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Trends and interdependencies in engineering trade patterns of industrial countries 1964-70.

By Lennart Ohlsson*

Recent decades have witnessed a growing international dependence of national production and consumption of industrial commodities. Increasing export ratios of production and decreasing home market shares of domestic comsumption give evidence of this tendency. Strong links have thus been established between industrial countries in commodity markets as well as in capital markets. The growing capital markets interdependence in the commodity markets is of course a mirror image of a growing production and trade specialisation leading to an increased international division of labour. However, there is little empirical research published about the nature of the long run changes in commodity trade specialisation and national trade adjustment patterns.

This paper purports to give a contribution to this field by analysing trends and interdependencies of the commodity trade patterns of 14 industrial countries in the engineering sector. By utilising a simple methodology earlier discussed in Ohlsson [1975] each country's engineering trade specialisation tendency between 1964 and 1970 is investigated in order to find out whether or not there are any systematic changes vis-à-vis the 1964 specialisation pattern. The interest is thus focused on revealing possible trends of a macroeconomic kind rather than changes caused by disparate movements for individual products, industries or firms in technology, tariffs, ability of management etc.

The development of trade specialisation of one country always corresponds to equivalent changes in the trade of other countries. A

*This paper reports result from a study of the engineering trade specialisation of Sweden and fourteen other industrial countries from the Industrial Institute for Economic and Social Research (Ohlsson [forthcoming]). The author is now studying the regional pattern of industrial specialisation in Sweden for the Expert Group on Regional Studies, a public commission under the Ministry of Labour. Thanks go to Bo Carlsson and Olle Renck for valuable comments on an earlier version of this paper.

comparison across countries of commodity trade specialisation tencencies may, in consequence reveal which economies are most interrelated. Put together with the information derived from the analysis of each country's trade specialisation trend, such a comparison might supply hypotheses of whether the international adjustment mechanism in the engineering sector has any features indicating macroeconomic causes to changing trade patterns.

In the following section two specialisation measures are presented. Section 2 shows the absolute and relative extent of engineering trade in industrial countries. By using the two trade specialisation measures the fourteen countries can be classified according to whether they have increased or decreased their specialisation on engineering goods in general. Section 3 presents trends in the same countries' specialisation within the engineering sector on 106 commodity groups. An outline of a possible, macroeconomic oriented interpretation of the results is sketched in section 4. This interpretation offers various hypotheses, some of which indicate certain interdependencies in the engineering trade specialisation patterns of the 14 countries. The latter hypotheses are put to some tests in a correlation analysis of how the patterns of these countries are linked to certain others (section 5). Section 6 summarizes the results and interprets them in a wider perspective.

1. Two specialisation measures.

Given the purpose of the present paper to analyse trends in commodity specialisation between two years, one would like to obtain a set of (homogeneous) products, for which set a given country j:s competitiveness was well defined in terms of an index of comparative advantage. Excluding among other things so called border trade, one would expect the products to be either pure exportables or pure importables. The net exports ratio $\frac{X_j - M_j}{X_j + M_j}$, i.e. the ratio between the difference and the sum of exports (X_j) and imports (M_j), would suffice to classify the products as (pure) exportables and importables respectively.[1)]

1) However, it would be impossible to evaluate from the net exports ratio the comparative advantage within the pure exportable and pure importable groups respectively, since it takes on only the extreme values +1.0 and -1.0. In addition, the possibilities to discriminate between various trade theories according to their explanatory power would become statistically difficult due to the dichotomous nature of the dependent variable, i.e. the specialisation measure. The best analytical possibility would probably be to study changes in the net exports ratio given that all changes in the determinants of the comparative advantage are known, occur frequently but one by one during the period.

It is, of course impossible to reach commodity groupings consisting of such homogeneous products. The consequences as far as the net exports ratio is concerned are of two kinds. The first one is that net exports ratios of +1.0 (pure exportables) and -1.0 (pure importables) become relatively rare. A second consequence is that part of the trade pattern cannot be explained at the chosen level of aggregation, namely that part called the intra-industry trade.[1] The net exports ratio of a given country is here used at a given level of aggregation for comparisons across 106 commodity groups. Consequently, the necessary assumption is that the broad variations in this ratio reflect more differences in international competitiveness of the domestic industry than differences in the heterogeneity of the commodity groups. The subsequent analysis will show the possible justification of this assumption.

As a safeguard, a second specialisation measure will be used parallelly with the net exports ratio. It is called the world exports share, measured for a given commodity group and a given country as X_j/X_w, where X_w = total OECD exports. The world exports share has the advantage over the net exports ratio of being more intuitively acceptable as a measure of a country's (or a firms) competitiveness. However, it is in principle disputable on the same grounds as the net exports ratio, i.e. the heterogeneity of commodity groups and the related aggregation problems. The two measures differs in one important respect and have three important characteristics in common.

To begin with their common features, the net exports ratio and the world exports share have both the advantage over some alternative measures of being fairly insensitive to commodity-specific natural trade impediments such as transport costs. Secondly they both neglect

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1) As discussed by Grubel & Lloyd [1975], chapter 2 various measures have been used in studying intra-industry trade. Other recent studies of intra-industry trade are Adler [1970], Gray [1973], Hufbauer & Chilas [1974] and Ohlsson [1975]. Grubel & Lloyd [1975] measures the extent of such trade for a given industry (or commodity group) i as $R_i = (X_i+M_i) - |X_i-M_i|$, i.e. the difference between the sum of and the absolute value of the difference in exports and imports. In other words they define intra-industry trade as that part of total trade (X+M), for which export matches imports. (For the sake of simplicity we may here neglect adjustments for the relative certain size of trade and for trade imbalance). The rest, i.e. $|X_i-M_i|$ is dubbed inter-industry trade. It is obvious that their definition utilizes the above noted property of the net exports ratio for perfectly homogeneous goods to become either +1.0 or -1.0. However, since they first of all wished to quantify the extent of intra-industry trade no distinction was made between a positive and negative sign of the ratio, i.e. between exportables and importables; only the size matters.

the existence of more than one foreign country at a time, i.e. the rest of the world is treated as one country.[1] Thirdly, both specialisation indices are constructed as ratios, the denominators of which are measuring differences in market size between commodity groups. Consequently, since both indices normalizes for the demand structure they are more oriented towards theories explaining trade specialisation in terms of differences in production costs.

