Wolter, Frank

Engineering exports of developing countries

Kiel Working Paper, No. 29

Provided in Cooperation with:
Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

Suggested Citation: Wolter, Frank (1975) : Engineering exports of developing countries, Kiel Working Paper, No. 29, Kiel Institute of World Economics (IfW), Kiel

This Version is available at:
https://hdl.handle.net/10419/46759

Kieler Arbeitspapiere
Kiel Working Papers

Working Paper No. 29

Engineering Exports of Developing Countries

by

Frank Wolter

Institut für Weltwirtschaft an der Universität Kiel

Kiel Institute of World Economics
Department I
2300 Kiel, Düsternbrooker Weg 120

Working Paper No. 29

Engineering Exports of Developing Countries

by

Frank Wolter

March 1975

Engineering Exports of Developing Countries

by Frank Wolter*

Introduction

Throughout the sixties and early seventies industrialization efforts made considerable headway in many developing countries (LDCs)[1]. In most LDCs the share both of manufacturing value added in GDP and of manufacturing employment in total employment increased within the last fifteen years; in contributing to LDCs' growth and job creation, manufacturing has kept a prominent place[2]. The industrialization successes were also reflected in the manufactured export flow from LDCs into the world market; its expansion rate surpassed that of developed market economies' (MDCs) manufactured exports. Thus, despite a decline of their overall export

---

* This paper reports research undertaken in the "Sonderforschungsbereich Nr. 86, Weltwirtschaft und internationale Wirtschaftsbeziehungen (Kiel/Hamburg)", with financial support provided by the Deutsche Forschungsgemeinschaft. The paper is a contribution to project I H "Anpassungsprozesse in Industrieländern als Folge der Industrialisierung der Entwicklungsländer" (Project Director: Prof. Dr. Gerhard Fels).

1 LDCs refer to Africa, America except Canada and the United States, Asia except centrally planned economies and Japan, Oceania except Australia and New Zealand, Cyprus, Portugal, Spain, Turkey, and Yugoslavia.

2 Nonetheless there is a widespread belief that in many LDCs industrialization could have been more successful had these countries pursued a more rational industrialization strategy. See the vast literature on this subject, among others Ian Little, Tibor Scitovsky, Maurice Scott, Industry and Trade in Some Developing Countries - A Comparative Study. London, New York, Toronto, 1970.

share, the LDCs' share in world manufacturing exports rose from 6.4 p.c. in 1960 to 7.9 p.c. in 1970. Inspite of the extensive and sophisticated protective systems which MDCs have partly uphelt to shelter their domestic industries[1], suppliers from LDCs proved capable of penetrating high-income markets for commodities in the production of which they could benefit from their competitive edge, namely their abundance of cheap labour and raw materials. Export success, however, was not confined to low-skilled labour-intensive or raw-material intensive products; certain LDCs even managed to successfully compete on markets for more sophisticated products[2]. Correspondingly, the classical division of labour between MDCs having the role of factories and LDCs having the role of bread-baskets is slowly but steadily changing.

2. Engineering activities were among the first industries to develop in LDCs. In part, such activities emerged sporadically from local handicraft, but they soon became a focus of development planning. Since the support of engineering activities was in accordance with available skills on the one hand, and with domestic demand as for simple

---

1 See Juergen B. Donges, Gerhard Fels, Axel D. Neu, u.a., Protektion und Branchenstruktur der westdeutschen Wirtschaft. "Kieler Studien", Nr. 123, Tübingen, 1973, especially Chapter II, III and IV.

2 See e.g. Juergen B. Donges, Shaping Spain's Export Industry. World Development", Vol. 1 (1973), No. 9, pp. 24 seq.

tools or for not readily available spare parts on the other hand, this was an obvious policy to pursue. Of course, engineering activities were particularly encouraged in cases where across the board import substitution was chosen as a development strategy. Thus handtools, cutlery and other household equipment, simple machines for agriculture and mining, for the food, leather, wood and textile industries as well as for construction were the first class of engineering products which were manufactured in LDCs and successively exported. Moreover, some predominantly small LDCs with a more outward-looking industrialization strategy specialized in labour-intensive activities within electrical machinery such as radio- and tv-sets or electronic components and appliances from the very beginning. The setting-up of labour-intensive engineering activities in LDCs has been the more fostered since engineering corporations located in high-income countries have increasingly tended to relocate the production of labour-intensive products or labour-intensive operations to low-wage countries either by sub-contracting or by direct investment. Though it is true that up to now only a small number of LDCs actually benefitted from these developments, the impact of engineering products' exports from LDCs into the world market and its repercussions in high-income countries is already been felt.

3. The recent performance of LDCs, as highlighted by an almost doubling of the share of ten selected LDCs from an admittedly low level in the world market for engineering products between 1964/65 and 1970/71 (Table 2), gives rise to the hypothesis that LDCs will increasingly penetrate this segment of the world market in the future. In order to lend this statement precision, we shall analyze the export record of important LDC suppliers of engineering products since the mid 1960s. The paper is arranged in four chapters. Chapter I tries to specify the characteristics of a typical (or potential) LDC exporter of engineering commmodities. In Chapter II we shall try to identify those products in the production of which LDCs are most likely to possess or to be able to develop a comparative advantage. Moreover, in this chapter we shall focus on the question of diversification of LDCs' engineering exports both by product and by country. Chapter III draws attention to the determinants of specialization and diversification; among others it will be tested whether the specialization of LDCs in engineering can be explained by factor-intensities and whether LDCs tend to diversify their engineering export assortment both with increasing stage of development and with increasing domestic market. In the last chapter the major results are summed up and some conclusions are drawn.

The typical engineering exporter

4. Canada, Italy, and Japan were the first countries to seriously challenge the dominant role of the United States and the industrial centres of Western and Northern Europe in the world market for engineering products. Within ten years, from 1960 to 1970, these three countries succeeded in enlarging their world market share in SITC 7 commodities from 8.7 p.c. to 20 p.c. While in the case of Canada the free access to the market of the United States under special foreign trade regulations may have been the main factor in explaining export performance, the exploitation of wage differentials relative to the traditional suppliers can be assumed to have mainly accounted for the spectacular export successes in engineering products which the technologically capable newcomers Italy and Japan experienced. Compared to these outstanding examples, LDCs are still marginal suppliers of engineering products. Yet, LDCs' impact on the world market for SITC 7 commodities can be more significant than would be evident from their moderate 2.5 p.c. share (1970), since

- the global figure hides a large variation of market shares within the universe of engineering products;

- the growth rate of engineering exports from LDCs throughout the 1960s outdistanced that for manufactured exports;

- the destinations of some of these exports were regionally concentrated.

Moreover, what is small in terms of the world market may be of tremendous importance for the LDC in question. So far, however, only a limited number of countries make up for the lion's share of LDCs' engineering exports; for the bulk of LDCs, engineering exports do not exist yet. In order to get an idea about which newcomers can be expected in this field in the future, in this first chapter we shall try to establish the properties, if any, of a typical LDC exporter of engineering products.

5. Let us start the analysis with a simple theoretical consideration. Recent developments in international trade theory suggest dividing the universe of traded goods into three categories, namely[1]

- Ricardo goods, which are characterized by a high input of natural resources; comparative advantage in producing these goods is governed by the countries relative endowment with natural resources;

- Heckscher-Ohlin goods, which are manufactured by fairly stable and universally available technologies; comparative advantage in producing these goods depends on

---

1 See Seev Hirsch, Hypotheses Regarding Trade between Developing and Developed Countries. In: H.Giersch (ed.), The International Division of Labour - Problems and Perspectives. Tübingen, 1974, pp. 65 seq.

the countries' factor endowment with capital and labour and on whether the product in question is capital-intensive or labour-intensive;

- Product Cycle goods, which are characterized by a high skill content. Moreover, technological know-how is limited to few suppliers and transfer costs of technology are high. In this case comparative advantage in production depends both on the availability of highly skilled manpower and on the capability to heavily invest in R and D.

Manufactured products are thought to pass through a cycle: being new they possess the properties of Product Cycle goods; becoming mature or standardized, they can be characterized as Heckscher-Ohlin goods (if not Ricardo goods). Engineering products, a rather heterogenous class of commodities, partly fit into the world of Heckscher-Ohlin goods. In so far as they are labour-intensive mature goods, developing countries - as is commonly known - are credited to have a comparative advantage in production. But even in the general category of labour-intensive mature goods skill requirements may differ largely: some of these activities may almost exclusively require low-skilled labour whereas others may mainly draw on semi-skilled, handicraft-type labour. Intuition as well as casual empiricism suggests that labour-intensive engineering (on average) belongs to

the latter group[1]. This in turn implies a comparative advantage for those countries which, both on account of their educational system, and due to a somewhat developed handicraft and industry sector, enjoy an elastic supply of such skills - namely the more advanced developing or semi-industrialized countries[2].

6. Table 1 provides selected characteristics for the countries of investigation. Ranked in declining order, these countries, except Singapore and South Africa[3] constitute the ten most important LDC exporters of engineering products[4] according to absolute export values in 1970. Among the features of

---

1 Except for electrical machinery this supposition is supported by evidence of the skill structure of West Germany's industry. See Gerhard Fels, The Choice of Industry Mix in the Division of Labour between Developed and Developing Countries. "Weltwirtschaftliches Archiv" (Review of World Economics), Bd. 108 (1972), Heft 1, pp. 112 seq. See also Ranadev Banerji, Exports of Manufactures from India: An Appraisal of the Emerging Pattern. Kieler Studien, Nr. 130, Tübingen, 1974, Chapter VII.

2 Moreover, compared to countries at a lower level of development engineering activities in semi-industrialized countries benefit from an elastic domestic demand.

3 Singapore (place 5 in 1970) was excluded from the analysis because re-exports which in this case are of paramount importance could not be deducted from trade data. For South Africa (place 6 in 1970) the United Nations' Commodity Trade Statistics do not provide data.

4 Engineering products include SITC classes 69, 71, 72, 73. In 1970 the ten countries mentioned accounted for 86 p.c. of total LDC exports of SITC 7 commodities.

