%)	-	0.26
15		-	-	-	-	-
16		-0.000	0.001 (10%)	-	-	0.10
17		0.000	-	0.041 (1%)	-	0.76
18		-	-	-	-	-
19		-	-	-	-	-
20		-	-	-	-	-
21		-	-	-	-	-
22		-	-	-	-	-
23		0.015	-	0.762 (1%)	-	0.57
24		0.017	-	-	0.018 (5%)	0.15

Annex (cont) Paper and paper products, Chemicals

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	09	0.005	0.019 (5%)	-	-	0.16
02		-	-	-	-	-
03		0.001	-	0.063 (1%)	-	0.67
04		-	-	-	-	-
05		0.019	-0.004 (10%)	-	-	0.11
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		0.025	-	0.128 (1%)	-	0.32
11		-	-	-	-	-
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.003	0.003 (10%)	-	-	0.10
17		-	-	-	-	-
18		0.002	0.002 (10%)	-	-	0.12
19		0.005	0.003 (5%)	-	0.005 (5%)	0.21
20		0.001	0.001 (10%)	-	-	0.10
21		0.001	0.002 (5%)	-	-	0.20
22		0.057	-	-	0.046 (5%)	0.17
23		0.024	-	-	0.016 (5%)	0.19
24		0.036	-	-	0.018 (10%)	0.12
01	10	-	-	-	-	-
02		-	-	-	-	-
03		0.001	-	0.016 (5%)	-	0.17
04		-	-	-	-	-
05		-	-	-	-	-
06		0.009	0.010 (1%)	-	-	0.37
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		-	-	-	-	-
11		0.007	0.092 (1%)	-	-	0.45
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		0.004	-	0.019 (10%)	-	0.12
16		-	-	-	-	-
17		0.001	0.003 (1%)	0.090 (1%)	-	0.56
18		0.001	0.006 (1%)	-	0.020 (1%)	0.67
19		0.001	0.003 (1%)	-	0.004 (5%)	0.29
20		0.000	0.001 (10%)	-	-	0.11
21		0.001	0.003 (1%)	-	-	0.26
22		0.053	-	-	0.050 (5%)	0.20
23		0.013	0.007 (5%)	-	0.013 (5%)	0.26
24		0.047	-	-	0.030 (5%)	0.19

Annex (cont.) **Non-metallic mineral products, Metals**

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	11	-	-	-	-	-
02		-0.001	-	0.056 (1%)	-	0.91
03		0.005	-	0.038 (5%)	-	0.15
04		-	-	-	-	-
05		-	-	-	-	-
06		0.024	-	-	0.009 (10%)	0.12
07		-	-	-	-	-
08		0.043	-0.011 (10%)	-	-	0.12
09		0.015	-	-	0.011 (1%)	0.28
10		-	-	-	-	-
11		0.036	0.015 (10%)	-	-	0.10
12		-	-	-	-	-
13		0.001	-	0.045 (1%)	-	0.44
14		-	-	-	-	-
15		0.002	0.001 (5%)	-	0.002 (5%)	0.24
16		-0.000	0.002 (1%)	-	-	0.31
17		0.002	-	0.065 (1%)	-	0.65
18		0.000	0.002 (5%)	0.081 (1%)	-	0.63
19		0.004	0.004 (10%)	0.078 (1%)	0.012 (1%)	0.46
20		-	-	-	-	-
21		0.004	-	0.249 (1%)	-	0.70
22		-	-	-	-	-
23		0.043	-	0.240 (1%)	-	0.28
24		-	-	-	-	-
01	12	-	-	-	-	-
02		-	-	-	-	-
03		-0.000	-	0.080 (1%)	-	0.79
04		-	-	-	-	-
05		-	-	-	-	-
06		0.012	0.009 (1%)	-	0.013 (5%)	0.31
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		0.005	0.003 (10%)	-	-	0.10
11		-0.001	0.003 (1%)	0.037 (1%)	-	0.42
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.000	0.001 (5%)	-	-	0.21
17		0.001	-	0.031 (1%)	-	0.63
18		-	-	-	-	-
19		0.004	0.010 (1%)	-	-	0.25
20		0.003	-	-	0.014 (1%)	0.30
21		-	-	-	-	-
22		-	-	-	-	-
23		0.028	0.170 (1%)	-	-	0.22
24		0.024	-	-	0.083 (1%)	0.56