The difference between the two specialisation indices relates to their different space or geographical dimension. The net exports ratio may be said to measure the competitiveness of the domestic producers at the national border line. In contrast, the world exports share reflects their global competitiveness i.e. in world-wide imports visavi exporting producers from other countries.[2]

Summarizing, two measures have been chosen for various analyses of changes in national specialisation patterns across 106 engineering commodities (or rather commodity groups). But first of all, the extent of engineering trade will be presented in the next section for the fourteen industrial countries.

2. Engineering trade in 1964 and 1970

Table 1 presents for the year 1970 14 countries' engineering[3] exports and imports in $ milj. and as per cent of their respective total exports and imports. The sum of their engineering exports amounts to a value about 50 % larger than that of their corresponding imports, thus rendering them an export surplus of 24 $ billion. Probably these countries cover around 90 % or more of total world exports of engineering products.

Table 1 gives the general impression that engineering products are relatively important in total trade of industrial countries. This is especially true for exports and usually more so for large than for small countries. Table 2 gives an account of how each country has specialised on engineering products as a whole visavi other products in 1964 and 1970. The aggregate net exports ratio of all fourteen countries showed then a notable decline from 26 to 19 %.[4]

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1) For each one of the fourteen countries its commodity trade specialisatic is thus studied only visavi the rest of the world.

2) The difference between the two measures becomes obvious if X_j is decomposed into M_j and M_R where M_j=imports of country j and $M_R=M_w - M_j$. Thus neglecting the valuation problem for imports and exports, the world exports share may then be rewritten as $X_j/(M_j+M_R)$. While the net exports ratio is a dichotomous variable in a world of only pure exportables and importables, the world exports share is so only if, in addition, the world consists of only two countries. Otherwise the latter share may vary for pure exportable but be equal to zero for pure impotables. In order to avoid the lack of variations for such importables the alternative measure $(O_j+X_j)/(O_j+M_j+M_R)$. where O_j denotes sales to the domestic market of the domestic producers. But O_j cannot be obtained for the countries.

3) The exact definition of engineering products is given in table 1. Note that both airplanes (SITC 734), ships and boats (SITC 735) and watches (SITC 861) are excluded. This definition is chosen to concord with an industry definition of the engineering sector in Ohlsson [forthcoming].

4) Note that there is a bias in this net exports ratio due to the fact that exports, fob. and imports, cif. have been evaluated differently. Consequently, the net exports ratio for the whole world will not obtain the value zero but instead a small negative value, since the numerator will equal the negative sum of transportation and insurance costs.

Table 1. Exports and imports of engineering products* in $ milj. and in % of total exports and imports of 15 industrial countries. 1970.

Country	Engineering exports in $ milj (1)	Engineering imports in $ milj (2)	Total exports in $ milj (3)	Total imports in $ milj (4)	Column 1 as % of column 3 (5)	Column 2 as % of column 4 (6)
Canada	5 123	6 875	16 564	13 348	30.9	51.5
USA	16 279	12 015	42 590	39 952	38.2	30.1
Japan	7 593	1 930	19 318	18 881	39.3	10.2
Belgium-Luxemburg	2 656	3 178	11 609	11 362	22.9	28.0
The Netherlands	2 284	3 743	11 766	13 393	19.4	27.9
West Germany	17 470	5 892	34 189	29 814	51.1	19.8
France	6 041	5 101	17 739	18 922	34.1	27.0
Italy	5 338	3 154	13 210	14 939	40.4	21.1
Great Britain	8 163	3 619	19 262	21 678	42.4	16.7
Norway	295	972	2 455	3 698	12.0	26.3
Sweden	2 654	2 242	6 782	7 005	39.1	32.0
Denmark	835	1 291	3 285	4 385	25.4	29.4
Austria	815	1 248	2 857	3 549	28.5	35.2
Switzerland	1 928	1 951	5 102	6 448	37.8	30.3
Sum	77 474	53 211	206 728	207 374	37.5	25.7
Total OECD	78 419	57 474	214 747	220 892	36.5	26.0

*Engineering products are here defined as SITC 69; 7; 812; 861 except SITC 711.4; 729.2; 734 and 735.

Source: OECD, Commodity trade statistics, Exports and Imports, 1970.

Table 2. Net export ratios and world export shares of 14 industrial countries' engineering trade* in 1964 and 1970

Country	Net export ratio 1964	Net export ratio 1970	World export share 1964	World export share 1970
Canada	-56.0	-14.6	2.3	6.5
USA	55.7	15.1	25.9	20.8
Japan	43.2	59.5	5.3	9.9
Belgium-Luxemburg	-17.5	-8.9	3.0	3.4
The Netherlands	-25.2	-24.2	3.1	2.9
West Germany	63.8	49.6	23.8	22.3
France	5.1	8.4	6.7	7.7
Italy	14.4	25.7	5.5	6.8
Great Britain	54.2	38.6	15.4	10.4
Norway	-63.3	-53.4	0.3	0.4
Sweden	1.0	8.4	3.4	3.4
Denmark	-27.0	-21.4	1.1	1.1
Austria	-26.1	-21.0	1.0	1.0
Switzerland	-3.7	-0.6	2.7	2.5
Sum of all countries	26.1	18.6	99.6	98.8
Total OECD	22.4	15.4	100.0	100.0

*See table 1 for a definition.

Source: See table 1.

Several countries have decreased their specialisation on engineering goods according to both measures, especially the U.S.A. and Great Britain but to some extent also West Germany. The latter country had in 1970 taken over the position of the U.S.A. in 1964 as the leading exporting country in the engineering field. These two countries accounted in 1970 together with Great Britain and Japan for 63 % of OECD engineering exports, compared to 70 % in 1964.

The British world exports share fell with more than 30 % from its 1964 value. Japan was, of course, rapidly increasing its share but Canada showed the largest relative increase as it almost trebled its 1964 share. France and Italy gained markets in OECD engineering exports while most other European countries showed little changes.

Tables 1 and 2 give ample evidence of the important positions held by the U.S.A., West Germany, Great Britain and Japan in the world market for engineering products but also for industrial products in general. Systematic changes of their specialisation may in consequence have had palpable world-wide repercussions on the pattern of international trade.