Table 1 - Selected Characteristics of Selected LDCs Exporting Engineering Products, 1970 and 1960/1970

Characteristics \ Country			Spain	Yugoslavia	Hongkong	Taiwan	Mexico	India	Brazil	Portugal	Argentina	S-Korea
Rank[a]			1	2	3	4	5	6	7	8	9	10
Stage of Development[b]			(2)	(2)	(1)	(2)	(2)	(2)	(2)	(2)	(2)	(3)
Predominant Development Strategy[c]			J/E	J	E	J/E	J	J	J	J	J	J/E
Absolute Values in 1970:												
- Gross Domestic Product[d]	US-$	Mio.	32344	12576[e]	2951	5454	33496	52845	37313	6073	25011	8281
- Population	Mio.		33.8	20.4	4.0	14.7	48.9	538.8	93.4	9.6	23.2	31.3
- GDP per Capita[d]	US-$		957	617[e]	738	371	685	98	400	631	1078	265
- Share of Gross Fixed Cap.Form. in GDP	p.c.		21.3	32.9[e]	20.2	22.1	19.2	14.7	16.5[f]	18.0	19.5	25.2
- Share of Manufacturing in GDP	p.c.		26.9	37.9[e,g]	35.0[h]	18.6	24.4	14.9	19.6[f]	30.9	23.6	23.5
- Export Share of SITC 5-8 in SITC 0-9	p.c.		55.3	70.5	95.9	78.2[h]	40.1	52.5	13.4	62.8	14.0	77.4
- Crude Steel Production	Thrd.	metr.tons	7394	2227	0	56[i]	3846	6271	5390	385	1859	481
Growth Rates 1960/1970:												
- Gross Domestic Product[d]	p.c.	Real Terms	7.2	6.6[e]	8.1[k]	9.6	7.2	3.5	5.5[l]	6.1	4.2	8.9
- Population	p.c.	Real Terms	1.1	1.0	2.6	3.1	3.4	2.3	3.0	0.8	1.2	2.4
- GDP per Capita[d]	p.c.	Real Terms	6.1	5.5[e]	5.3[k]	6.3	3.9	1.3	2.5[l]	5.2	2.6	6.2
- Gross Fixed Capital Formation	p.c.	Real Terms	10.2	6.8	5.1[k]	13.2	8.4	4.7[l]	7.2	6.8	4.3	20.9
- Value Added of Manufacturing	p.c.	Real Terms	9.9	8.9	12.4[h,k]	13.1[h]	9.2	5.4	7.0	8.7	5.4	16.5
- Crude Steel Production	p.c.	Real Terms	14.4	4.4	0	8.8	9.9	6.7	11.3	21.2[m]	21.0	25.4
- Exports SITC 0-9		Nominal Terms	14.5[l]	20.1	13.8	24.5	4.7	4.3	8.0	11.3	5.1	38.6
- Exports SITC 5-8			22.1[l]	24.4	15.2	34.4[h]	10.2	5.9	29.1	13.1	18.8	63.6
- Exports SITC 69, 71, 72, 73			38,4[l]	27.6	22.0	.	32.5	32.4	48.7	21.9	36.0	95.4

[a]According to export values of SITC 69, 71, 72, 73 in 1970. - [b]According to World Bank, Industry (Sector Working Paper). Washington, April 1972. (1) industrialized, (2) semi-industrialized, (3) industrializing countries. - [c] J: importsubstitution; E: exportdiversification; J/E: switch to exportdiversification at the end of the 1950s or during the 1960s after preceding phase of importsubstitution. - [d]At 1970 purchaser values. - [e]Gross material product. - [f]1969. - [g]Including mining and electricity, gas and water. - [h]Estimated. - [i]Pig iron. - [k]1966/1970. - [l]1960/1969. - [m]1961/1970.

Source: United Nations, Yearbook of National Accounts Statuties; Monthly Bulletin of Statistics; Statistical Yearbook; Yearbook of International Trade Statistics, New York. - Taiwan Statistical Yearbook, 1972, CJECD, Taipeh. - Government Printer, Hongkong Review of Overseas Trade; Estimates of Gross Domestic Product 1966 to 1972; Hongkong Statistics 1947 to 1967, Hongkong. - Socijalisticke Federationa Republika Jugoslavija, Statisticki Godisujak Jugoslavije, Beograd.

a typical LDC exporting engineering products, the following stand out:

- The "development stage" hypothesis, as stated above, is by and large corroborated: With the exception of Hong Kong, who is ahead of, and the Republic of Korea, who is very close to that stage of development, all important LDCs exporting engineering products belong to the group of semi-industrialized countries[1].

- Except Hong Kong all countries investigated are steel producers. Compared to most high-income countries, per capita production, however, is still rather low[2].

- Concerning the development strategy, no clear picture is discernible. Six of the countries in question still predominantly pursue importsubstitution. Accelerated export growth may be expected in case of a possible switch to export promotion.

- The interrelation between the rank in the hierarchy of engineering exporters and the rank according to the various indicators of the economic stage of development presented in Table 1 is negligible, if any. All Spearman coefficients of rank correlation are insignificant at the 1 p.c. level (Table A1).

---

1 It should be noted that the same applies to South Africa; as Hong Kong, Singapore is classified as industrialized.

2 The range is from 4 kg per capita for Taiwan to 218 kg per capita for Spain compared to 582 kg per capita for the U.S. in 1970.

Thus, the salient finding of this exercise is that one can limit the range of possible candidates who can potentially compete with the established suppliers of engineering products to those LDCs who are already semi-industrialized or who can be reasonably expected to become semi-industrialized within the near future[1].

The Pattern of Export Specialization and Diversification

7. Having established the geography and the stage of development of the most important LDCs supplying engineering products in the world market our next step will be to examine the pattern of specialization which has emerged so far. Once again drawing on the product cycle hypothesis the typical engineering export product stemming from LDCs would be expected to at least meet one of the following criteria, namely

- to be produced labour-intensively,
- to be technologically less sophisticated,

---

1 According to the 1972 World Bank grouping, in addition to the countries listed in Table 1 Rhodesia, South Africa, New Zealand, Egypt, Finland, Greece, Ireland, Israel, Lebanon, Malta, Costa Rica, Chile, and Uruguay belong to the semi-industrialized countries. The next best category to become semi-industrialized namely the group of industrializing countries includes Zaire, Kenya, Mauritius, Swaziland, Cameron, Ghana, Nigeria, Senegal, Malaysia, Philippines, Thailand, Burma, Ceylon, Iran, Pakistan, Cyprus, Jordan, Morocco, Syria, Tunisia, Turkey, Dominican Republic, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Nicaragua, Panama, Trinidad and Togo, Venezuela, Bolivia, Colombia, Ecuador, Paraguay, Peru. See World Bank, Industry (Sector Working Paper). Washington, April 1972, Annex 1.

- to be highly standardized and/or
- to require little or no after sales service[1].

Apart from these factors which refer to comparative costs considerations and reflect the factor endowment of LDCs the industrialization policy pursued clearly leaves its mark on each countries' export pattern. Laissez-faire will much more likely result in an export pattern governed by the law of comparative costs than a policy of heavy government interventions; outward-oriented countries are more probable candidates for export specialization than is true for inward-oriented economies; domestic and foreign investment will react to inter- and intra-industry differences in incentives, thereby affecting the factor allocation and hence the structure of exports. In addition, differences in market sizes can be reasonably assumed to account for differences in export patterns.

---

1 Insufficient after sales services probably is one of the main causes for the fact that Indian suppliers had to give discounts up to 62 p.c. of the competitor's price in exporting engineering products. See Mark Frankena, Marketing Characteristics and Prices of Exports of Engineering Goods from India. "Oxford Economic Papers (New Series)", Vol. 25 (1973), No. 1, p. 130. Insufficient after sales services may, however, become less of a bottleneck for LDCs in exporting to MDCs because these services can be as well provided by wholesalers.

8. As the countries of investigation largely differ with respect to the above factors, a uniform pattern of export specialization in engineering products can hardly be expected to evolve. Nevertheless, it may be possible to identify broad categories of engineering products in which LDCs are likely to overcome their present role of marginal suppliers to the world market in the not to distant future, leading to successive adjustment needs in MDCs. For reasons of manageability, the analysis will be limited to the three-digit SITC level. While presumably leaving some potential export products of LDCs undetected, it can be safely assumed that both the relevant important products and their typical characteristics will be detected. From this, export specialization on a more disaggregated level can be inferred. The analysis covers the period from 1954/64 to 1970/71. Apart from statistical reasons, the mid 1960s were chosen as starting point because it was only at that time that most of the LDCs in question had achieved a breakthrough in exports of engineering products[1]. In order to smoothen still occuring erratic exports a two years average was taken in each case.

---

1 See GATT, Exports of Engineering from Selected Industrializing Countries. International Trade 1968, Geneva, 1969, pp. 61 seq.

9. Table 2 shows the world market share in per thousand of the ten LDCs investigated, individually and combined, for the three-digit SITC commodity groups 691 to 735 and the years 1964/65 and 1970/71[1]. In this exercise the world market was defined as exports of OECD-countries plus exports of Non-OECD-LDCs investigated. Let us first consider the combined countries' world market shares. Though the still marginal role of LDCs as exporters of engineering products as a whole is reemphasized by the figures shown in this table, the recent dynamic development of engineering exports from LDCs can be also seen: within only six years their world market share almost doubled. Moreover, at least since 1970/71, LDCs have been exporters of all the commodities under investigation. Within the engineering sector world market shares, however, show a wide dispersion ranging from 13.5 p.c. for household equipment of base metals to mere 0.3 p.c. for aircraft.

An analysis of the ten LDCs' individual engineering exports reveals a more differentiated picture:

- Although between 1964/65 and 1970/71 most of the countries under investigation experienced a rapid increase of their world market share in engineering products, this was not true for each of the countries. Compared to the LDCs'

---

1 A similar picture for developed countries can be found in GATT, Development of World Trade and Export Specialization in Engineering Products. International Trade 1967, Geneva, 1968, pp. 31 seq. See also United Nations (ECE), Europe in 1971, Geneva, 1972, p. 108 seq.

Table 2 - Share of Selected LDCs in the World Market[a] for Engineering Products, 1964/65 and 1970/71 (p.m.)