Annex (cont.) Textiles, Wearing apparel

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	13	0.128	-0.034 (5%)	-	-	0.14
02		-	-	-	-	-
03		0.000	-	0.005 (1%)	-	0.22
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		0.002	0.002 (5%)	-	0.008 (1%)	0.39
10		-	-	-	-	-
11		0.000	-	0.005 (1%)	-	0.40
12		-	-	-	-	-
13		-	-	-	-	-
14		-0.001	0.004 (10%)	-	-	0.11
15		-	-	-	-	-
16		0.001	0.002 (1%)	-	-	0.22
17		-	-	-	-	-
18		-	-	-	-	-
19		-	-	-	-	-
20		-	-	-	-	-
21		0.002	0.002 (10%)	-	-	0.10
22		0.054	-	-	0.044 (5%)	0.17
23		0.016	0.023 (1%)	-	-	0.41
24		-	-	-	-	-
01	14	0.019	-	0.310 (1%)	-	0.31
02		-	-	-	-	-
03		-	-	-	-	-
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		0.007	-	-	0.004 (5%)	0.16
10		-	-	-	-	-
11		-0.000	-	0.032 (1%)	-	0.74
12		-	-	-	-	-
13		-	-	-	-	-
14		0.080	-	0.322 (1%)	-	0.27
15		-	-	-	-	-
16		-	-	-	-	-
17		-	-	-	-	-
18		0.003	-	-	0.004 (1%)	0.35
19		-	-	-	-	-
20		-	-	-	-	-
21		0.000	0.002 (1%)	-	-	0.24
22		0.133	-0.033 (5%)	-	-	0.15
23		-	-	-	-	-
24		0.034	-	-	0.023 (10%)	0.10

Annex (cont.) Wood products, Printing and publishing

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	15	-	-	-	-	-
02		-	-	-	-	-
03		-	-	-	-	-
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-0.001	0.003 (1%)	-	-	0.54
10		-	-	-	-	-
11		-0.000	0.001 (1%)	0.058 (1%)	-	0.79
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		-0.000	0.001 (1%)	-	-	0.37
17		0.007	-	0.045 (5%)	-	0.19
18		-	-	-	-	-
19		-	-	-	-	-
20		0.001	0.001 (10%)	-	-	0.10
21		-	-	-	-	-
22		-	-	-	-	-
23		0.029	-	-	0.028 (1%)	0.27
24		-	-	-	-	-
01	16	-	-	-	-	-
02		-	-	-	-	-
03		-0.000	0.001 (10%)	-	-	0.12
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		-	-	-	-	-
11		-0.000	-	0.017 (1%)	-	0.91
12		-	-	-	-	-
13		0.001	-	0.007 (10%)	-	0.10
14		0.000	0.001 (10%)	-	-	0.11
15		0.000	-	0.008 (1%)	-	0.47
16		0.010	0.020 (5%)	-	-	0.16
17		-	-	-	-	-
18		-	-	-	-	-
19		0.004	-	-	0.007 (1%)	0.34
20		0.000	0.001 (10%)	-	-	0.12
21		0.000	0.002 (5%)	-	-	0.20
22		0.061	-0.017 (10%)	-		0.12
23		0.007	0.007 (1%)	-	-	0.25
24		-	-	-	-	-

Annex (cont.) Plastic and rubber products, Metal products

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	17	-	-	-	-	-
02		-0.000	-	0.072 (1%)	-	0.88
03		0.000	-	0.012 (1%)	-	0.46
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		0.002	0.007 (1%)	0.034 (10%)	-	0.40
10		0.038	0.018 (10%)	-	-	0.11
11		-	-	-	-	-
12		0.007	0.004 (10%)	-	-	0.11
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.002	0.002 (5%)	-	-	0.15
17		-	-	-	-	-
18		-0.001	0.005 (1%)	0.111 (1%)	-	0.45
19		-0.003	0.006 (1%)	0.123 (1%)	-	0.63
20		-	-	-	-	-
21		-0.008	0.004 (5%)	0.355 (1%)	-	0.89
22		0.102	-0.026 (5%)	-	0.071 (1%)	0.36
23		0.013	-	0.545 (1%)	0.016 (1%)	0.74
24		0.041	-	-	0.053 (1%)	0.36
01	18	-	-	-	-	-
02		-	-	-	-	-
03		0.001	-	0.011 (10%)	-	0.12
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		0.011	-	-	0.006 (10%)	0.12
11		-0.001	0.001 (1%)	0.040 (1%)	-	0.71
12		-	-	-	-	-
13		0.000	0.000 (10%)	-	-	0.10
14		-	-	-	-	-
15		-	-	-	-	-
16		-0.000	0.001 (1%)	-	-	0.35
17		0.004	-	0.035 (1%)	-	0.25
18		0.016	0.017 (10%)	-	-	0.13
19		0.002	0.007 (1%)	-	0.011 (5%)	0.27
20		-	-	-	-	-
21		-	-	-	-	-
22		-	-	-	-	-
23		0.016	-	-	0.014 (5%)	0.16
24		-	-	-	-	-