3. Trends in specialisation 1964-70

Trade theories might be classified in two groups according to whether or not they emphasize determinants of a macroeconomic, long run nature behind a given country's commodity trade pattern. One notable theory of the former kind is the factor proportions theory, which in its modern version comprises a large number of theories including the Heckscher-Ohlin-Samuelson model as a special case. The technological gap theory exemplifies instead a theory designed to give a microeconomic explanation of sometimes temporary trade in certain products or industries (cf. for instance Posner [1961]). As a starting point suppose we have a theoretical framework allowing for various trade explanations. Furthermore, suppose that these explanations are jointly defining one index of comparative advantage for a given country in the year 1964. This index varies across the 106 commodity groups presumably in a way that is roughly revealed by our two measures of specialisation.

If we are solely interested in discovering whether or not there are macroeconomic causes to changes in the commodity trade specialisation it may be sufficient to relate the changes of a specialisation measure 1964-70 to its 1964 values. Causes of a microeconomic kind connected with firm or product specific changes in technology, efficiency, tariffs, etc. cannot possibly give such a systematic relationship in a cross-section

of commodities. Given that such a systematic relationship is obtained it is as shown by Ohlsson [1975] of interest to assess the sign of the intercept as well as the sign and sometimes also the size of the slope of the regression line. A positive (negative) intercept means that the country has on average increased (decreased) its specialisation on the 106 commodity groups. A positive slope reveals that it has increased (decreased) its specialisation on commodity groups in which it had a strong (weak) competitive position already in 1964. A negative slope indicates the opposite tendency, but the interpretation depends in this case also on how the slope is related to that of a 135^{o}-line.

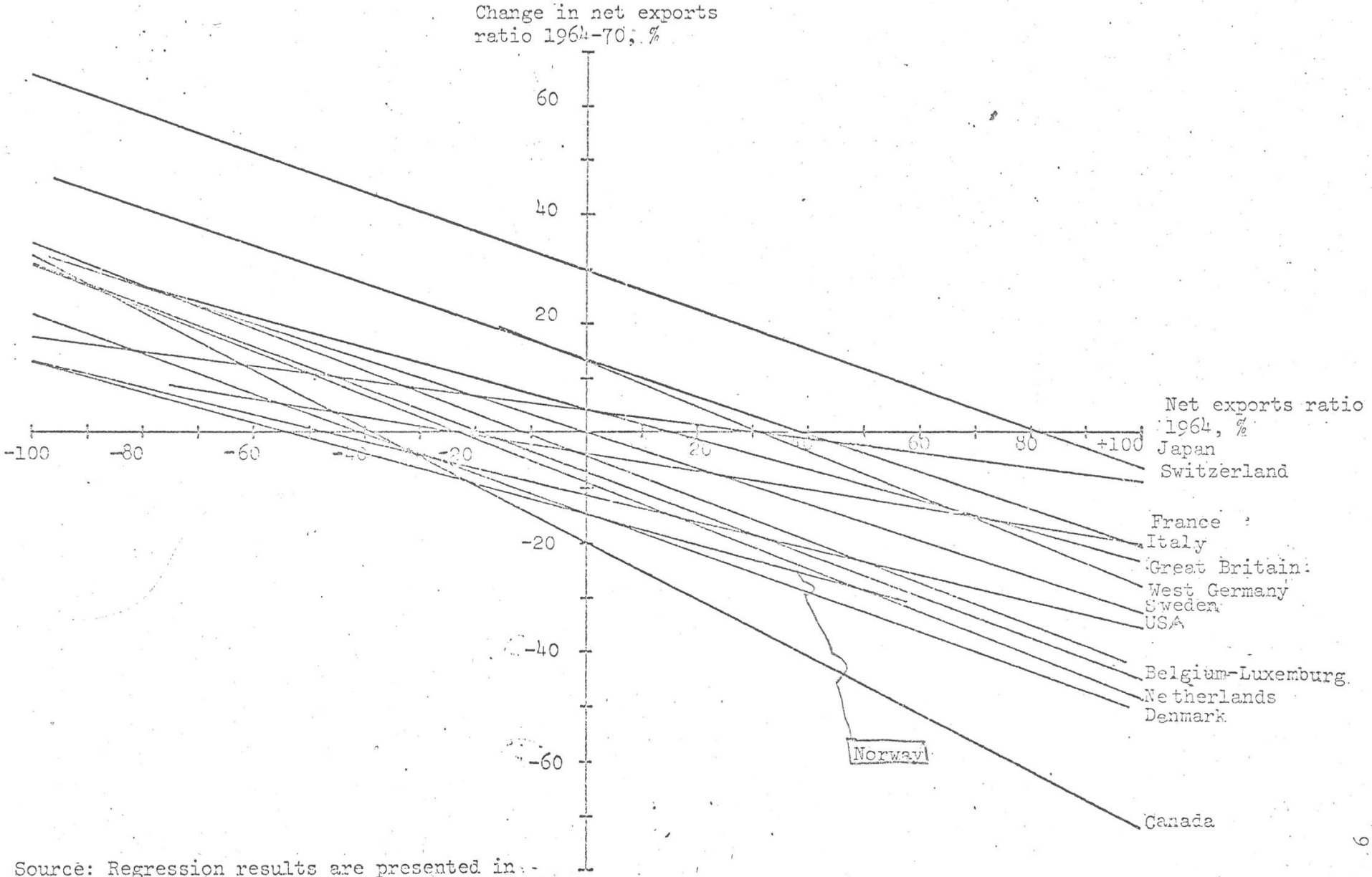
A point lying on an 135^{o}-line through the origin has the property that the 1964-70 change in the specialisation measure exactly matches the negative value of the same measure in 1964, implying that the 1970 value is equal to zero. Obviously, a line with a significantly lower slope, i.e. having a regression coefficient below -1.0, suggests that the specialisation pattern has become reversed. Commodity groups with a strong competitive position in 1964 - in terms of the net exports ratio or world exports share - have thus systematically tended to obtain a weak position in 1970.

If, on the other hand, the regression slope is larger that 135^{o} (i.e. the regression coefficient is larger than -1.0) no definite conclusion can be derived. In principle, the following three interpretations, which are not necessarily mutually exclusive, are possible:

1. The specialisation pattern is reversing but the reversal requires a longer time period than 1964-70.
2. Deep going systematic changes in specialisation and its underlying causes has in fact occurred, although they are not eventually leading to a complete reversal.
3. There has merely been an increased specialisation within rather than between commodity groups, which tendency is stronger for commodity groups with little intra-industry trade in 1964 than for those with smaller such trade.