SITC No / Country	Spain		Jugoslavia		Hongkong		Taiwan		Mexico		India		Brazil		Portugal		Argentinien		S-Korea		Ten LDCs		Hirschman Coef. of Concentr.[c]	
	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71
691 Finished structural parts	0.8	9.5	13.6	14.4	0.8	1.0	1.5	0.8	0.6	0.5	1.8	13.5	0.2	0.8	4.2	2.0	0.2	0.1	0	0.3	23.7	42.9	61.1	51.4
692 Metal containers	0.3	16.4	11.0	12.3	3.2	2.3	0	0	4.0	9.0	1.8	1.1	0.3	0.8	8.5	6.1	1.4	2.4	0	0	30.5	50.4	49.2	46.6
693 Wire products	9.2	27.6	19.6	6.3	1.1	0.3	2.3	2.6	3.4	1.6	1.9	5.8	0	0.9	1.8	3.1	1.9	5.0	0	4.0	41.2	57.2	54.1	52.3
694 Nails,Screws,nuts,bolts,rivets	1.3	6.4	14.2	17.3	4.4	5.0	3.1	2.9	0.5	0.5	2.6	2.9	0	0.4	1.7	1.7	0	0.7	0	0.2	27.8	38.0	66.0	51.7
695 Tools for use in the hand or in mach.	6.9	14.5	7.3	6.4	0.8	2.3	1.2	2.0	0.4	0.3	1.3	3.4	1.0	3.5	4.5	4.0	0.6	1.4	0.1	0.3	24.1	38.1	46.7	45.6
696 Cutlery	6.1	12.7	1.5	0.7	13.0	17.4	2.6	13.8	0.8	3.0	3.3	1.6	1.1	6.8	3.1	4.0	0.5	2.0	0.6	12.7	32.6	74.7	47.3	40.0
697 Household equip. of base metals	6.9	37.6	16.6	21.1	41.5	41.3	0	10.0	2.2	1.7	7.9	7.8	0	1.0	12.0	11.4	1.8	2.1	0.5	1.4	89.4	135.4	53.2	45.9
698 Manufactures of metal n.e.s.	3.1	8.7	5.7	8.3	10.3	13.0	1.1	3.3	5.4	5.3	3.5	3.1	0.1	0.5	3.4	4.3	1.1	0.4	1.2	0.7	34.9	47.6	41.0	41.0
711 Power generating machinery	1.1	2.8	5.4	3.8	0	0	0.2	0.1	0.1	3.0	1.3	1.1	0.4	0.7	0.4	0.2	0.2	0.8	0.3	0.4	9.4	12.9	60.7	45.1
712 Agricultural machinery	2.9	3.5	6.9	4.1	0	0	0	0.3	0.1	0.3	0.0	0.3	0.2	0.7	0.2	0.4	0.2	2.1	0.1	0.1	10.6	11.8	70.7	49.7
714 Office machines	2.5	5.0	0.2	0.4	0	0.5	0	3.9	0	0.8	0.6	0.6	1.5	6.3	0.5	1.3	5.3	4.1	0	1.0	10.6	23.9	57.6	42.0
715 Metalworking machinery	7.0	13.0	3.5	3.3	0.4	0.6	0.4	1.1	0	0	0.2	1.1	1.0	1.8	0.5	0.6	1.2	0.8	0	0.1	14.2	22.4	56.5	61.0
717 Textile and leather machinery	4.9	10.9	2.3	1.1	0.6	0.9	0.5	3.0	0.1	0.1	1.2	2.9	1.9	1.9	0.6	0.6	0.2	0.1	0.2	0.4	12.5	21.9	47.6	54.5
718 Machines for special industries	0.7	3.8	4.0	1.0	0.1	0.1	0.5	0.5	0.1	0.1	0.2	0.3	0.8	2.7	0.4	0.3	0.1	0.6	0.0	0.1	6.9	9.5	60.8	51.1
719 Machinery and appliances n.e.s.	1.3	4.7	1.9	3.2	0.4	0.6	0.0	0.6	1.1	2.7	0.4	0.8	0.6	1.1	0.8	1.0	0.4	0.7	0.0	0.1	6.9	15.5	41.0	42.6
722 Electric power mach., switchgear	2.1	9.7	5.6	11.6	0.3	0.5	0.3	2.0	0.3	8.9	0.2	1.5	0.3	1.7	1.2	3.2	0.1	0.5	0.0	1.3	10.4	40.9	59.0	44.4
723 Equipm. for distributing electricity	2.3	12.0	66.9	45.0	0	0.2	4.7	4.6	0.7	0.2	1.5	5.5	0	2.1	3.2	7.4	0.3	1.5	0	0.2	79.6	78.9	84.4	60.5
724 Telecommunication apparates	0.4	2.6	2.1	3.2	10.7	24.1	1.7	21.9	0.2	5.5	0.2	0.6	0.1	1.4	0.6	4.3	0.3	0.3	0.5	1.6	16.8	65.5	65.9	51.3
725 Domestic electrical equipm.	0.8	14.7	4.3	10.5	3.3	4.2	0.4	1.7	0.3	0.2	1.7	1.7	0.8	1.5	0.1	0.2	1.6	1.0	0	0	13.3	35.7	45.3	52.6
726 Electric app. for medical purposes	0	1.8	0	1.5	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0	3.7	-	64.2
729 Other electrical machinery	1.3	3.4	2.0	3.8	7.3	18.6	0.5	3.7	0.3	0.6	0.8	0.8	0.9	1.4	0.8	2.3	0.3	0.5	0.1	7.8	14.3	42.9	54.8	49.7
731 Railway vehicles	6.5	32.8	48.4	21.8	0	0	0.5	0.3	2.6	0.3	0.2	3.5	0	0.8	0.5	2.2	1.3	0.6	0	0.2	60.0	62.5	81.5	63.4
732 Road motor vehicles	1.8	4.1	1.5	1.1	0	0	0.0	0.2	0.1	1.1	0.3	0.8	0.3	0.5	0.2	0.2	0.2	0.4	0.0	0.0	4.4	8.4	54.5	53.7
733 Road vehicles other than motorvehicles	1.5	2.8	11.6	24.0	0	0	2.7	6.6	0.4	0.2	7.8	11.3	0	0.3	0.5	2.7	0.9	0.4	0	0.4	25.4	48.7	56.5	56.7
734 Aircraft	0.1	0.3	10.2	0.3	0	0	0	0	0.2	1.7	0.2	0.0	0.8	0.3	0.0	0.0	0	0	0.0	0.7	11.5	3.3	89.0	57.9
735 Ships and boats	13.4	33.1	20.9	33.8	1.8	2.5	0.0	0.5	0.4	0.3	0	0.0	1.6	1.7	0.1	1.0	0	0	0	0.5	38.2	73.4	65.3	64.6
Total Engineering Products	2.6	6.9	5.9	5.3	1.9	3.5	0.4	2.4	0.5	1.8	0.7	1.2	0.6	1.4	0.8	1.3	0.5	0.7	0.1	0.9	14.0	25.4	49.2	40.0
Hirschman Coeff. of Concentration[b,d]	27.8	26.4	32.9	29.3	41.1	41.6	32.1	35.0	35.0	33.4	32.3	36.5	28.1	27.7	34.6	28.6	33.8	29.3	43.6	45.6	26.0	24.1		

[a]Exports of OECD-countries and listed Non-OECD-LDCs. - [b]For definition of this coefficient see charts 2 and 3. - [c]Theoretical range 5.1 G 100. - [d]Theoretical range 3.2 G 100

Source: UN, Commodity Trade Statistics, Series D, New York, var.issues. - OECD, Commodity Trade Statistics, Paris, var. issues.

average, Argentina achieved a moderate increase in her world market share only, and Yugoslavia even had to suffer from an absolute setback[1].

- The degree of diversification, as indicated by Hirschman's coefficient of (commodity-) concentration, was higher than average for each country investigated and differed between each pair of countries. Even in South-Korea, the least diversified exporter, the export assortment, however, was fairly wide.

- Over time, there were six countries of increasing export diversification and four countries of increasing export specialization. Concerning the latter case, the only thing these countries have exclusively (i.e. among the sample countries) in common is that they are asiatic countries.

- For each commodity the degree of export concentration among the countries (row coefficients) was - with few exceptions - higher than the degree of commodity diversification of the least diversified exporter.

- Over time for the bulk of commodities the export concentration among the countries decreased. Exceptions are manufactures of metals n.e.s. the comparatively low degree of concentration of which remained the same and metalworking machinery, textile and leather

1 In the case of Yugoslavia the economic reforms of 1965 which lead to considerable changes in her price structure are the most probable reasons for this development. See United Nations (ECE), Economic Survey of Europe in 1967. New York, 1968, pp. 93 seq.

machinery; machinery and appliances n.e.s. and road vehicles other than motor vehicles, the degree of concentration of which increased.

Thus, the main findings may be summed up by saying that the remarkable expansion of LDCs' world market share in engineering products was accompanied by both a widening of the export assortment and an increase in the number of suppliers. The basis for further progress in penetrating the world market has considerably strengthened.

10. In order to identify those commodity groups in which LDCs specialize several indicators could be used. The GATT study on engineering industries of MDCs applies the world market shares for each commodity group and defines those commodities as specialization groups the world market share of which surpasses that for total engineering products[1]. Although this measure seems adequate to describe specialization export it gives little evidence of future trends. That applies especially to newcomers to the world market who are at the threshold of shaping their longer term export structure. Taking this in account, in identifying specialization

---

1 See GATT, Development of World Trade and Export Specialization in Engineering Products, op.cit.

2 Indeed, several changes in the relative position of the commodity groups are indicated by a Spearman coefficient of rank correlation of 0.89 between the hierarchy of world market shares in 1964/65 and in 1970/71.

categories we rather propose to apply a mixed indicator which includes both the relative position in the hierarchy of world market shares and the relative position in the hierarchy of changes in world market shares. Such an effort is presented in Table 3. In this table the commodities under investigation are classified in four classes; throughout the table the commodities are ranked in order of declining power of specialization:

- Class I commodities experienced an above average growth rate of their world market share between 1964/65 and 1970/71 and kept an above average - as compared to total engineering - world market share in 1970/71 (specialization categories).

- Class II commodities experienced an above average growth rate of their world market share but kept a below average world market share.(candidates for specialization).

- Class III commodities experienced a below average growth rate of their world market share but kept an above average world market share (candidates of relative reduction).

- Class IV commodities experienced a below average growth rate of their world market share and kept a below average world market share (relative reduction categories).

Table 3 - Engineering Exports of Ten LDCs Combined: Specialization and Relative Reduction[a]

Rank	SITC-No.	Class I : Specialization Categories
1	722	Electric power machinery and switchgear
2	724	Telecommunications apparatus
3	729	Other electrical machinery and apparatus
4	725	Domestic electrical equipment
5	696	Cutlery
6	733	Road vehicles other than motor vehicles
7	735	Ships and boats
		Class II : Candidates for Specialization
8	726	Electric apparatus for medical purposes and radiological apparatus
9	714	Office machines
10	719	Machinery and appliances (other than electric) and machine parts, n.e.s.
11	732	Road and motor vehicles
		Class III : Candidates for Relative Reduction
12	691	Finished structural parts and structures, n.e.s.
13	692	Metal containers for starage and transport
14	695	Tools for use in the hand or in machines
15	697	Household equipment of base metals
16	693	Wire products (excluding electric) and fencing grills
17	694	Nails, screws, nuts, bolts, rivets and similar articles of iron, steel, copper
18	698	Manufactures of metal, n.e.s.
19	731	Railway vehicles
20	723	Equipment for distributing electricity
		Class IV : Relative Reduction Categories
21	717	Textile and leather machinery
22	715	Metalworking machinery
23	711	Power generating machinery (other than electric)
24	718	Machines for special industries
25	712	Agricultural machinery
26	734	Aircraft

[a]For method of selection see para. 10.

Source: Table 2. - Own calculations.

Within each of these classes the commodities are ranked according to the growth rate of their world market shares[1]. The analysis leads to remarkable results:

- LDCs' electrical machinery and transport equipment seem to possess the most promising export potential. Almost all sub-branches of these industry sectors either belong already to the specialization categories or are candidates for specialization[2]. Besides these commodity groups, only cutlery of metal manufactures belongs to the first class and office machines and machinery and appliances n.e.s. of mechanical engineering belongs to the second class.

- There seems to be no chance for LDCs to achieve any breakthrough in the world market for mechanical engineering products. With the exceptions mentioned above all sub-branches of machinery belong to the relative reduction category. Apart from machinery this category is completed by aircraft.

---

1 Alternatively, one could have given priority to the world market share in 1970/71 by taking this variable as the first criterion and the growth rate of world market shares as the second criterion for selection. Besides some re-arrangement within the classes, in this case only classes II and III would have exchanged their position. As we are particularly interested in what will happen in the future we preferred the more dynamic concept to the more static one.

2 SITC group 726 (electric apparatus for medical purposes and radiological apparatus) which is known to be very research intensive may be an exception. Its high rank in the hierarchy is due to the fact that it was not until the period of investigation that LDCs began exporting commodities of this group. In cases like this the applied concept may be misleading.

- Metal manufactures clearly is loosing its outstanding role it once held in the export structure of LDCs' engineering exports. While still keeping above average world market share, all sub-branches except cutlery have lost in importance in relative terms.

In turn, these results seem to imply for MDCs that new competition from LDCs will mainly arise in the fields of electrical machinery and transport equipment, whereas the more traditional LDC export activities in metal manufactures evidently are much more consolidated. Furthermore, MDCs' outstanding world market position in machinery (except office machines) seems to remain virtually untouched by the industrialization efforts of LDCs. It is in this commodity group in which LDCs are most likely to remain marginal suppliers within the foreseeable future[1].

11. What proves correct for worldwide export performance, however, must not necessarily apply for regional markets for two reasons. Firstly, on theoretical grounds differences in the regional specialization patterns of LDCs are to be expected as the determinants of trade flows between

---

1 A more disaggregated analysis for three high-income countries supports this conclusion. See Frank Weiss and Frank Wolter, Machinery in the United States, Sweden, and Germany - An Assessment of Changes in Comparative Advantage. "Kieler Working Papers", No. 23, Kiel, September 1974, pp. 46 seq.

countries at the same level of development and of trade flows between countries at different levels of development differ[1]. Secondly, the weight of each of the LDCs investigated in their combined export basket from region to region differs; due to country specific factors and as the countries' respective stages of development are far from being uniform (Table 1), differences in weights must result in different specialization patterns.