Annex (cont.) Machinery, Transport equipment

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	19	-	-	-	-	-
02		-	-	-	-	-
03		-	-	-	-	-
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		0.003	0.002 (10%)	-	-	0.11
10		0.011	-	-	0.022 (1%)	0.67
11		0.004	-	0.054 (1%)	-	0.35
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.000	0.002 (1%)	-	-	0.28
17		0.010	-	0.056 (5%)	-	0.18
18		0.005	0.017 (1%)	-	-	0.35
19		0.059	0.016 (10%)	-	-	0.11
20		-0.001	0.005 (5%)	-	-	0.21
21		0.001	0.003 (5%)	-	-	0.16
22		-	-	-	-	-
23		0.011	0.005 (10%)	-	-	0.11
24		-	-	-	-	-
01	20	-	-	-	-	-
02		-	-	-	-	-
03		-	-	-	-	-
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		0.000	0.001 (1%)	-	-	0.42
10		-	-	-	-	-
11		0.002	-	0.071 (1%)	-	0.78
12		0.050	-	0.211 (10%)	-	0.11
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		-0.000	0.001 (1%)	-	0.002 (1%)	0.44
17		0.049	-0.013 (5%)	-	-	0.16
18		0.000	0.020 (1%)	-	-	0.24
19		-	-	-	-	-
20		-	-	-	-	-
21		-0.000	0.003 (1%)	-	-	0.50
22		-	-	-	-	-
23		0.011	-	-	0.010 (1%)	0.23
24		-	-	-	-	-

Annex (cont.) Construction, Trade

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	21	-	-	-	-	-
02		-	-	-	-	-
03		-	-	-	-	-
04		-	-	-	-	-
05		0,009	-	-	0.005 (10%)	0.10
06		0.002	-	-	0.002 (1%)	0.35
07		-	-	-	-	-
08		0.035	-0.010 (10%)	-	-	0.12
09		-0.000	0.001 (1%)	-	-	0.43
10		-	-	-	-	-
11		-	-	-	-	-
12		0.032	-	0.139 (5%)	-	0.16
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.000	0.001 (1%)	-	-	0.25
17		0.004	-	0.078 (1%)	-	0.54
18		0.022	0.008 (10%)	-	0.020 (1%)	0.25
19		0.013	0.008 (1%)	-	-	0.24
20		-	-	-	-	-
21		-	-	-	-	-
22		-	-	-	-	-
23		-	-	-	-	-
24		-	-	-	-	-
01	22	-	-	-	-	-
02		-	-	-	-	-
03		-0.000	0.000 (10%)	-	-	0.09
04		-	-	-	-	-
05		-	-	-	-	-
06		-	-	-	-	-
07		-	-	-	-	-
08		-	-	-	-	-
09		0.002	0.004 (1%)	-	-	0.36
10		-	-	-	-	-
11		-	-	-	-	-
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.002	0.004 (5%)	-	-	0.19
17		-	-	-	-	-
18		0.000	0.000 (5%)	-	-	0.13
19		-	-	-	-	-
20		0.002	0.003 (5%)	-	-	0.15
21		-	-	-	-	-
22		-	-	-	-	-
23		0.026	0.013 (10%)	-	-	0.12
24		-	-	-	-	-