Figure 1 summarizes the linear relationships, which have been obtained for 14 industrial countries in regressions between their respectiv change 1964-70 in and 1964 level of the net exports ratio. Table 3 gives the underlying details. The relationship is for each country significantly negative at the 2.5 % (or lower) level. The explanatory value varies between 5.3 % (for France) and 33.6 % (for Japan). The layest negative regression coefficient is -0.526 for Canada. Consequently, no reversals of trade patterns was obtained for the countries in 1964-70 leaving open to further discussion which one of the three possible interpretations

Figure 1. - The linear relationship between changes in net exports ratios 1964-70 and 1964 net exports ratios for 14 industrial countries



Source: Regression results are presented in table 3. The horisontal extent of the lines shows the extreme values of the 1961 net exports ratios.

Table 3. The relationship between changes in the net exports ratios 1964-70 and the 1964 net exports ratios of 14 industrial countries

Regression No	Country	Constant	Regression coefficient (with standard deviation)	R^2	F-value (degrees of freedom)
1	Canada	-0,2008	-0.5227[a]	0.2536	35.333[a]
			(0,0884)		(1;104)
2	USA	-0,1158	-0,2429[a]	0,1366	16,461[a]
			(0,0599)		(1;104)
3	Japan	0,2909	-0,3629[a]	0,3364	52,718[a]
			(0,0500)		(1;104)
4	Belgium-Luxemburg	-0,0728	-0,3787[a]	0,2294	30,956[a]
			(0,0681)		(1;104)
5	The Netherlands	-0,0994	-0,4043[a]	0,2664	37,763[a]
			(0,0658		(1;104)
6	West Germany	0,1300	-0,4145[a]	0,2013	26,207[a]
			(0,0810)		(1;104)
7	France	-0,0417	-0,1624[a]	0,0526	5,779[a]
			(0,0676)		(1;104)
8	Italy	0,1238	-0,3455[a]	0,1595	19,743[a]
			(0,0778)		(1;104)
9	Great Britain	0,0425	-0,2804[a]	0,1480	18,072[a]
			(0,0660)		(1;104)
10	Norway	-0,1522	-0,2766[a]	0,1390	16,795[a]
			(0,0675)		(1;104)
11	Sweden	-0,0054	-0,3293[a]	0,2022	26,359[a]
			(0,0641)		(1;104)
12	Denmark	-0,1588	-0,3765[a]	0,2359	32,100[a]
			(0,0664)		(1;104)
13	Austria	-0,0493	-0,3916[a]	0,2335	31,686[a]
			(0,0696)		(1;104)
14	Switzerland	0,0400	-0,1309[a]	0,0914	10,456[a]
			(0,0405)		(1;104)

a = significant at the 2.5 %(or lower) level.

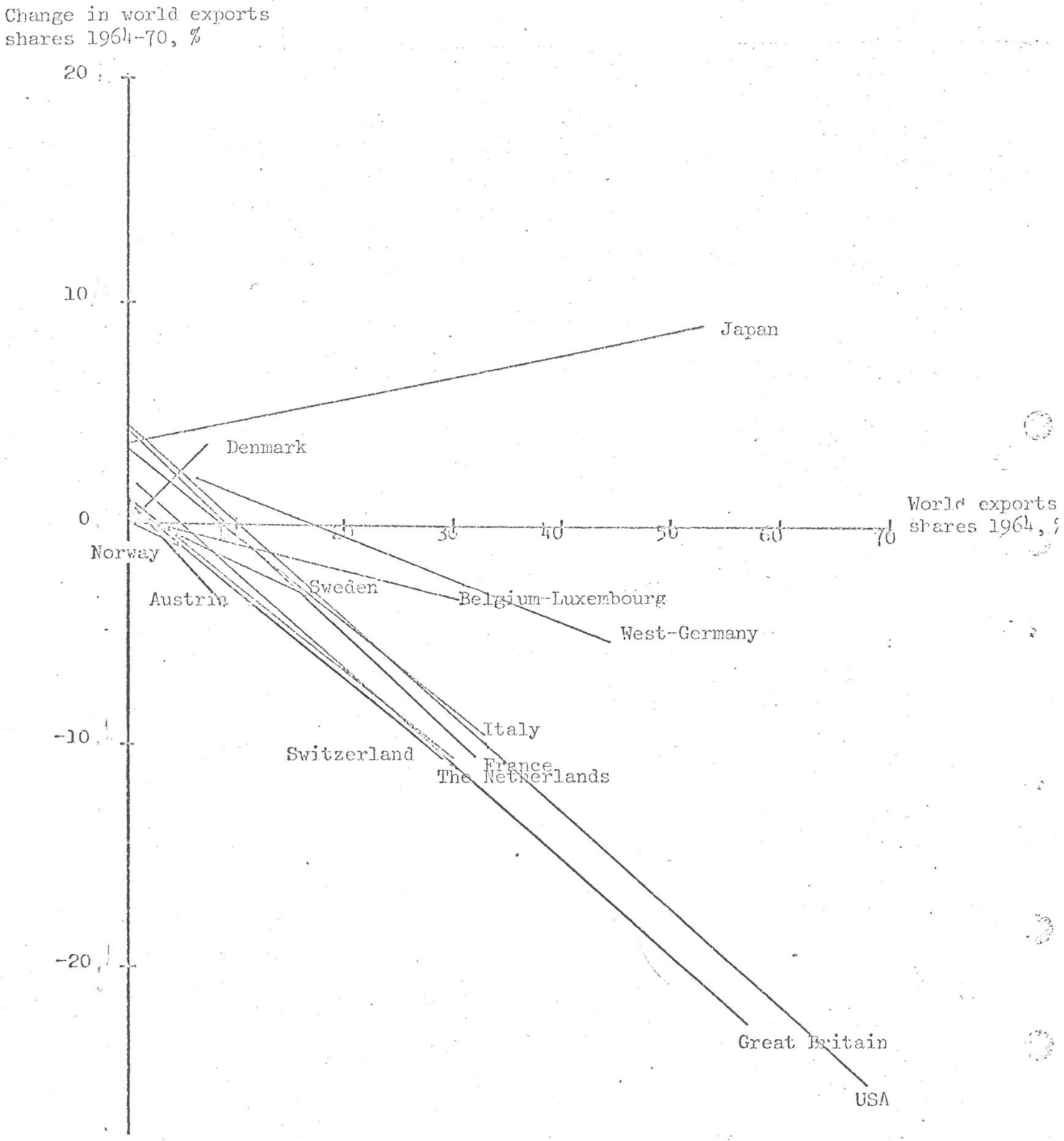
above is true.