12. In order to determine the relevant export specialization towards the three large areas of the world market, namely MDCs, LDCs, and centrally planned economies (SCs) the same procedure as for determining the overall specialization structure was adopted[2]. Tables A2, A3 and A4 show the engineering exports of the LDCs investigated to MDCs, LDCs, and SCs related to world exports (OECD plus Non-OECD-LDCs investigated) to these regions in per thousand

---

1 See Herbert Giersch (ed.), The International Division of Labour-Problems and Perspectives. Tübingen, 1974, Chapters I and II. Also see Chapter III below.

2 In this exercise the three regions correspond to the United Nations' Economic Classes I (MDCs), II (LDCs), and III (SCs).

for the years 1964/65 and 1970/71. Again, taking the combined LDCs export shares, the four specialization classes were calculated. The results are plotted in Chart 1 and can be summarized as follows[1]:

- As expected, the specialization pattern differs both between each of the regions and the world and among the regions. Disorder, however, is not quite as perfect as it seems to be from a glance on Chart 1. Taking e.g., Class I commodities (specialization categories) four out of five possible cases vis à vis MDCs, three out of eight possible cases vis à vis LDCs and four out of eight possible cases vis à vis SCs[2] belong to Class I commodities vis à vis the world as well.

- Concerning the pattern of specialization vis à vis MDCs, the most important and most deviating observation as compared to total exports is that three sub-branches of machinery (textile and leather machines,

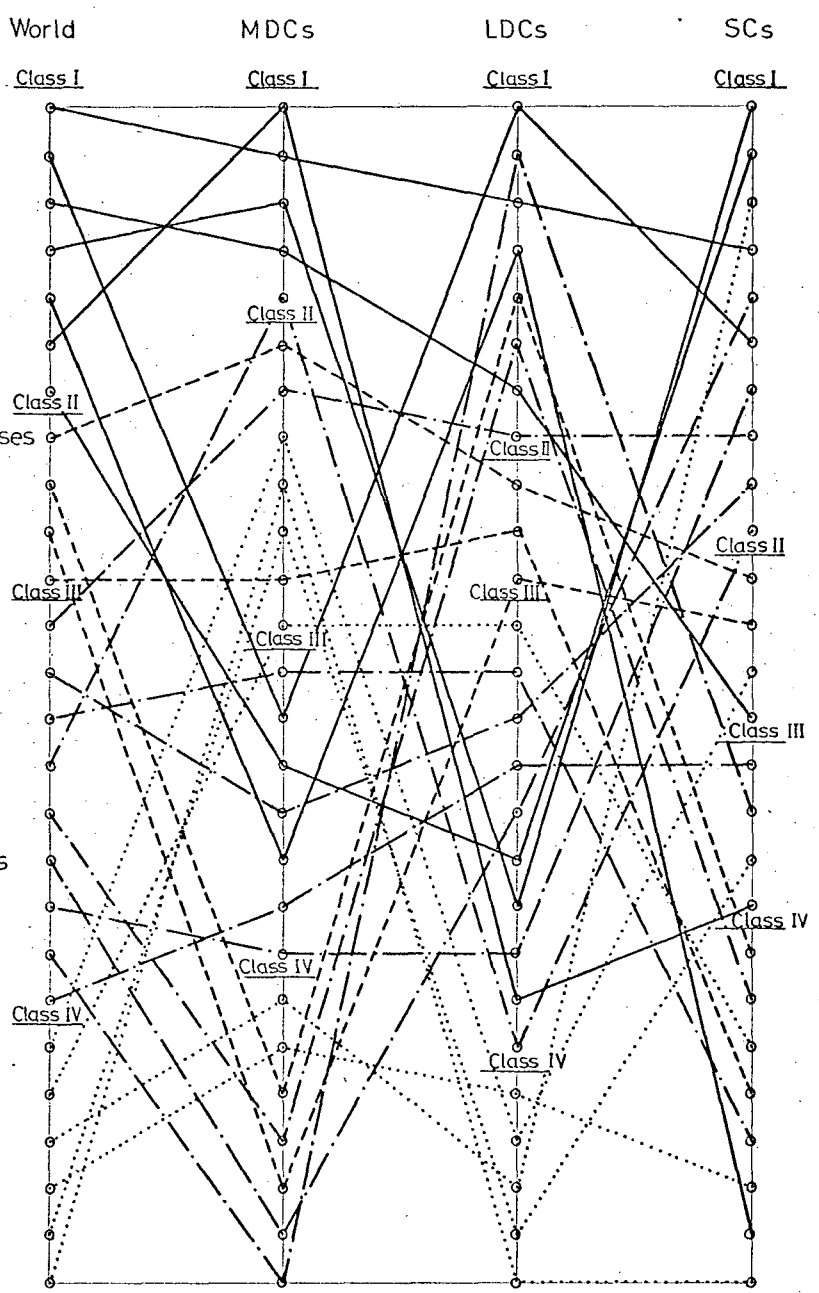
---

1 Chart 1 has to be read in the following manner: the commodity groups on the left side are ranked in declining order of specialization vis à vis world (see Table 3). The pattern of export specialization vis à vis each of the two world market regions can be deduced by pursuing the crossing line at each point of the respective schedule to its left side origin. Also, one can easily deduce from Chart 1 to which regions' export specialization the overall specialization pattern is due.

2 Exports to SCs stem almost exclusively from Yugoslavia. Therefore, specialization structure vis à vis SCs is largely influenced by the Yugoslavian events in 1965. See para. 9.

Chart 1 - TEN LDCs' COMBINED PATTERN OF SPECIALIZATION IN EXPORTING ENGINEERING PRODUCTS TO THE WORLD AND TO MDCs, LDCs AND SCs[a]

SITC No.	BRANCH (Ranked in order of declining specialization vis à vis world according to table 3)
722	Electric power machinery
724	Telecommunication apparatur
729	Other electrical machinery
725	Domestic electrical equipment
696	Cutlery
733	Road vehicles other than motor
735	Ships and boats
726	Electric app. for medical purposes
714	Office machines
719	Machinery n.e.s.
732	Road motor vehicles
691	Finished structural parts
692	Metal containers
695	Tools
697	Household equipment of base metals
693	Wire products
694	Nails, screws, bolts, nuts, rivels
698	Manufactures of metals n.e.s.
731	Railway vehicles
723	Equipment for distributing electricity
717	Textile and leather machinery
715	Metalworking machinery
711	Power generating machinery
718	Machines for special industries
712	Agricultural machinery
734	Aircraft



[a] *For method of calculation see para 10 and 12. Commodity classes according to table 3 (Class I: specialization categeries; Class II: candidates for specialization; Class III: candidates for relative reduction; Class IV: relative reduction categories).*

——————— *Belonging to Class I vis à vis world*
– – – – – – – – *Belonging to Class II vis à vis world*
—·—·—·— *Belonging to Class III vis à vis world*
..... *Belonging to Class IV vis à vis world*

Source: Table 3, A2, A3, A4.

agricultural machines and metalworking machines) appear among Class II commodities (candidates for specialization). This development, however, rests on the export success of Spanish manufacturers (Table A2). Since by the stage of development Spain can be classified at the very top of LDCs, it can still be maintained that, broadly speaking, of the four main branches of engineering, MDCs' machinery industries can be assumed to remain least threatened by competition from LDCs.

- Eight out of eleven SITC-groups belong to the specialization classes both vis à vis the world and vis à vis LDCs. Also, railway vehicles, wire products and finished structural parts show an above average export share towards both regions; but while their weight is increasing in world engineering exports to LDCs, it is decreasing in world engineering exports as a whole[1].

- The most country-biased and least representative specialization pattern concerns LDCs engineering exports to SCs. Due to specific trade connections, Yugoslavia is the predominant trade partner of the SCs; besides this country, Spain, Hong Kong and India are the only LDCs investigated to keep minor export interests in this region.

---

1 For ships and boats, domestic electrical equipment and road vehicles other than motor the reverse is true.

In short, this exercise suggests that there are significant differences in regional as against worldwide export specialization of LDCs. Although most of the general trends (para. 10) are reflected in regional export flows, the impact of LDCs exports in regional markets have to be analyzed by starting from the regional specialization.

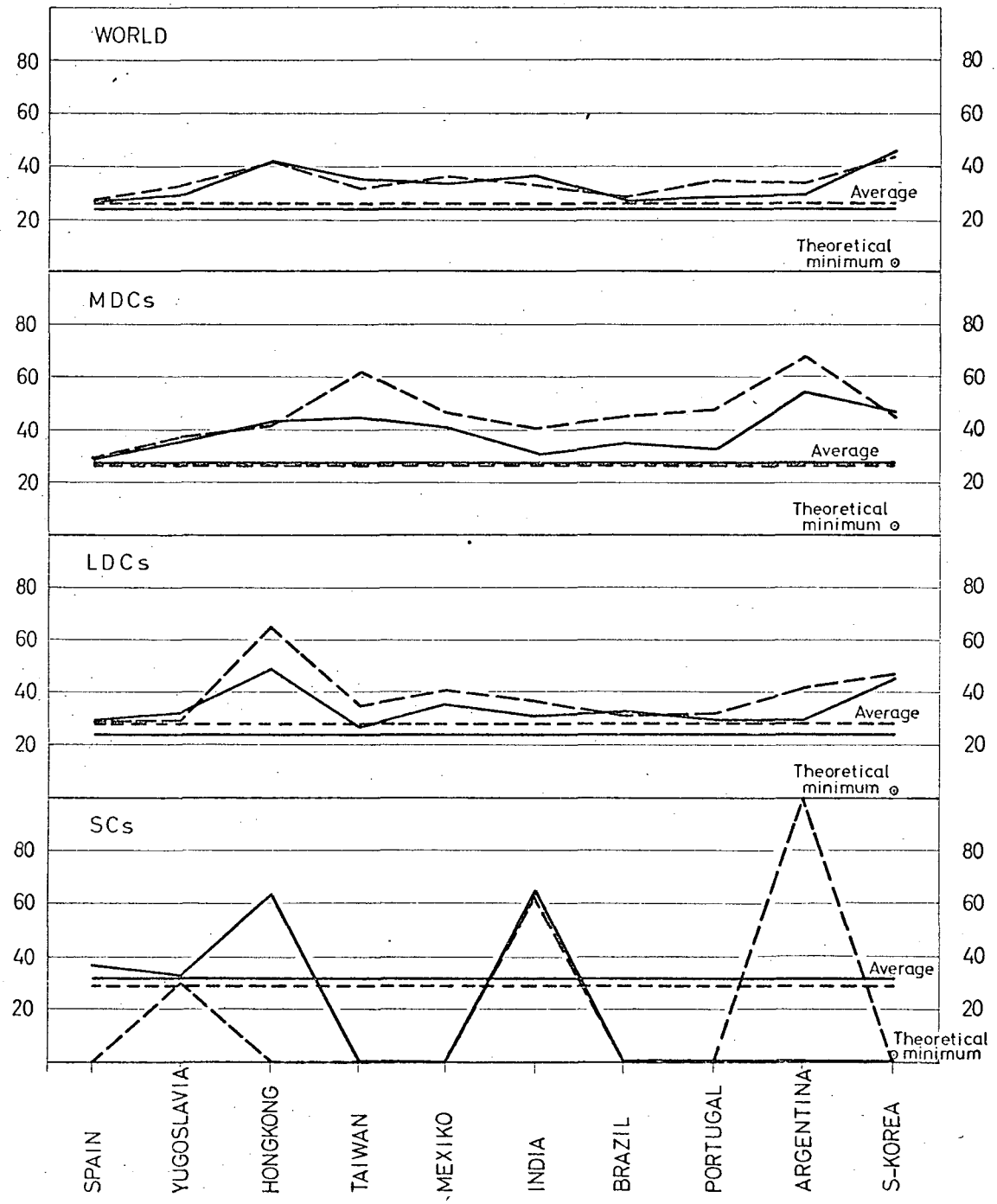
13. The worldwide and regional (commodity-) concentration of LDCs' engineering exports by country, as measured by Hirschman's coefficient of concentration, is depicted in Chart 2. The following picture emerges:

- In average, the degree of concentration is about the same worldwide and for each of the regions. Over time, the average degree of concentration slightly decreased, except for SCs.