Annex (cont.) Transport and communication, Other services

Row	Column	Intercept	GDP per head	Population	Population density	R^2
01	23	-	-	-	-	-
02		-	-	-	-	-
03		-0.000	-	0.006 (1%)	-	0.80
04		-	-	-	-	-
05		0.046	-0.012 (5%)	-	0.046 (1%)	0.44
06		0.004	0.002 (5%)	-	-	0.16
07		-	-	-	-	-
08		-	-	-	-	-
09		0.000	0.001 (1%)	-	-	0.33
10		-	-	-	-	-
11		-0.000	-	0.032 (1%)	-	0.89
12		0.000	0.001 (5%)	-	-	0.16
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		-0.000	0.002 (1%)	-	-	0.52
17		0.009	-	0.074 (1%)	-	0.30
18		-0.000	0.002 (10%)	-	-	0.12
19		0.001	0.004 (1%)	-	-	0.25
20		0.036	-	-	0.020 (10%)	0.12
21		0.005	0.011 (10%)	-	-	0.12
22		0.053	-0.014 (10%)	-	-	0.10
23		0.014	0.020 (5%)	-	-	0.13
24		-	-	-	-	-
01	24	0.003	-	-	00086 (1%)	0.36
02		0.008	0.005 (5%)	-	-	0.13
03		-	-	-	-	-
04		-	-	-	-	-
05		0.002	-	-	0.004 (1%)	0.38
06		0.003	0.002 (5%)	-	0.005 (1%)	0.40
07		-	-	-	-	-
08		-	-	-	-	-
09		-	-	-	-	-
10		-	-	-	-	-
11		-	-	-	-	-
12		-	-	-	-	-
13		-	-	-	-	-
14		-	-	-	-	-
15		-	-	-	-	-
16		0.002	0.004 (1%)	-	-	0.38
17		-	-	-	-	-
18		-	-	-	-	-
19		0.001	0.002 (5%)	-	-	0.18
20		-	-	-	-	-
21		0.015	0.005 (10%)	-	-	0.11
22		-	-	-	-	-
23		-	-	-	-	-
24		-	-	-	-	-

Annex (cont.) Value added

Row	Column	Intercept	GDP per head	Population	Population density	R^2
VA	01	0.791	-0.059 (1%)	-	-0.107 (1%)	0.46
	02	0.280	-	-	0.046 (10%)	0.13
	03	-	-	-	-	-
	04	0.147	-	1.600 (5%)	-	0.21
	05	-	-	-	-	-
	06	-	-	-	-	-
	07	0.732	-0.109 (5%)	-2.695 (1%)	-0.281 (5%)	0.41
	08	-	-	-	-	-
	09	-	-	-	-	-
	10	-	-	-	-	-
	11	0.581	-	0.534 (1%)	-	0.29
	12	-	-	-	-	-
	13	-	-	-	-	-
	14	-	-	-	-	-
	15	0.465	-	0.580 (5%)	-	0.17
	16	-	-	-	-	-
	17	0.616	-	-0.984 (1%)	-0.087 (1%)	0.46
	18	-	-	-	-	-
	19	-	-	-	-	-
	20	-	-	-	-	-
	21	-	-	-	-	-
	22	0.782	-	-1.257 (1%)	-	0.30
	23	-	-	-	-	-
	24	0.865	-0.034 (5%)	-1.560 (1%)	-	0.71

NOTE ON THE MEETING ON TECHNOLOGY CHARACTERISTICS

1. The meeting on technological characteristics in the UNITAD system of models took place in the UNIDO Building, in Vienna, from 22-24 October 1979, with about 25 participants composed mostly of econometricians and technology experts from the two sponsoring Organizations, i.e. UNIDO and UNCTAD. However, seven outside consultants were also invited, Prof. A. Anderson, Dr. M. Bhagavan, Prof. H. C. Bos. Dr. R. Dayal, Mrs. I. Kreko, Prof. E. Fontela and Dr. J. Skolka. The contributions of these experts were extremely valuable to the meeting, as well as the participation of a member of the Department of International Economic and Social Affairs (UN Headquarters).

2. The meeting examined two papers presented by the UNITAD team, as a result of processing work and analysis conducted both in Geneva and Vienna. The main outcome of the meeting will be embodied in the modelling work to be done by the UNITAD team. It is worth noting, in this connexion, that the most important conclusion, on the capital goods sector, will have a stronger impact on the import functions of the model than on the production functions proper. This is a good illustration of the need to handle complementary trade and production aspects in one and the same process. Another example will be the use of the cost structure, as emerging from the technology analysis, as explanatory variables for the import functions. In general, it can be stated that a vast amount of quantified knowledge on the industrialization process has been accumulated, going much further than what was so far available to the UN system at large.1/

3. The main policy conclusions of the meeting (see attachment) are circulated to the participants of the meeting and other experts. It should be made clear that these conclusions are those drawn by the UNITAD team and were not submitted to the meeting. It is nevertheless hoped that they will stimulate further reflections on important policy issues.