The differences between the countries as regards the development of their average (unweighted) specialisation on the 106 commodity groups is indicated by the intercepts in figure 1 (or the regression constants of table 3). Japan received the largest positive intercept with Canada in the opposite extreme. However, both countries increased their aggregate net exports ratio for engineering trade as a whole according to table 2. Clearly, since the intercept term does not weight the commodity groups according to their relative size in foreign trade a negative intercept does not necessarily indicate un unfavourable development of the net trade balance for engineering products.

One simple way to check the obtained results as far as the negative sign obtained for the relationships is to run the analogous regressions for the world exports shares. A visual summary of these latter regressions is presented in figure 2, while as the full regression results are shown in table 4. A significant (at the 2.5 %, or lower, level) negative relation ship was obtained for 11 out of 14 countries. For Denmark and Japan the relationship is weak but significant positive. No significance was received for Canada. The results for Japan and Canada are interesting in so far as they both had strong negative relationships for the net exports ratio. It is possible that the difference between the measures in geographical specification is especially important for these two rather distant countries.

High R^2 values and large negative regression coefficients was derived for the U.S.A., Great Britain, the Netherlands and Switzerland.

Figure 2. The linear relationship between changes in world exports shares 1964-70 and 1964 world exports shares for 13 industrial countries*



* No significant relationship was obtained for Canada.

Source: Regression results are presented in table 4. The horisontal extent of the lines shows the extreme values of the 1964 world export shares.

Table 4. The relationship between changes in world exports shares in 1964-70 and the 1964 world exports shares for 14 industrial countries.

Regression No	Country	Constant	Regression coefficient (with standard deviation	R^2	F-value (degrees of freedom
1	Canada	0.0143	0.1155 (0.2027)	0.0031	0.325 (1;104)
2	USA	0.0460	-0.4342[a] (0.0545)	0.3790	63.481[a] (1;104)
3	Japan	0.0362	0.1034[b] (0.0655)	0.0234	2.491 (1;104)
4	Belgium-Luxemburg	0.0030	-0.1188[a] (0.0298)	0.1329	15.934[a] (1;104)
5	The Netherlands	0.0143	-0.3935[a] (0.0453)	0.4200	75.314[a] (1;104)
6	West Germany	0.0336	-0.1898[a] (0.0634)	0.0792	8.949[a] (1;104)
7	France	0.0440	-0.4635[a] (0.1438)	0.0908	10.388[a] (1;104)
8	Italy	0.0346	-0.3919[a] (0.0927)	0.1465	17.858[a] (1;104)
9	Great Britain	0.0235	-0.4308[a] (0.0400)	0.5276	116.146[a] (1;104)
10	Norway	0.0019	-0.2694[a] (0.0692)	0.1272	15.156[a] (1;104)
11	Sweden	0.0080	-0.2465[a] (0.0485)	0.1988	25.809[a] (1;104)
12	Denmark	-0.0029	0.5465[a] (0.2384)	0.0481	5.257[a] (1;104)
13	Austria	0.0103	-0.5187[a] (0.2020)	0.0596	6.596[a] (1;104)
14	Switzerland	0.0100	-0.3954[a] (0.0439)	0.4377	80.971[a] (1;104)

a = significant at the 2.5 % (or lower) level

b = significant at the 5 % level

Summarizing, the results obtained do not exclude the possibility of macroeconomic causes to changes in trade specialisation of industrial countries. However, no firm conclusion can be drawn from these results alone, since one interpretation might be an increased intra-industry (intra-commodity group) trade if the increase is linked with the initial specialisation pattern as described above (cf interpretation 3). Following Ohlsson [1975], one way of analysing whether there has in general been an increased intra-industry trade, would be to look at the change in standard deviations for the net exports ratio between 1964 and 1970. Decreasing standard deviations imply, that this is the case. However, according to appendix table 1 the changes are all so small that no important increases in intra-industry specialisation seem to have occurred.

In order to be able to draw more definite conclusions, one would have to study whether the results could be generalized.

a) to all commodity trade for the 14 countries

b) for a longer time period than 1964-70.

If negative relationships were in fact obtained for all commodity trade during such an extended period, that at least some countries' regression coefficients became lower than -1.0, then the intra-industry trade hypothesis could be rejected as the main explanation[1] of the results above. Another way of testing the same thing would be to relate the changes in specialisation to possible determinants of a macroeconomic kind. In this paper no investigation along with the suggested lines is presented. Suffice it to say that Ohlsson [1975] has shown the results to be insensitive for further disaggregation as far as Swedish trade with fabricated metal products is concerned. Ohlsson [1974a] produces similar evidence for the Swedish engineering industry. He reveals in addition that changes in the net exports ratios are significantly correlated with three factor intensities of production at a sub-industry level and in a way indicating a factor proportions explanation to the shifting trade pattern.

In the following section a specific hypothetical, macroeconomic

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1) Of course an increased intra-industry trade can be derived as a consequence of thorough changes in macroeconomic incentives to the commodity trade pattern.

explanation of the negative relationships of figures 1 and 2 is proposed. The explanation is chosen so as to allow further testing by analysing interdependencies between the commodity trade patterns of the 14 industrial countries.

4. An outline of a possible interpretation of the results

In the following one possible interpretation of the results is outlined. It is a macroeconomic explanation based on an assumption that both the world exports share and the net exports ratio can be accepted as measuring differences in international competitiveness across the commodity groups for a given country. The basic determinants of this competitiveness are furthermore assumed to be the technology characteristics of the products in terms of factor intensities together with the factor abundance of the given country. The factor intensities are assumed to be internationally given and, as far as the ranking is concerned, stable over time. Thus the two specialisation measures are assumed to reveal differences in comparative advantage, the latter concept being interpreted within the framework of the modern factor proportions theory. First a schematic theoretical example is outlined.

Suppose now that we have a multiproduct - two factor - multicountry model, in which the world consists of one major country and a number of small ones. Foreign trade represents only a small proportion of the economy o the major country but very large proportions of the economies of the small ones. It is assumed that each country's factor abundance is well defined and that the specialisation pattern of each country conforms well to its comparative advantage on the given set of products. Assume furthermore that the major country had for a long time been well endowed with capital - human as well as non-human - per unit of labour vis-à-vis the rest of the world (or vis-à-vis each of the small countries). At a given point in time this major country experiences an instantaneous and substantial decrease of its capital endowment reversing its capital/labour proportion compared to those of the small countreis. The decrease may for simplicity be assumed to occur in the large non-competing sector of the economy spreading gradually to the competing sector. The scarcer capital supplies means that the adjustment of the foreign trade sector can be expected to decrease the major country's specialisation on capital intensive products.