- By country, in many cases the Hirschman coefficient fluctuates quite considerably from region to region, especially when comparing the values of SCs with those for the other two regions. Between 1964/65 and 1970/71, no country significantly increased her degree of concentration in exporting to MDCs and LDCs while many countries managed to considerably diversify their export structure.

- Among the countries, the variation in concentration is much more smooth worldwide than within the regions. As for MDCs and LDCs, Spain, India, Brazil, and Portugal show a relatively diversified export structure while Hong Kong's and South Korea's export activities are comparatively concentrated.

Chart 2 - SELECTED LDCs' EXPORT CONCENTRATION IN ENGINEERING: WORLDWIDE AND REGIONAL[a], 1964/65 AND 1970/71[b]



[a] *Calculated as* $g = \sqrt{\sum_i \left(\frac{x_{ijqt}}{\sum_i x_{ijqt}}\right)^2} \cdot 100$ *with* x_{ijqt} *as country j's world market share of engineering product i (SITC-Nos. 691 through 735) in region q (world, economic classes I, II, III) at time t. Theoretical range of g: 3,2 ≤ G ≤ 100; g = 0 indicates no exports. For definition of world market and other details see para*

[b] ----- *1964/65;* ——— *1970/71.*

Source: Tables 2, A2, A3, A4.

- Generally, country-specific concentration ratios are higher than is true for the average.

Chart 3 shows the worldwide and regional (country-) concentration of the investigated LDCs' engineering exports by commodity:

- Generally, the concentration of LDCs' engineering exports by commodities is larger than the concentration by country[1]. As in the latter case, product-specific concentration ratios mostly exceed those for the respective averages.

- Among the products, the variation in concentration is about as marked worldwide as it is for each of the regions.

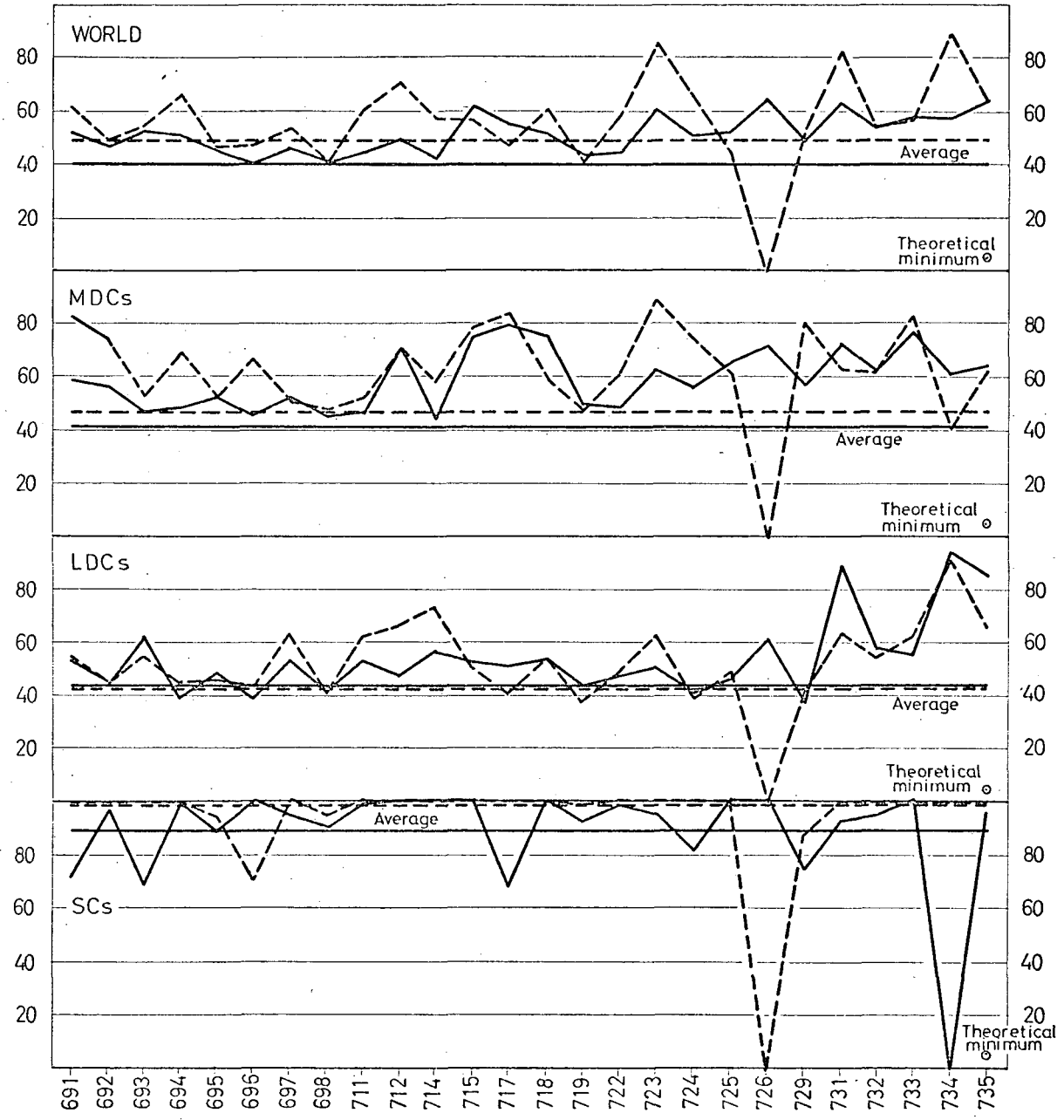
- By product, the fluctuations of concentration ratios are even more distinct from region to region than by country. Over time, in the majority of cases concentration decreased, but for quite a number of products it increased.

- In average the degree of concentration by product is about the same worldwide and for each region except for SCs. Over time, the average concentration ratio decreased except for LDCs where it remained about the same.

---

1 This is only partly due to the fact that the number of observations for the former concentration ratio is larger than for the latter.

Chart 3 - REGIONAL CONCENTRATION OF ENGINEERING WORLD MARKET SHARES IN TEN LDCs: WORLDWIDE AND REGIONAL[a], 1964/65 AND 1970/71[b]



a *Calculated as* $g = \sqrt{\sum_i \left(\frac{x_{ijqt}}{\sum_i x_{ijqt}}\right)^2} \cdot 100$ *with* x_{ijqt} *as country i's world market share of engineering product j (SITC-Nos. 691 through 735) in region q (world, economic classes I, II, and III) at time t. Theoretical range of G: 5.1 = G = 100; g = 0 indicates no exports. For definition of world market and other details see para*

b – – – – – *1964/65;* ——— *1970/71.*

Source: Tables 2, A2, A3, A4.

Thus, although for the ten LDCs combined a distinct pattern of specialization in engineering has developed, there remain substantial differences in the export pattern and in the degree of diversification from country to country by product and from product to product by country. The main reasons for these phenomena may be found firstly in the fact that there are marked differences in the stage of development among the countries investigated, secondly in that there are differences in the economic policies pursued among these countries, and thirdly in that due to differences in transport costs, trade preferences and traditional trade ties access possibilities to specific markets differ extensively. Over time, however, these factors seem to have lost influence because the export structures seem to have become slightly more similar.

Determinants of Specialization and Diversification

14. As is commonly known, traditional trade theory would suggest LDCs to specialize in relatively labour-intensive engineering products, and the more sophisticated Product Cycle hypothesis would hold that in addition to being labour-intensive these are standardized commodities. Plausible as it is, the latter hypothesis cannot be checked with the data readily available; consequently, the efforts to specify determinants of specialization will be restricted to a test of relative factor requirements in producing the commodities in question. In order to do so, relative factor requirements for each of the 26 three-digit SITC groups of engineering have to be determined. As there are neither data on factor stocks required for producing exports nor data on value added or wage content of exports this task can be approached indirectly only. Conceptually, we have applied the well-known Lary-concept because no sufficient data for other possibilities to measure factor intensities are available on the disaggregated level chosen here[1]. The Lary-concept claims that under certain assumptions value added per employee of a specific activity

1 For more sophisticated measures of factor-intensities see e.g. Peter B. Kenen, Nature, Capital, and Trade. "The Journal of Political Economy". Vol.73.(1965), p.456. - Donald B. Keesing, Labor Skills and International Trade: Evaluating Many Trade Flows with a Single Measuring Device. "The Review of Economics and Statistics", Vol. 47 (1965), pp. 287 seq. - G. Fels, The Choice of Industry Mix in the Division of Labour between Developed and Developing Countries. "Weltwirtschaftliches Archiv" (Review of World Economics), Bd. 108 (1972), pp. 77 seq.

relative to value added per employee of manufacturing as a whole can be taken as a proxy for labour- or capital - intensity compared to this reference system: an above average value added per employee would indicate relative capital-intensity and vice versa[1]. Furthermore, according to this concept relative wages per employee would indicate relative human capital intensity and relative non-wage value added per employee relative physical capital intensity, respectively. In applying this measure the results may be biased due to either differences in factor- or product-market distortions between the specific activities and the relevant reference system or differences in the disutility of labour; thus it can be taken as a rough approximation to reality, only.

15. Concerning the general approach, one of the crucial assumptions in deducing comparative advantage from relative factor-intensities is that of the non-existence of factor-intensity reversals. Theoretically highlighted by Samuelson[2], the discussion about the empirical relevance of this assumption has remained controversial[3]. We shall circumvent this disputed area by directly testing

---

1 See Hal B. Lary, Imports of Manufactures from Less Developed Countries. New York, London, 1968, Chapter 2.

2 See Paul A. Samuelson, A Comment on Factor Price Equalisation. "The Review of Economic Studies", Vol. XIX (1951/52), pp. 121 seq.

3 See Gerhard Fels, The Choice of Industry Mix, op. cit., pp. 83 seq. and the literature quoted there.

whether the relevant factor-requirements of a highly industrialized country like the United States can explain LDCs' specialization structures, world market shares as well as patterns of specialization. Relative wages and non-wage values added per employee were calculated by attaching relevant data from branches of the U.S. four-digit SIC to the three-digit SITC groups[1]. Unavoidably, this procedure includes some arbitrary decisions; also, the attached branches often do not cover the whole range of products of the respective SITC groups and are based on an establishment as opposed to the SITC product concept. These factors add to the reservations concerning the results.

16. Table 4 shows the results of regressions between the relative factor-intensities and the ten LDCs' combined world-wide and regional world market shares in engineering according to Tables 2, A2, A3 and A4[2]. A priori one would expect significant negative coefficients both for human

---

1 Data were available from the 1971 Annual Survey of Manufactures. The relationship between SIC and SITC and the calculated factor-intensities for the three-digit SITC groups are given in the appendix (Table A5).

2 In the regression analysis linear, semi-logarithmic and logarithmic function types were tested.

Table 4 - United States' Relative Factor-Intensities[a] Regressed on LDCs' World Market Shares 1970/71 (WMS) in Engineering: World-Wide and Regional

Region	Regressions	R^2
World	ln WMS = 10.428 - 0.056 WE - 0.011* NWE	0.48
MDC	ln WMS = 29.290 - 4.460 lnWE - 1.237* lnNWE	0.30
LDC	ln WMS = 10.051 - 0.057 WE - 0.002* NWE	0.42
SC	ln WMS = 14.651 - 0.096 WE - 0.002* NWE	0.33

[a]For method of calculation see para. 14 seq WE and NWE symbolize human capital-intensity (relative wages per employee) and physical capital intensity (relative non-wage value added per employee).
*Coefficient not significant at the 95 p.c. level according to t-test.