1/ News was received recently that the World Bank also decided to exploit the same data source, i.e. the Yearbook on Industrial Statistics. An offer will be made to them to joint efforts in improving the source.

MAIN CONCLUSIONS OF THE MEETING ON TECHNOLOGY CHARACTERISTICS

Summary by the UNITAD team

1. A number of policy conclusions emerged from the meeting as well as suggestions for further research. The main conclusions are briefly summarized in this paper with respect to (i) the development of the capital goods sector; (ii) the influence of plant size; (iii) capital requirements.

Development of capital goods sector

2. The development of the capital goods sector, as shown by the analysis, is related to variables such as income per capita which may be said to represent the "level of industrialization", but also to the size of countries (whether the population size or a more precise definition of market size). Similar findings were published by Chenery a few years ago[1/] but the important issue is how to interpret the analysis for policy purposes.

3. One interpretation, which has largely discussed in the international literature was that the slow development of the sector in small countries is ess ntially due to the existence of dis-economies of scale. This explanation did not gain much support in the meeting simply because many activities of the sector do not lend themselves to economies of scale. For example in the highly industrialized countries, a larger share of the production consists of small series of intermediary or final goods (machine tools is a good example).

1/ See Chenery and Syrquin (1975). Chenery suggested that there is a threshold of US$ 1000 per capita (1973 price) for the development of a certain "balanced" industrialization process in small countries, as against US$ 300 for large countries.

4. According to the meeting, the explanation lies partly in the high degree of self-integration of the industry itself i.e. the fact that the sector is composed of an integrated network of complementary activities, generally conducted in different establishments which can be components of a large enterprise or independent sub-contractors working for a number of assembly plants producing different final demand products (whether equipment goods or consumer durables). In Europe, in the post-war period, the importance of complementary activities within the sector is illustrated by the fact that most new establishments in the mechanical and engineering industries have been located in the neighbourghood of historical existing initial "nuclei". In developing countries, experience has shown the difficulty of developing a mechanical and engineering industry around one single assembly plant, without an initial "cluster" of servicing industries. In other words, one condition for the industry to develop is the successful performance of a minimum critical "cluster" of activities generally located in one region with a good communication network. (The obvious exception is the development of an isolated establishment under control of a TNC and related to the other affiliates of the same TNC through a telecommunication network).1/

5. Another condition is the need for accumulated industrial experience embodied in skilled workers. The sector is known to be a skill intensive sector (see Analysis B) but here again, what seems to be required is a certain threshold of cumulative skill experience overtime.

6. It will be noted that if this type of explanation is accepted, it opens the way for an active government intervention to accelerate the process. There are successful cases of government intervention to negotiate with private interpreneurs - whether national or transnational - a coordinated programme of development of the industry. The experience of socialist countries is also very relevant to this issue.

7. What should be, then, the justification for accelerating the process in small or in large countries? The meeting was reminded by UNCTAD and UNIDO technology experts of the absolute need to develop the capital good sectors in all countries, irrespective of size, to decrease their dependence

1/ The importance of the information network is worth being noted. It can be related to the fact that the industry produces differentiated goods (as distinct from standardized goods), i.e. goods which cannot be defined by a streighforward price of tariff number.

from foreign suppliers who impose the terms of the transactions, the design and the technological characteristics of equipment goods. Two aspects of such policy issues should be explored in the model:

(i) the development of this sector, as one of the main source of technical progress and innovation, should illustrate the development of a "technological infrastructure" which commands the whole industrialisation process (and in particular maintenance activities in all other industries);

(ii) domestic production should be oriented in a first stage towards the development of consumer good industries (specific-purpose equipment) and in a next stage towards the manufacture of producer goods for producing producer goods (multi-purpose equipment). This historical sequence (specific-purpose prior to multi-purpose) is mentioned here as a reminder of the various degrees of technological complexity of different activities. At the end of the process, taking the group of semi-industrialised countries, lies the problem of mastering the highly modern, science-based technologies which are behind the technological hierarchy among advanced economies.