The repercussions on the smaller countries should in turn mean that they might increase their specialisation on some capital intensive products and in turn decrease it on some of the capital extensive ones. For each affected country the trends in specialisation will tend to be negatively connected with its initial specialisation.

This schematic example of an international adjustment mechanism is formulated as a comparative static factor proportions model. The nature of the adjustment mechanism is attributable to the strategic assumption that the capital intensity ranking of the commodities is both internationally given and stable in the long run. This assumption has received some empirical support at the subindustry and commodity group level especially as regards its long run stability.[1] The underlying determinant of the tendency of shifting trade patterns was here an exogenous change in the capital stock of the country. Other causes discussed in the factor proportions literature are changes in trade impediments or technology. However, such changes can hardly imply a similar specialisation reversal tendency except in the usual text-book model with two products. In a multiproduct model the same implication might be derived only in the more unlikely case that these changes are systematic in relation to the initial structure of tariffs or technology characteristics. For instance in the two factor model the changes in the factor intensity must be negatively related to the initial intensity thus leading to an evening out of the factor intensity differences.

Summarizing, one interpretation of the results in the preceding section would be that at least one of the major countries have experienced a drastic change in its factor abundance vis-à-vis other industrial countries. Such a change may have been brought about by the second world war in which case the effects can be analysed within a comparative static framework. Alternatively, it may be connected with persisting differences in growth performance. Evident examples of differences of this kind are those between Great Britain and the US on the one hand and West Germany and Japan on the other. Of course, it cannot be expected that the trade adjustment

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1) At the subindustry level the hypothesis of complete stability of the ranking of capital and technical personnel intensities, respectively, could not be rejected for the Swedish engineering industry in the periods 1954-68 and 1959-68 (cf Ohlsson [1974 a and forthcoming]). In addition, there was a similar strong stability at the 106 commodity groups level in 1964-70 ton prices as measured in OECD-Europe's exports (cf Ohlsson [forthcoming, chapter 7]).

mechanism is as simple as that schematically outlined above in the multi-product - two factor - multicountry case due among other things to the existence of more than two factors of production, temporary technological gaps, economies of scale, product differentiation etc. However, if there have in fact been such major changes in the general comparative advantage of countries due to dissimilar growth performances many of the various adjustments for individual products/producers have the same cause. In consequence, the changes in inter-industry and intra-industry specialisation may be complementary and the underlying causes the same. However, the various adjustments cannot all be interpreted in terms of a single trade theory.

The suggested interpretation has two important implications. The first one is that the derived negative relationships of section 3 for the engineering sector can be expected to be generally true for all commodity trade.[1] The second implication is that the trade adjustment of a given country experiencing strong repercussions on its trade specialisation ought to be connected with the technology characteristics of the products in a way concording to the factor abundance of this country. As mentioned above, such an adjustment pattern has been found for Sweden at the sub-industry level (cf Ohlsson [1974a]).

One of the most important questions to tackle if the suggested interpretation is accepted is which countries may have experienced such drastic changes in their comparative advantage. Table 2 suggests West Germany, USA, Great Britain and Japan because of their relative size. In the next section we shall try to assess whether the trade patterns of the 14 industrial countries relate to those of these four countries in a way concording to the hypothesis that notable repercussions from such drastic changes can be traced.

5. The interdependence of national specialisation patterns

For the sake of brevity the following discussion is concentrated on the world export share correlation matrix in table 5, while the analogous correlations for the net exports ratio put in appenix table 2 is not commented upon. Table 5 gives three kinds of correlations which are discussed separately in the following.

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1) With due respect taken to the fact that the short time period 1964-70 may not be sufficient to reveal similar changes in the heavy process industries, for which the adjustment periods may be much longer.

Table 5. A correlation analysis of the interrelationship of national specialisation patterns in 1964-70. 106 observations.

Country j	Correlations between 1964 world exports shares of country j and those of				Correlations between 1964 world exports shares of country j and the 1964-70 changes of world exports shares of				Correlations between the 1964-70 changes of worlds exports shares of country j and those of			
	USA	Japan	West-Germany	Great Britain	USA	Japan	West-Germany	Great Britain	USA	Japan	West-Germany	Great Britain
Canada	0,29[a]	-0.10	-0.17[a]	-0.20[a]	-0.21[a]	-0.09	0.02	0.25[a]	-0.28[a]	-0.10	-0.05	-0.05
USA	1.00[a]	-0.38[a]	-0.32[a]	-0.24[a]	-0.62[a]	-0.14	0.29[a]	0.21[a]	1.00[a]	0.02	-0.22[a]	-0.36[a]
Japan	-0.38[a]	1.00	-0.10	-0.21[a]	0.09	0.15	-0.24[a]	0.19[a]	0.02	1.00[a]	-0.21[a]	-0.14
Belgium-Luxembourg	-0.25[a]	0.07	-0.14	-0.12	0.07	-0.09	0.03	0.11	-0.17[a]	-0.09	0.32[a]	0.10
The Netherlands	-0.20[a]	0.00	-0.09	-0.04	0.29[a]	-0.10	0.11	-0.05	-0.24[a]	-0.06	-0.05	0.15
West Germany	-0.32[a]	-0.10	1.00	-0.13	0.13	0.10	-0.28[a]	-0.03	-0.22[a]	-0.21[a]	1.00[a]	-0.09
France	-0.25[a]	-0.14	-0.09	0.07	0.19[a]	-0.02	-0.09	-0.13	-0.31[a]	-0.04	-0.30[a]	0.16
Italy	-0.21[a]	-0.02	0.00	-0.19[a]	0.09	0.13	-0.24[a]	0.17[a]	-0.26[a]	-0.25[a]	-0.01	-0.15
Great Britain	-0.24[a]	-0.21[a]	-0.13	1.00	0.29[a]	0.02	0.17[a]	-0.73[a]	-0.36[a]	-0.14	-0.09	1.00[a]
Norway	0.00	-0.10	-0.23[a]	0.12	-0.10	0.07	-0.03	-0.09	-0.03	0.05	-0.04	-0.03
Sweden	-0.02	-0.24[a]	0.03	-0.02	0.08	-0.07	0.12	-0.01	-0.22[a]	-0.13	-0.13	0.11
Denmark	-0.06	-0.21[a]	-0.02	-0.02	0.19[a]	-0.13	-0.04	-0.05	0.22[a]	-0.07	-0.06	-0.25[a]
Austria	-0.19[a]	0.13	0.05	-0.07	0.09	0.14	-0.13	0.05	-0.17[a]	-0.45[a]	0.04	0.08
Switzerland	-0.09	-0.04	-0.01	-0.05	0.21[a]	-0.01	0.12	0.23[a]	-0.31[a]	-0.06	0.00	-0.12

a = significant at the 5 % level (one-tail test).