Source: Own calculations.

and physical capital-intensity[1]. The results, however, only partly conform to a priori expectations:

- The general influence of factor-intensities on LDCs' specialization in engineering as measured by world market shares is confirmed; all coefficients of determination are significant at the 95 p.c. level according to F-test. The explanatory power of factor-intensities, however, ranges from 30 to 48 p.c. of the endogenous variable's variation only.

1 This is conclusive for export performance in regional markets as well, because in these markets LDCs compete with high-income countries.

- As expected, LDCs' world market shares tend to be the larger the lower human and physical capital intensity. The influence of physical capital-intensity, however, is not significant at the 95 p.c. level.

In addition to the above regressions, we have correlated the rank orders of specialization according to Chart 1 with the rank orders of human and physical capital-intensity. Again, all coefficients turned out to be negative and human capital explained more than physical capital; in this exercise, however, no Spearman coefficient of rank correlation passed the 95 p.c. significance test.
As the world market shares can be taken as an indicator for LDCs' present specialization structure and Chart 1 specialization can be taken as an indicator for LDCs' future specialization (para. 10) one can conclude that LDCs are presently specialized in low-skill-intensive engineering products but that there are no distinct characteristics in factor-intensities concerning LDCs' future specialization in engineering. In other words, it seems not to be predominantly labour-intensive engineering activities in which LDCs tend to specialize in the future[1].

---

1 Indeed, the SITC groups presumably are even less labour-intensive than would follow from the above calculations. As the factor-intensity calculations are based on domestic production data they include the large engineering sector of non-tradable repair activities which can be safely assumed highly labour-intensive. To the extent that these activities have a larger weight in engineering than in manufacturing as a whole (reference system) the calculations of factor-intensities for the respective tradable commodities are biased towards relative labour-intensity, provided that the respective branch in average is less labour-intensive than its repair activities.

17. Striking as this result may seem when compared to a priori expectations (para. 14), its economic rationale can be revealed. Indeed, there are a number of factors both for explaining the relatively low coefficients of determinants and the non-significance of physical capital in the regressions for the world market shares and for expecting non-labour-intensive activities to appear among the Chart 1 specialization classes:

a) LDCs' specialization in some capital-intensive products may originate from mislead economic policies. As is widely known, in many LDCs overall economic policy discriminates against labour-intensive activities and hence favours a too capital-intensive production and export structure as compared to what would be adequate under given factor endowments: while real interest rates are kept artificially low (sometimes negative), labour legislations raise labour renumerations well above their scarcity prices. These factor market distortions inter alia tend to promote (mis-) specialization in capital-intensive engineering.

b) Apart from factor market distortions, the observed trend of specialization may be the result of selective rather than overall economic policies: as the development of engineering is often considered as the backbone of industrialization, this industry may have been particularly subsidized. Also, special export subsidies may establish competitiveness inspite of comparative disadvantages in production[1].

1 India seems to be a case in point. See Ranadev Banerji, Exports of manufactures from India. Kieler Studien, Nr. 130, Tübingen 1975, Chapters VII and IX.

c) One of our basic assumptions is that unskilled labour is the most abundant and human and physical capital are relatively scarce production factors in LDCs. Because of its international mobility, physical capital, however, may be much less of a bottleneck for allocating capital-intensive (unless skill-intensive) engineering industries in LDCs than is usually assumed. The conjecture is strongly supported by the investment behaviour of multinational corporations which tend to split production processes into their skill-intensive and non-skill intensive components and who increasingly dislocate the latter from high-income countries to LDCs, more or less irrespective of the amount of capital per job invested. The more this trend continues the more LDCs in addition to being suppliers of labour-intensive mature goods to the world market will become suppliers of physical capital-intensive mature goods.

d) Apart from the Heckscher-Ohlin and Product Cycle Approach there are competing explanations for international trade flows, among others[1] similarities in consumer preferences[2]. Thus for one thing, LDC suppliers

---

1 These include static or dynamic economies of scale or technological factors. See Robert E. Baldwin, Determinants of The Commodity Structure of U.S.Trade. "The American Economic Review". Vol. LCI (1971), pp. 141 seq.

2 See Staffan Burenstam-Linder, An Essay on Trade and Transformation. Stockholm, Uppsala, 1961. This and the above hypotheses cannot be tested here because adequate data are lacking.

may be capable of successfully exporting capital-intensive products to other LDCs' markets because contrary to comparable products stemming from MDCs, the properties exactly match consumer needs; for another, LDCs may have difficulties in selling labour-intensive products in MDCs' markets because of inadequate properties (e.g. quality standards).

Presumably, all of these factors have contributed to the specialization structure depicted in Chart 1. From this, one might cautiously conclude that LDCs are not under way to exploit their comparative advantage within engineering to the extent possible.

18. To finish the analysis of LDCs' engineering exports we shall investigate whether LDCs tend to diversify their engineering export structures with increasing stage of development, increasing domestic market sizes and outward as opposed to inward looking development strategies:

- Sponsored by manyfold forward and backward linkages the industrial structure normally widens and deepens throughout the development process, concomittantly generating an increasing number of branches which are apt to develop an export potential. Hence, a positive relationship between export diversification and development stage is likely to be expected.

- The domestic market size may exert a positive influence on export diversification. The reason is that a country which is comparatively richly endowed with production factors may have more possibilities to exploit economies of scale and gains from an internal division of labour.

- As across the board import substitution is more likely to result in a relatively diversified domestic structure of production (and in a waste of resources) export specialization in activities of comparative advantage only is less likely to occur than in the case of outward-oriented development strategies.

The test of these hypotheses was carried out by regressing per capita income as proxy for the development stage, population as proxy for the domestic market size and a dummy variable to take into account development strategies on the coefficients of (commodity-) concentration (ED) for the ten LDCs[1]. Regarding the small sample, high coefficients of determination could hardly be expected and those found indeed are not. The influence of the stage of development and the market size on export diversification,

---

1 ED is measured in terms of Hirschman's coefficients of concentration as shown in Table 2. The stage of Development is measured by GDP per capita (PCI) in 1963 US-$, market size by population (P) in millions, and the development strategy (DEV) by a dummy variable with 1 for I, 2 for I/E and 3 for E according to Table 1. The regressions were based on a 1964/65 and 1970/71 combined sample for the ten LDCs investigated.

however, is significant as the following best fit reveals[1]:

$$\ln ED = 4.797 - 0.171 \ln PCI - 0.086 \ln P \qquad R^2 = 0.36$$
$$(\pm\ 0.060) \qquad (\pm\ 0.031)$$

If the development strategy is introduced as additional explanatory variable, this variable as well as market size have the right sign but are insignificant at the 95 p.c. level as judged from the best fit:

$$ED = 61.579 - 4.659 \ln PCI - 1.611 \ln P + 3.285\ DEV$$
$$(\pm\ 2.114) \qquad (\pm\ 1.307) \qquad (\pm\ 1.905)$$
$$R^2 = 0.45$$

Thus, as the influence of the development strategy, on export diversification in engineering remains somewhat ambiguous, one can only say that LDCs engineering export basket tends to become increasingly diversified as these economies develop and as their domestic markets grow.

---

1 As the exogenous variables are regressed on export concentration a negative coefficient hints at a positive correlation with export diversification and vice versa.

Concluding Remarks

19. The recent remarkable performance of LDCs in penetrating the world market for engineering products is depicted in Table 7 once again. Although from a modest base, between 1964/65 and 1970/71 LDCs' engineering exports grew almost twice as quick as world exports. The main source of this growth was the capability of LDCs to adapt their export structures to those commodities which benefitted from a high income elasticity of demand in high-income market economies; also, their traditional export structure vis à vis centrally planned economies was favourable for a quick export expansion. Particularly in view of LDCs' export successes in MDCs there seems to be no reason why the increasing integration of LDCs in the world market for engineering products should not continue.

20. So far, however, it is only a handful of countries who supply the bulk of LDCs' engineering exports. With one exception these countries have in common that they are at least semi-industrialized. Evidently the abundance of cheap (unskilled) labour only is not a sufficient pre-condition to become an engineering exporter. As apart from the countries investigated there are only few more countries who can be

Table 7 - Sources of LDCs' Engineering Export Growth 1964/65 to 1970/71

	R^a	R*	S
World	1.81	0.93	1.95
MDC	1.01	0.25	4.11
LDC	0.87	0.93	0.93
SC	1.10	2.86	0.39

$$^aR = R^* \cdot S = \frac{\sum_i x_{oi} \cdot X_{1i}}{\sum_i x_{oi} \cdot X_{oi}} \cdot \frac{\sum_i X_{1i}}{\sum_i X_{oi}} \cdot \frac{\sum_i x_{1i} \cdot X_{1i}}{\sum_i x_{oi} \cdot X_{1i}}$$

X equals the world's exports of engineering product i in 1964/65 (X_o) and 1970/71 (X_1). x_1 are the respective world market shares of the ten LDCs in product i.

Source: UN, Commodity Trade Statistics, Series D. - Tables 2, A2, A3, A4. - Own calculations.

reasonably expected to develop a large supply of technically oriented, semi-skilled labour in the near future, the number of LDCs who are apt to participate in the booming world market for engineering products for the next ten years or so will remain rather restricted.

21. Today, LDCs export engineering commodities throughout the range investigated. Moreover, there is a clear trend in changes in LDCs' specialization in engineering exports. Had these countries had their past domain in metal products, nowadays (and presumably in the future) their predominant export successes occur in the fields of electrical machinery and transport equipment. Partly explained by (as for the given scarcity relations) detrimental factor-price policies in LDCs', by selective subsidization and by the international mobility of physical capital LDCs' specialization is not confined to labour intensive mature engineering commodities. As far as this development continues, LDCs are not using their comparative advantage to the extent possible and therefore their participation in the world market of engineering products probably will be smaller than it otherwise could be.

22. The shift in LDCs' specialization structure in engineering is accompanied by two tendencies. Firstly, as the case for outward-orientation of development in an increasing number of LDCs gains ground some streamlining of engineering exports of LDCs is likely to occur; secondly, as the regressions have shown the resulting export basket is likely to become increasingly diversified as these countries develop and as their domestic markets grows. Thus, the outcome will be probably both a narrowing and a deepening in LDCs' engineering exports. This outcome is the more likely as foreign direct investment and sub-contracting policies of suppliers from high-income countries foster these tendencies.

Table A1 - Spearman Coefficient of Rank Correlation (R_s) between Rank as Exporter of Engineering Products and Selected Variables for Ten Developing Countries

Selected Variables:	
Absolute Values 1970	
- GDP	- 0.08
- Population	- 0.14
- GDP per Capita	0.25
- Share of Gross Fixed Capital Formation in GDP	0.32
- Share of Manufacturing in GDP	0.42
- Share of SITC 5-8 in SITC 0-9	0.31
- Crude Steel Production	0.19
Growth Rates 1960/1970	
- GDP	0.28
- Population	- 0.02
- GDP per Capita	0.31
- Gross Fixed Capital Formation	0.08
- Value Added of Manufacturing	0.25
- Crude Steel Production	- 0.69
- Exports of SITC 0-9	0.18
- Exports of SITC 5-8	- 0.08
- Exports of SITC 69, 71, 72, 73	- 0.37[a]

[a] 9 observations.

Source: Table 1. - Own calculations.

Table A 2 - Share of Selected LDCs in World Engineering Exports[a] to MDCs, 1964/65 and 1970/71 (p.m.)