6. How should these effects be "captured" by the UNITAD model? The following tentative replies can be made:

(i) the degree of self-integration of the sector can and should be reflected in the diagonal coefficient of the sector in the input-output table;

(ii) the rate of growth of the sector will, however, depend essentially on the amount of capital goods contained in the final demand vector, which in turn is a function of the domestic and external demand generated by the model, less imports of similar goods. These components are examined below;

(iii) the domestic demand will come from two competing sources, i.e. equipment goods needed for the industrialisation process and consumer durables. The model will measure the impact of various demand levels on the trade balance and will therefore show the need to keep down the demand for consumer durables (through tariff barriers or otherwise);

(iv) the model is likely to be very sensitive to the import functions selected for capital goods and consumer durables. As shown by ECE studies, the mirror image of the slow development of the capital good sector in small countries is a high import propensity for similar goods, a propensity much higher than large countries.1/ One attempt will be made, in the model, to endogenize this import propensity. The idea is to explain this variable (and by the same token the slow development of the capital good sector) by a stock variable (e.g. skills, cumulated output) conveying the idea of a cumulative learning-by-doing process;

(v) the same variable should be used to trigger all input-output coefficients related to maintenance and repair, i.e. inputs of the capital good sector into all other sectors (see Analysis A);

(vi) finally, there remain the export variable. Use should be made here of the ECE studies1/ showing the high level of "intra-industry" trade in this sector. This should affect the share coefficients in the trade matrix for equipment goods, which, in the model, is instrumental in generating exports for regional models.

9. There remain an important point for clarification, i.e. which policy instruments can (and should) be used to foster the development of the capital good industry? Further advise from technology experts will be needed to simulate such policies in the model. One possible research line would be to study the development of the sector in small socialist countries (Bulgaria, Romania) for which good statistical series exist.

1/ See for example ECAD (XIV)/R.7/Add.2, 25 January 1977.

The influence of plant size

10. One of the main objectives of the Lima plan of action is to strenghten the relationship between the growth of agriculture and industry, or more generally that of the rural with the urban sector. There is plenty of evidence that an excessive concentration of the resources in the latter can have most adverse implications not only for the rural sector but, on the long run, on the development of the economy as a whole. There are clear indications that in the future, much greater attention will be devoted to the economic and social problems of rural areas and that industrialisation will be called upon to assume a highly important role.

11. The industrial projects suitable for the needs and possibilities of the rural sector of the economy seem to be of a type which, compared to what is needed in terms of capital and other outside components, can contribute most to the mobilization and development of locally available resources - labour force, materials, technical skill, managerial ability and entrepreneurship. To a very large extent these requirements can be met by properly organized small and medium-size plants adapted to the local needs and conditions. A well-planned decentralization of industrial activity aimed at creating a net work of industrial centres of varying importance - at the lower level of local communities and at the higher level of larger areas - would greatly contribute towards diffusing progress and preparing the ground for the further advancement of industrialisation.

12. It should be noted, in this connection, that the old problem of the large-scale versus the small-scale industries will be increasingly regarded from the angle of complementary and not of competitivity. A certain dualism in the structure of manufacturing should not be considered as an impediment to industrialisation, provided that there is a sound and creative relationship between the modern and the more traditional small-scale sectors.

13. A special section of Analysis B is devoted to the study of size of establishment. The following results are relevant[1]:

1/ A note of caution should be entered. The size used in this analysis is the average size for each sector. It does not exclude a wide dispersion of data inside the sector.

(i) the size in terms of value added is generally more variable than in terms of workers but the correlations with other variables generally work in the same direction;

(ii) some consumer good industries behave in an "abnormal" way when looking at industry size. No correlation is found between plant size and capital intensity or productivity for:

- Tobacco (314), Primary textile (321), Wearing apparel (322), Leather and products (323).

In such industries, high size (value added), and high productivity plants are found in developed countries, and high size and low productivity plants in some developing countries, which conveys the idea of different technologies being used simultaneoulsy here and there. In the case of Primary textile (321) a negative correlation is even found between size and average wage per worker, suggesting that large establishments have a lowe skill content;

(iii) in the general case, i.e. for other consumer good industries, for all heavy industry and equipment good industry a good correlation is found between size and capital intensity. A positive correlation is also found with average wage per worker for industries such as:

- Petroleum refineries (353), Rubber products (355), Pottery and china (361), Iron and steel (371), Electrical machinery (383) and Professional goods (385).