In the first four columns the correlations between the 1964 world exports shares of the four major countries and the share of each one of the 14 industrial countries are presented. They intend to give a picture of how these countries' exports were competing with each other in a given world market in 1964. A comparison between correlations with the US world export share and those with the German world export share indicates that the US specialisation is more dissimilar to other industrial countries than the West German one. The US share is negatively correlated with 8 other countries' shares while for Germany only three significant negative correlations are obtained.[1] Furthermore, the US specialisation was in 1964 dissimilar to the specialisation of all the three other major countries and especially with the Japanese and German ones. For these three countries only the correlation between the world export shares of Japan and Great Britain was significantly negative. Since the German and US aggregate world exports share was almost the same this shows, as did the standard deviations in table 1, that the latter country had a stronger specialisation in 1964 in terms of differences in world exports shares and net exports ratios across commodities.

The middle group of four columns in table 5 shows how the changes in world exports shares of the USA, Japan, West Germany and Great Britain respectively were correlated with the 1964 shares of the 14 countries. These correlations indicate in other words how the changing trade patterns of these four countreis may have affected other countries differently according to whether the changes were similar or dissimilar to the latter countries' trade pattern in 1964. Thus the USA tended to increase its specialisation on commodities, in which Great Britain, France, the Netherlands, Denmark and Switzerland were specialised in 1964. Japan's changing specialisation was not at all correlated with other countries' initial specialisation. West Germany increased its world exports shares for commodities, in which the US and British shares were large in 1964, whereas Japanese, West German and Italian shares were small. Lastly, the British engineering industry increased its concentration on commodities with high Canadian, US, Japanese, Italian and Swiss world export shares in 1964. The only significantly negative correlation between changes in Great Britain's world export shares and 1964 shares was obtained with the British shares.

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1) Cf also figure 1, which shows that West Germany in 1964 had no observations with large negative net export ratios. Instead the net exports ratios were in general positive that year. The development between 1964 and 1970 meant, however, that some larger negative net exports ratios were obtained.

The last four columns of table 5 present the correlations between the 1964-70 changes in the world exports shares of USA, Japan, West Germany and Great Britain and the corresponding changes for the 14 industrial countries. These correlations indicate similarities/dissimilarities between countries in their trends in specialisation. It is evident from table 5 that the US trend is dissimilar to the trends of most other countries except Japan (no correlation), Norway (no correlation) and Denmark (a positive correlation). The Japanese specialisation moves in the opposite direction to the West German, Italian and Austrian ones. West Germany and Belgium-Luxembourg have tended to increase their specialisation on the same commodities while West Germany and France have a dissimilar development. Great Britain, finally, has directed its exports towards commodities, for which exports from USA and Denmark have not expanded much.

A summary can be made in three points. First, there are tendencies in the world exports shares of expecially the USA but also West Germany and Great Britain, which indicate that they might have changed their specialisation in different directions vis-à-vis each other as well as against other industrial countries. Secondly, the generally increasing world exports shares of Japan (cf table 2) do not seem to have affected the specialisation pattern of any other country with the possible exception of West Germany and Italy. This development suggests perhaps that the Japanese development was not as much characterized by an increased participation in the international division of labour as a general catching up or market expansion process of an economy with a large growth potential in the beginning of the period. Such an interpretation concords also with the positive relation derived between changes in Japan's world exports shares and its corresponding shares in 1964.

Thirdly, the size of the (significant) correlation coefficients indicates that no single country has had to adjust its specialisation pattern very much in the analysed period. This result may in part be due to the short period. However, a more plausible explanation is that the adjustment burden is spread out over several countries as indicated by the fact that the changes in the US world exports shares are positively correlated with the 1964 shares of many countries and negatively with the changes in many countries world export shares. Such an interpretation has perhaps some support in the long run trend of European countries to approach the US GNP per capita or wage level.

6. Summary and conclusions

The analysis of this paper has been directed towards an analysis of trends in specialisation patterns within the engineering industry of 14 OECD countries. Two specialisation measures were used, namely the net export ratio $(\frac{X_j - M_j}{X_j + M_j})$ of country j and the world exports share $(\frac{X_j}{X_{OECD}})$. Both measures were supposed to represent differences across 106 commodity groups in a given country's international competitiveness.

Under this assumption the changes in the specialisation measures 1964-70 were regressed on the initial specialisation pattern in 1964. Practically all countries had a highly significantly negative relationship even though the R^2-values varied much across the countries. USA, Great Britain, the Netherlands and Switzerland obtained the strongest relationships in the latter respect, when their world exports shares were used as specialisation indices.

Two conclusions might probably be drawn. First, the derived negative relationships might be interpreted to suggest the possibility of drastic changes or even shifts in the specialisation patterns of individual countries. Secondly, if this is the case the explanation is probably macroeconomic in kind. It is hypothetically proposed that it might be attributed to differencies between countries in long run growth performance and factor accumulation leading to changes in their factor abundance situation. A tentative correlation analysis of the interdependence of specialisation patterns in 1964-70 of the countries suggests that the negative relationships might under this hypothesis be attributed to repercussions of the industrial development of especially the USA but possibly also West Germany and Great Britain. The joint world exports share of these three countries was 50 % in 1970. Japan's rapid expansion on the world market was not strongly affecting the specialisation of any single country in particular. It seemed instead to have been a general expansion all over the engineering field thus tending to lower the market shares for other countries over all commodity groups.

It is, of course, hard to assess whether or not and for which countries the specialisation pattern might eventually be reversed. That depends on how strong and persisting the underlying causes are. For Sweden there are indications suggesting that the negative slope becomes considerably larger when extending the time period 1960-64 to 1960-69 (cf Ohlsson

[1975]. In addition, the changing specialisation pattern at the sub-industry level in 1960-70 is correlated negatively with the capital intensity and positively with the technical personnel and skilled worker intensities (cf Ohlsson [1974a and forthcoming]). But in order to obtain more firm conclusions the analysis of this paper should be broadened in three directions. First the trends in specialisation of the industrial countries should be analysed against possible determinants. Such an analysis is carried through in Ohlsson [forthcoming], chapters 8 and 9, utilizing a methodology presented also in Ohlsson [1974b]. Secondly, the period 1964-70 should be extended backwards and forwards in order to see whether general shifts have occurred. Thirdly, the analysis ought to be broadened to include specialisation patterns of the whole industrial sector.