SITC	Spain		Jugoslavia		Hongkong		Taiwan		Mexico		India		Brazil		Portugal		Argentinien		S-Korea		Ten LDCs	
	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71
691 Finished structural parts	1.2	6.3	-	1.5	-	-	-	0.2	-	-	-	3.2	-	0.3	0.3	0.5	-	-	-	0.4	1.5	12.4
692 Metal containers	-	14.3	2.4	2.4	-	0.5	-	-	1.0	11.5	-	0.2	-	-	8.4	5.6	-	-	-	-	11.8	34.5
693 Wire products	2.7	5.3	2.8	1.5	-	-	-	0.4	3.4	1.1	-	1.6	-	-	1.1	1.5	-	-	-	3.6	10.0	15.0
694 Nails, screws, nuts, bolts, rivets	0.3	5.0	12.6	3.2	4.1	4.9	0.5	1.5	-	0.3	2.0	1.1	-	-	-	0.3	-	-	-	0.1	19.5	16.4
695 Tools for use in the hand or in mach.	3.3	12.0	1.2	3.4	0.6	2.4	-	1.3	0.2	0.1	0.4	2.1	-	2.1	2.1	1.3	-	0.2	0.1	0.4	7.9	25.3
696 Cutlery	5.2	12.5	-	-	15.5	19.0	2.3	15.2	-	-	0.5	0.3	0.9	4.0	-	2.6	-	0.6	0.6	15.2	25.0	69.4
697 Household equip. of base metals	6.8	38.7	1.7	5.6	9.3	32.5	-	11.9	0.7	0.6	0.7	1.6	-	0.2	7.1	8.3	-	0.6	0.7	1.7	27.0	101.7
698 Manufactures of metal n.e.s.	2.7	7.7	1.2	3.1	7.9	10.7	0.2	2.2	3.6	4.8	0.9	0.5	-	0.1	1.0	2.2	1.0	0.1	1.4	0.8	19.9	32.2
711 Power generating machinery	0.8	2.2	0.5	1.1	-	-	-	-	0.1	1.0	0.2	0.3	0.1	0.7	0.1	0.1	-	0.2	0.1	0.5	1.9	6.1
712 Agricultural machinery	0.4	2.0	0.1	0.3	-	-	-	-	0.1	0.2	-	0.2	-	0.1	-	-	-	-	-	0.1	0.6	2.9
714 Office machines	3.3	5.0	-	0.2	-	0.1	-	4.3	-	0.0	0.7	0.4	0.4	2.9	0.5	1.4	2.9	2.2	-	1.1	7.8	17.6
715 Metalworking machinery	3.7	12.8	0.6	2.5	-	-	-	0.1	-	-	-	0.9	0.1	0.5	0.3	0.5	0.1	0.1	-	0.1	4.8	17.5
717 Textile and leather machinery	1.5	11.0	0.0	0.2	-	-	0.0	1.2	-	0.0	0.1	0.2	0.0	0.5	0.1	0.4	-	-	0.1	0.4	1.8	13.9
718 Machines for special industries	0.7	2.9	0.2	0.4	-	-	-	-	-	0.1	-	0.1	0.1	0.1	0.2	0.1	-	0.1	0.1	0.1	1.3	3.9
719 Machinery and appliances n.e.s.	3.7	3.3	0.9	2.3	0.5	0.1	-	0.1	2.3	3.2	0.2	0.3	0.4	0.3	1.8	0.6	0.2	0.2	0.1	0.1	10.1	10.5
722 Electric power mach., switchgear	1.2	6.3	0.2	4.5	0.1	0.3	-	1.2	0.1	10.5	-	0.4	-	0.4	0.8	2.3	-	0.1	-	1.3	2.4	27.3
723 Equipm. for distributing electricity	1.6	11.2	14.2	16.0	-	-	-	2.0	-	-	-	0.5	-	1.3	-	0.6	0.3	-	-	-	16.1	31.6
724 Telecommunication apparates	0.4	1.6	1.9	0.8	17.1	30.1	2.7	28.0	0.2	7.0	0.2	0.2	-	0.5	0.2	4.9	0.0	-	0.8	2.1	23.5	75.2
725 Domestic electrical equipm.	0.9	13.4	1.0	6.0	0.4	2.2	-	0.6	-	-	-	-	-	0.3	-	0.1	-	-	-	-	2.3	22.6
726 Electric app. for medical purposes	-	1.7	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9
729 Other electrical machinery	1.0	3.0	0.4	1.5	6.8	21.8	0.1	3.3	0.0	0.4	0.1	0.2	0.1	0.4	0.1	2.2	0.0	0.0	0.1	8.8	8.7	41.6
731 Railway vehicles	2.1	2.7	6.3	8.2	-	-	-	-	7.1	0.4	-	0.4	-	0.2	-	-	-	-	-	-	15.5	11.9
732 Road motor vehicles	0.6	3.1	0.4	0.5	-	-	-	0.2	0.0	1.2	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.0	0.0	0.0	1.2	5.4
733 Road vehicles other than motorvehicles	0.6	1.7	2.4	27.4	-	-	-	3.4	-	0.1	-	1.4	-	-	-	1.6	-	-	-	0.5	3.0	36.1
734 Aircraft	0.2	0.5	-	0.1	-	-	-	-	0.2	2.5	0.2	0.0	0.3	0.4	-	0.0	-	-	-	1.1	0.9	4.6
735 Ships and boats	11.3	39.3	8.3	22.0	3.3	3.9	-	0.8	0.3	0.4	-	-	-	1.9	-	1.6	-	-	-	0.5	23.2	70.4
Total Engineering Products	1.7	5.5	1.0	2.3	1.8	3.7	0.2	2.4	0.3	1.9	0.1	0.3	0.1	0.6	0.3	1.0	0.2	0.2	0.1	1.0	5.8	18.9

[a] Exports of OECD-countries and listed Non-OECD-LDCs.

Table A 3 - Share of Selected LDCs in World Engineering Exports[a] to LDCs, 1964/65 and 1970/71 (p.m.)

SITC	Spain		Jugoslavia		Hongkong		Taiwan		Mexico		India		Brazil		Portugal		Argentinien		S-Korea		Ten LDCs	
	1964/65	1970/71	1964/64	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71
691 Finished structural parts	0.5	16.1	17.2	22.7	1.8	2.5	3.1	1.7	1.1	1.4	3.9	3.2	0.3	1.7	8.5	4.6	0.4	0.4	-	-	36.8	54.3
692 Metal containers	-	21.8	8.5	11.7	8.2	6.0	-	-	14.2	5.0	4.3	0.2	0.8	2.3	9.5	7.9	2.3	7.2	-	-	47.8	62.1
693 Wire products	20.9	89.4	39.5	12.4	2.6	0.6	6.3	8.2	3.8	3.1	2.4	1.6	-	3.1	2.7	7.8	5.1	18.1	-	6.2	83.8	150.5
694 Nails, screws, nuts, bolts, rivets	5.6	16.1	11.3	7.7	6.4	6.7	15.3	13.2	-	1.9	5.3	1.1	-	2.4	8.4	11.0	-	5.3	-	0.8	52.3	66.2
695 Tools for use in the hand or in mach.	16.1	25.4	5.7	1.5	1.4	2.5	3.9	5.1	0.9	1.0	2.0	2.1	3.2	9.0	10.5	9.9	2.1	5.5	-	-	45.8	62.0
696 Cutlery	9.9	14.9	-	-	5.0	12.1	2.8	8.9	3.4	16.8	6.9	0.3	1.3	20.2	13.9	10.7	2.5	8.4	-	2.8	45.7	95.1
697 Household equipm. of base metals	7.4	37.3	15.6	7.6	130.6	82.5	-	3.2	6.3	6.2	27.7	1.6	-	4.4	25.8	25.3	6.3	8.7	-	-	219.7	176.8
698 Manufactures of metal n.e.s.	4.4	12.3	7.5	10.1	17.8	22.2	3.6	7.6	11.0	7.6	10.3	0.5	0.5	2.2	10.7	12.5	1.4	1.4	0.8	0.5	68.0	76.9
711 Power generating machinery	2.0	5.1	13.8	2.2	-	-	0.7	0.2	0.1	9.9	4.0	0.3	1.0	0.5	1.1	0.5	0.4	2.8	0.7	0.4	23.8	21.9
712 Agricultural machinery	11.8	7.8	20.0	6.9	-	-	-	1.2	0.2	0.4	0.2	0.2	0.7	2.6	1.1	1.4	1.1	8.2	0.2	0.2	35.3	28.9
714 Office machines	-	5.2	-	-	-	4.1	-	1.5	-	7.5	1.1	0.4	9.6	37.1	1.8	1.4	26.8	21.0	-	-	39.3	78.2
715 Metalworking machinery	16.5	24.2	5.8	1.6	1.6	3.8	2.1	6.6	-	-	0.6	0.9	4.5	8.8	1.4	1.7	5.4	4.4	-	-	37.9	52.0
717 Textile and leather machinery	4.9	12.3	5.3	0.5	2.2	2.9	1.7	7.9	0.3	0.4	3.4	0.2	6.5	5.5	1.5	1.4	0.8	0.4	0.3	0.4	26.9	31.9
718 Machines for special industries	1.3	6.6	7.5	1.0	0.4	0.3	1.6	1.5	0.3	0.2	0.6	0.1	2.4	9.0	1.0	1.1	0.4	1.7	-	0.2	15.5	21.7
719 Machinery and appliances n.e.s.	2.6	9.7	3.9	1.7	1.3	1.9	0.2	2.5	1.4	2.0	1.3	0.3	2.0	3.8	1.9	2.3	1.3	2.4	0.1	0.0	16.0	26.6
722 Electric power mach., switchgear	3.5	13.4	5.6	10.4	0.7	0.6	0.8	3.0	0.5	0.7	0.4	0.4	0.7	4.1	1.7	3.7	0.3	1.2	0.1	0.7	14.3	38.2
723 Equipm. for distributing electricity	3.7	14.9	39.5	34.9	-	-	11.2	9.7	1.7	0.2	3.8	0.5	-	3.9	7.9	19.6	0.3	4.2	-	0.5	68.1	88.4
724 Telecommunication apparates	0.7	6.6	1.2	3.1	1.6	10.6	0.4	9.6	0.4	2.3	0.4	0.2	0.4	4.6	1.9	3.6	1.2	1.2	-	0.7	8.2	42.5
725 Domestic electrical equipm.	0.4	23.1	22.6	3.4	14.3	16.9	1.8	8.9	1.5	1.1	8.2	-	3.7	8.7	0.4	0.6	7.9	7.5	-	-	60.8	70.2
726 Electric app. for medical purposes	-	4.5	-	2.3	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	9.3
729 Other electrical machinery	2.2	5.8	1.7	2.5	7.7	7.6	2.3	6.6	1.4	1.3	1.7	0.2	4.1	6.3	3.4	3.5	1.2	2.6	-	5.9	25.7	42.3
731 Railway vehicles	10.4	79.5	3.1	-	-	-	0.9	0.7	-	-	-	0.4	-	1.6	0.9	5.4	2.3	1.6	-	0.4	17.6	89.6
732 Road motor vehicles	5.4	10.2	2.1	1.9	-	-	0.1	0.6	0.3	0.6	1.1	0.1	0.9	2.1	0.6	0.9	0.3	2.5	0.3	0.1	11.1	19.0
733 Road vehicles other than motorvehicles	3.5	7.5	2.8	2.1	-	-	9.2	19.7	-	-	26.7	1.4	-	1.4	1.4	7.2	2.9	2.3	-	-	46.5	41.6
734 Aircraft	-	-	-	1.4	-	-	-	-	0.2	0.1	-	0.0	4.5	-	0.3	-	-	-	-	-	5.0	1.5
735 Ships and boats	19.1	30.4	28.6	30.7	0.7	1.4	0.1	0.3	0.5	0.3	0.1	-	3.7	1.9	0.1	0.5	-	-	-	0.6	52.9	66.1
Total Engineering Products	5.6	13.1	8.4	6.2	2.6	3.0	1.1	3.0	1.0	1.9.	2.0	0.3	2.0	4.4	2.2	2.6	1.4	2.7	0.2	0.6	26.5	37.8

[a]Exports of OECD-countries and listed Non-OECD-LDCs.