The interpretation is that, as industrialisation proceeds, the output mix in these industries changes from small to large size, low to high capital intensiveness, low to high skill intensiveness and probably low to high influence of trade-unions on wage level.

14. The various cases defined in the preceding paragraph should normally call for different treatments in the model. In the first place, when size and productivity are not correlated, an attempt should be made to better characterize the specific technologies involved so as to simulate the impact on the model of various technology-mixes.

15. On the other hand, when size is strongly correlated with capital intensity, it should be possible to generate any size distribution simply by playing with capital intensity indicators. If, however, a size can be defined, for each particular sector, in terms of a specific output within that sector, what is actually simulated, when associating different sizes, is an output-mix within the sector. For example, taking sector 381 (metal products) small plants may produce simple hand tools while large plants produce more sophisticatedmetal products. The logic of the I/O model would require that two or several categories of goods should be distinguished in the bill of goods in the final demand sector, and two or several sub-sectors should produce these different categories. A simple treatment can and should be found, but it is clear that the choice between "technologies" should not be governed by a mechanical device (such as a linear programming model) conveying the idea that the same goods can be produced with different technologies.

16. Further research is needed to characterize more carefully both the technologies and the output of small versus large plants. This is actually underway using the UNIDO publication on "manufacturing profiles".

Capital requirements

17. The main findings of the analysis, as discussed by the meeting, can be summarized under two headings, i.e. the capital required by unit of output (capital-output ratios) and the capital labour substitution process.

18. Starting with capital-output ratios, a first comparison can be made between the U.S. economy and large semi-developed countries (Spain, Brazil, Korea, Turkey). In the latter group, the capital-output ratios are found to be lower than, or very similar to the U.S. indicators in a number of

sectors, including the capital goods sector (except transport equipment) and the capital-intensive sectors (ratios higher than 1)1/. In other sectors, consumption goods sectors, the capital-output ratio for semi-industrialized countries is found to be about 25 per cent higher than that of the USA. For manufacturing as a whole, the capital-output ratio is 15 per cent lower for large semi-industrialized countries than for the USA. Some participants in the meeting suggested the conventional two-factor explanation by the neo-classical theory but many others challenged these views; two explanations seem to make sense: in most sectors, the output-mix of individual sectors is not the same when comparing economies at such a widely different income level, and the results should be interpreted in terms of output-mix more than technology-mix. The second is that the availability of skills and accumulation of know-how are probably determinant for the selection of the output/technology-mix, which makes the assumption of substitution between two "homogenous" labour and capital factors retained in text books rather hazardous.

19. Another interesting comparison can be made between small and large semi-industrialized countries. The general finding is that capital-output ratios are generally higher for small countries especially in capital-intensive sectors, thus pointing to "dis-economies" of scale.2/

1/ In particular for primary textiles, for the whole chemical industry group, for ferrous and non-ferrous metallurgy and for the non-electrical machinery and the electrical machinery sectors.

2/ It is also worth noting that similar coefficients for small and large developing countries are found in capital goods sectors and in primary textiles. In terms of the neo-classical two-factor theory, it seems difficult to explain the fast development of primary textiles and the slow development of the capital goods sectors in small countries. This strengthens the conclusion of the section on capital goods.

The main influence is however due to a cyclical low rate of utilization, which can be observed in the analysis in all small economies, whether fully industrialized or not, thus underlining the vulnerability of industrialization based on the world market.

20. Next comes the analysis of the capital-labour substitution process. The main conclusion here is that capital-labour substitution indicators are increasing with income per capita both over time and across countries. For developed countries, the increase between the two points seems of the order 10 per cent, as against 50 per cent for large semi-industrialized countries. It seems relevant to note that the trend towards capital-intensive technologies observed in the developed countries is bound to accelerate the rate of capital-labour substitution in those developing countries which borrow such a technology. It is therefore all the more important for them to become less dependent on foreign "inappropriate" technology, i.e. a technology based on a completely different factor mix.

21. For model building purposes, the way is open now to further work on production functions, based on multi-regression analysis. It follows from the analysis that important explanatory variables, in terms of output, should be the capital-labour substitution process 1/, but also the size of the market and the technical progress.

1/ Functions based on the complementary factors such as those selected by W. Leontief, 1974 should be avoided.

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