Economists of different "theoretical schools" have expressed as their beliefs that the various trade theories are really complements rather than substitutes (cf for instance Grubel [1970] , Fortune [1971], Hufbauer [1970], Johnson [1970], Morall III [1972] and Wells [1972]. However, there is no general agreement on how the theories complement each other. No agreement exists on which the major underlying economic causes are to changes of a given trade pattern. Perhaps the results of this paper can suggest how they complement each other in explaining recent changes in trade patterns of industrial countries. Given that it is possible to generalize on results in the direction suggested above, the causes to shifting trade patterns are the same as those giving individual countries. different growth performances and levels of development. Consequently, the causes of changing trade patterns might for analytical purposes be assumed to be macroeconomic in kind, whereas the particular trade adjustments for individual products or firms have different explanations. Different trade theories are thus complementing each other in explaining the variety of adjustment paths but not as much in offering causes behind the analysed changes in trade patterns.

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Appendix table 1. Trade specialisation measures of 14 industrial countries in 1964 and 1970 for 106 engineering products

Country	s= standard deviation m= mean value	Net export ratio $(\frac{X_j - M_j}{X_j + M_j})$ 1964	Net export ratio $(\frac{X_j - M_j}{X_j + M_j})$ 1970	World export share $(\frac{X_j}{X_W})$ 1964	World export share $(\frac{X_j}{X_W})$ 1970
Canada	s	0,465	0,474	0,024	0,056
	m	-0,586	-0,479	0,016	0,032
USA	s	0,567	0,552	0,148	0,118
	m	0,415	0,198	0,210	0,165
Japan	s	0,565	0,461	0,102	0,132
	m	0,454	0,580	0,081	0,125
Belgium-Luxemburg	s	0,472	0,439	0,070	0,065
	m	-0,242	-0,223	0,038	0,037
Netherlands	s	0,414	0,371	0,045	0,034
	m	-0,293	-0,274	0,037	0,037
West Germany	s	0,251	0,254	0,094	0,098
	m	0,621	0,493	0,232	0,222
France	s	0,394	0,427	0,046	0,071
	m	0,092	0,036	0,070	0,082
Italy	s	0,466	0,479	0,064	0,072
	m	0,148	0,221	0,064	0,073
Great Britain	s	0,388	0,383	0,095	0,067
	m	0,479	0,387	0,151	0,110
Norway	s	0,375	0,374	0,007	0,007
	m	-0,610	-0,594	0,005	0,005
Sweden	s	0,523	0,490	0,034	0,031
	m	-0,046	-0,036	0,034	0,034
Denmark	s	0,523	0,481	0,015	0,044
	m	-0,334	-0,367	0,012	0,016
Austria	s	0,526	0,491	0,016	0,035
	m	-0,225	-0,186	0,014	0,017
Switzerland	s	0,560	0,539	0,040	0,030
	m	-0,220	-0,151	0,029	0,027

Note: X_j = exports of country j in $ 1 000
M_j = imports " " " " " "
X_W = sum of X_j over all OECD countries.

Sources: OECD, Commodity trade statistics, Exports and Imports of the respective years.

Appendix table 2. Correlations indicating the international interdependence through national specialisation patterns in 1964-70. 106 observations.

Country j	Correlations between 1964 net exports ratios of country j and those of				Correlations between 1964 net exports ratios of country j and the 1964-70 changes in net exports ratios of				Correlations between the 1964-70 changes of net exports ratios of country j and those of			
	USA	Japan	West Germany	Great Britain	USA	Japan	West Germany	Great Britain	USA	Japan	West Germany	Great Britain
Canada	-0.02	0.03	0.01	0.09	0.13	-0.27[a]	0.21[a]	0.28[a]	-0.05	0.15	-0.13	-0.29[a]
USA	1.00[a]	-0.24[a]	-0.05	0.25[a]	-0.37[a]	0.03	0.11	-0.11	1.00[a]	0.02	0.16	0.03
Japan	-0.24[a]	1.00[a]	0.25[a]	0.17[a]	-0.10	-0.58[a]	-0.30[a]	0.00	0.02	1.00[a]	0.07	-0.27[a]
Belgium-Luxemburg	-0.17[a]	0.22[a]	0.04	0.27[a]	0.19[a]	0.03	-0.09	-0.13	-0.21[a]	0.03	-0.00	0.21[a]
The Netherlands	-0.02	0.00	-0.22[a]	-0.09	-0.05	-0.11	0.13	0.09	0.18[a]	0.15	-0.15	-0.01
West Germany	-0.05	0.25[a]	1.00	0.30[a]	0.14	0.10	-0.45[a]	-0.09	0.16	0.07	1.00[a]	-0.02
France	0.04	0.30[a]	0.05	0.38[a]	-0.07	-0.13	0.11	-0.02	0.11	0.18[a]	-0.06	-0.05
Italy	-0.15	0.28[a]	0.23[a]	0.25[a]	0.00	-0.05	-0.08	-0.14	-0.21[a]	0.19[a]	-0.16	0.15
Great Britain	0.25[a]	0.17[a]	0.30[a]	1.00	-0.06	0.19[a]	0.04	-0.39[a]	0.03	-0.27[a]	-0.02	1.00[a]
Norway	-0.01	-0.10	-0.27[a]	0.11	0.01	0.13	0.01	0.03	-0.19[a]	-0.09	-0.19[a]	-0.10
Sweden	0.30[a]	-0.11	0.10	0.24[a]	-0.05	0.10	0.16	-0.20[a]	-0.15	-0.12	-0.01	0.33[a]
Denmark	0.16	-0.16	-0.11	-0.04	0.03	-0.10	-0.09	0.01	-0.04	0.11	0.23[a]	-0.04
Austria	-0.10	0.22[a]	0.03	0.01	-0.01	-0.09	0.04	0.13	0.05	-0.01	-0.19[a]	-0.11
Switzerland	0.06	-0.19[a]	-0.12	-0.13	-0.16	0.18[a]	0.31[a]	-0.05	0.21[a]	0.03	0.02	-0.11

a = significant at the 5 % level (one-tail test)