Table A 4 - Share of Selected LDCs in World Engineering Exports[a] to Centrally Planned Economies, 1964/65 and 1970/71 (p.m.)

SITC		Spain		Jugoslavia		Hongkong		Taiwan		Mexico		India		Brazil		Portugal		Argentinien		S-Korea		Ten LDCs	
		1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71	1964/65	1970/71
691	Finished structural parts	-	-	247.7	106.5	-	-	-	-	-	-	-	138.6	-	-	-	-	-	-	-	-	247.7	245.1
692	Metal containers	-	6.0	192.9	181.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	192.9	187.2
693	Wire products	-	5.6	55.5	21.0	-	-	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-	55.5	33.2
694	Nails, screws, nuts, bolts, rivets	-	3.0	378.1	477.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	378.1	480.3
695	Tools for use in the hand or in mach.	-	-	217.8	48.6	-	-	-	-	-	-	13.1	8.3	-	-	-	-	-	-	-	-	230.9	56.9
696	Cutlery	-	-	83.5	36.0	-	-	-	-	-	-	82.1	-	-	-	-	-	-	-	-	-	165.6	36.0
697	Household equip. of base metals	-	-	945.1	837.8	-	-	-	-	-	-	-	41.0	-	-	-	-	-	-	-	-	945.1	878.8
698	Manufactures of metal n.e.s.	-	7.5	172.8	204.6	-	6.7	-	--	-	-	10.0	7.4	-	-	-	-	-	-	-	-	182.8	226.2
711	Power generating machinery	-	0.9	80.2	116.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80.2	117.0
712	Agricultural machinery	-	-	248.7	98.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	248.7	98.3
714	Office machines	-	-	16.4	9.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.4	9.9
715	Metalworking machinery	-	-	31.5	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.5	9.8
717	Textile and leather machinery	-	3.4	16.7	12.4	-	0.6	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	16.7	19.5
718	Machines for special industries	-	-	35.5	8.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35.5	8.3
719	Machinery and appliances n.e.s.	-	1.1	12.6	18.4	-	0.2	-	-	-	-	-	0.3	-	-	-	-	0.2	-	-	-	12.8	20.0
722	Electric power mach., switchgear	-	1.0	76.4	107.8	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-	76.4	109.2
723	Equipm. for distributing electricity	-	10.5	477.8	306.8	-	-	-	-	-	-	-	3.9	-	-	-	-	-	-	-	-	477.8	321.2
724	Telecommunication apparates	-	-	92.7	92.7	-	22.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	92.7	115.4
725	Domestic electrical equipm.	-	-	288.1	468.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	288.1	468.0
726	Electric app. for medical purposes	-	-	-	20.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.8
729	Other electrical machinery	-	1.1	36.1	34.7	-	11.2	-	-	-	-	5.7	1.2	-	-	-	-	-	-	-	-	41.8	48.2
731	Railway vehicles	-	-	524.7	192.8	-	-	-	-	-	-	-	17.1	-	-	-	-	-	-	-	-	524.7	209.9
732	Road motor vehicles	-	0.4	152.1	40.8	-	-	-	-	-	-	-	1.8	-	-	-	-	-	-	-	-	152.1	43.0
733	Road vehicles other than motorvehicles	-	-	556.4	80.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	556.4	80.7
734	Aircraft	-	-	-	-	-	-	-	-	-	-	97.1	-	-	-	-	-	-	-	-	-	97.1	-
735	Ships and boats	-	7.6	106.8	158.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	106.8	165.9
	Total Engineering Products	-	1.7	93.5	59.9	-	2.1	-	-	-	-	1.0	3.3	-	-	-	-	0.0	-	-	-	94.5	67.0

[a]Exports of OECD-countries and listed Non-OECD-LDCs.

Table A5 - Measuring Factor Requirements: Relationship between the United Nations' SITC and the United States' SIC and Relative Factor-Intensities[a] of Engineering Industries

SITC-No.	SIC-No.					HC[a]	PC[a]	TC[a]
691	3441	3442	3443	3444	3446	102.6	86.4	94.0
	3449							
692	3411	3443	3491			110.6	129.0	120.4
693	3357	3481				98.3	99.8	99.1
694	3315	3452				108.7	85.0	96.0
695	3423	3425	3544	3545		117.5	72.4	93.4
696	3421	3914				90.8	120.5	106.6
697	3433	3631				97.2	88.1	92.3
698	3356	3361	3362	3369	3391	106.7	78.6	91.6
	3392	3399	3429	3452	3461			
	3481	3492	3493	3494	3499			
	3566	3599	3623	3644	3993			
711	3443	3511	3519	3722		124.7	92.5	107.5
712	3522	3551				105.7	90.0	97.3
714	3572	3573	3574	3576	3579	120.6	110.9	115.4
715	3541	3542	3548			116.3	70.8	92.0
717	3552	3582	3633	3636		101.5	103.9	102.8
718	3531	3532	3533	3551	3554	113.9	91.8	102.1
	3555	3559						
719	3079	3293	3423	3432	3433	107.3	87.9	96.9
	3443	3461	3494	3499	3522			
	3531	3532	3533	3534	3535			
	3536	3537	3541	3542	3544			
	3545	3551	3553	3554	3559			
	3561	3562	3564	3566	3567			
	3569	3576	3581	3582	3585			
	3586	3589	3632	3639				

(continued)

Table A5 continued

SITC-No.	SIC-No.					HC[a]	PC[a]	TC[a]
722	3611	3612	3613	3621	3622	103.1	82.5	92.1
723	3264	3357				103.7	116.2	110.4
724	3651	3661	3662			116.9	75.2	94.6
725	3589	3631	3632	3633	3634	96.5	120.1	109.1
	3635	3639						
726	3693					112.5	124.8	119.1
729	3423	3499	3548	3559	3567	107.8	73.2	89.3
	3611	3623	3624	3629	3641			
	3642	3662	3671	3672	3673			
	3674	3679	3691	3692	3694			
	3699	3811	3821	3822	3831			
731	3741	3742				94.8	79.2	86.4
732	3461	3522	3531	3533	3713	121.0	124.7	123.0
	3717	3799						
733	3537	3715	3751	3791		88.1	72.2	79.6
734	3721	3729				135.2	83.4	107.5
735	3731	3732				105.4	38.4	69.6
Manufacturing						100	100	100

[a]Human capital-intensities (HC), physical capital-intensities (PC), and total capital-intensities (TC) of specific engineering industries relative to manufacturing as measured by the Lary-concept.

Source: U.S. Bureau of the Census, Annual Survey of Manufactures: 1971, Industry Profiles, 1971 (AS) - 10, Washington D.C., 1973.

Kieler Arbeitspapiere - Kiel Working Papers:

Kiel Working Papers make available to interested persons preliminary versions of papers originating from work done at the Kiel Institute of World Economics. Distribution rests with the author.

1. M. G i r g i s, Labor Absorptive Capacity of Export Expansion and Import Substitution in Egypt, 1954 to 1970. Kiel, July 1973, 32 pp.

2. A.D. N e u, Adjustment in the Textile and Clothing Industry. The Case of West Germany. Kiel, November 1973, 32 pp.

3. W. K o s c h o r r e c k, Antidumpingrecht im Bereich der Bundesrepublik Deutschland. Kiel, November 1973, 26 S.

4. H.R. K r ä m e r, The Changing Principles of International Trade Policy. Kiel, November 1973, 17 pp.

5. S. H e l d t, Exportförderung in Lateinamerika, insbesondere in den Andenländern. Eine Bestandsaufnahme. Kiel, November 1973, 31 S.

6. U. H i e m e n z and K.v. R a b e n a u, Effective Protection of West German Industry. Kiel, December 1973, 47 pp.

7. W. K o s c h o r r e c k, Die paratarifären Handelshemmnisse bei Einfuhr in die Bundesrepublik. Kiel, Dezember 1973, 24 S.

8. H.R. K r ä m e r, "Technische Hemmnisse" bei Einfuhren in die Bundesrepublik Deutschland. Gesundheitsschutzbestimmungen, Sicherheitsvorschriften, Normen und Maßnahmen zum Schutz der Umwelt. Kiel, Dezember 1973, 44 S.

9. R.J. L a n g h a m m e r, Der Integrationsprozeß in Zentralafrika. Kiel, Dezember 1973, 31 S.

10. J.B. D o n g e s, The Economic Integration of Spain with the E.E.C. - Problems and Prospects. Kiel, December 1973, 28 pp.

11. W. K o s c h o r r e c k, Nichttarifäre Handelshemmnisse durch Prämien, Subventionen und Ausgleichszölle. Kiel, Januar 1974, 32 S.

12. R.J. L a n g h a m m e r, Common Industrialization Policy in Small Integration Schemes. The Central African Approach. Kiel, February 1974, 34 pp.

13. K. B i e d a, Export Performance and Potential of Singapore. Kiel, March 1974, 78 pp.

14. G. F e i s, Assistance to Industry in West Germany. Kiel, March 1974, 42 pp.

15. H.R. K r ä m e r, Nichttarifäre Handelsschranken im öffentlichen Auftragswesen der Bundesrepublik Deutschland, Kiel, März 1974, 48 S.

16. A.D. N e u, Ökonomische Implikationen einer Reform des Strafvollzuges. Kiel, April 1974, 27 S.

17. S. H e l d t, Die zentralamerikanische Integrationsbewegung, ein Erfolg? Kiel, Mai 1974, 40 S.

18. R.J. L a n g h a m m e r, Probleme und Perspektiven von Gemeinschaftsunternehmen im Rahmen einer regionalen Integration von "least developed countries". Kiel, Mai 1974, 29 S.

19. S. H e l d t, Zur Messung von Integrationseffekten im Zentralamerikanischen Gemeinsamen Markt. Kiel, Juni 1974. 40 S.

20. J. R i e d e l, Factor Proportions, Linkages and the Open Developing Economy. Kiel, July 1974, 20 pp.

21. H.R. K r ä m e r, The Principle of Non-Discrimination in International Commercial Policy. Kiel, July 1974, 68 pp.

22. R. P o m f r e t, Israeli Policies Towards Imports of Manufactured Goods. Kiel, August 1974, 70 pp.

23. F. W e i s s and F.W o l t e r, Machinery in the United States, Sweden, and Germany - An Assessment of Changes in Comparative Advantage. Kiel, September 1974. 56 pp.

24. R. B a n e r j i and J.B. D o n g e s, The Domestic Resource Cost Concept - Theory and an Empirical Application to the Case of Spain -. Kiel, November 1974, 38 pp.

25. H. V ö g e l e, Die Entwicklung der Wirtschaftsstruktur und des Arbeitsplätzeangebots in den Ländern der Bundesrepublik Deutschland bis 1985. Kiel, Januar 1975, 74 S.

26. C.R. C h i t t l e, The Industrialization of Yugoslavia under the Workers' Self-Management System: Institutional Change and Rapid Growth. Kiel, January 1975, 71 pp.

27. R.W.T. P o m f r e t, Export Policies and Performance in Israel. Kiel, February 1975, 88 pp.

28. C.R. C h i t t l e, Yugoslavia under the Workers' Self-Management System: Growth and Structural Change in the External Sector. Kiel, March 1975, 59 pp.