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CHANGES IN THE STRUCTURE OF
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CHANGES IN THE STRUCTURE OF THE FINNISH ECONOMY 1970-1980

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1. INTRODUCTION

The Finnish economy fell from its long-term growth path in the 70's. The average annual growth rate of GDP was annually 4.6 percent until 1975. In 1976-1983 the growth rate was 2.9 percent. The period from 1975 until today is too short to justify the conclusion that the long-term growth rate has also decreased. We can assume that, after a period of smooth and rapid growth, the Finnish economy was faced with structural adjustments in connection with the marked changes in the relative price of oil. How long a period of time will these adjustments related to overall structural changes in the world economy take? And, will there be again a period of smooth and rapid growth in the future? These are interesting questions, but they are hard to answer for the present.

We can consider that structural adjustments take at least five years, but we need a longer period in order to identify them. Hence, we must know the course of the economy almost throughout the 80's before final conclusions can be drawn. Nevertheless, I will try to analyse the structural growth and the course of the Finnish economy over the 70's.

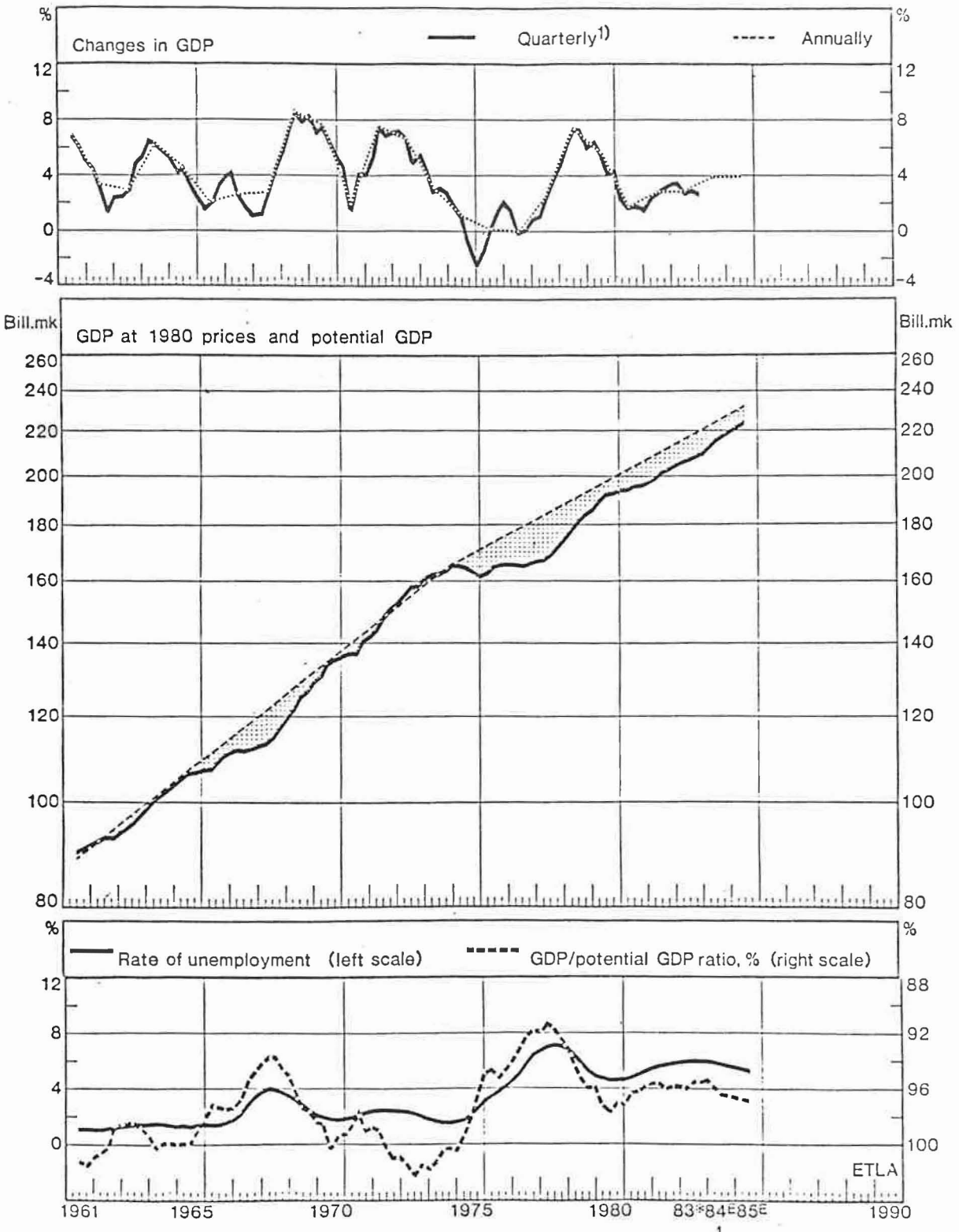

Chart 1. Total production and rate of utilization of resources[1]

[1]The Research Institute of the Finnish Economy, Economic prospects, autumn 1984, Espoo 1984.

My main interest will be in industrial structural changes, which will be analysed with static input-output models for the years 1970 and 1980. The components of disproportional growth of output in industries are analysed by studying the effects of the growth and changes in the structure of final demand categories and the effects of changes in the input-output technology on the output of industries.

Industrial restructuring or structural adjustment is the search for a new equilibrium between the demand and supply of industrial outputs, between the demand and supply of labour, between growing industries and maturing industries, between exports and imports, and between saving and investment. The balance within and between different markets is difficult to determine in practice. Long-run structural tendencies, short-run cyclical changes and once-for-all incidental changes have simultaneous effects on economic developments. Transition from one developmental period to another is often slow, gradual and indeterminate. It is easy to agree with Schumpeter (1939) in that industrial change is never a harmonius advance of all elements of the system actually moving or tending to move in step. Some industries move on and others stay behind. In different markets. equilibrium conditions can only accidentally be attained in the same year. In cases where it is impossible to observe such a year, it can be determined only by using model simulation.

A full-capacity year can be used as an approximation to an equilibrium year in choosing comparison years for static growth analysis. The years 1960 and 1970 satisfy this condition for the Finnish economy. The actual GDP was the same as the potential GDP and the unemployment rate was only two percent. The next peak year was

1980, but then the actual GDP was only 96 percent of the potential GDP and the unemployment rate was five percent. If we assume, however, that the Finnish economy fell from its growth path in 1975, the potential GDP, in an economic sense, is no longer the same as before. The performance capacity of the Finnish economy diminished. The potential GDP might thus be the same as the actual GDP. The unemployment rate was high, which reveals that the labour market had not adapted itself to the new situation. It may be concluded that the Finnish economy had already partly adapted itself to the new conditions by 1980. Some structural changes had already taken place. It makes sense, then, to analyse these changes by comparing the 1970 and 1980 states of the economy with other. A decisive factor determining the years of comparison is formed by the availability of input-output tables. Fortunately, they exist just for these two years.

Other imbalances typical of a long-wave downswing (van Duijn, 1984) were wage increases which exceeded productivity increases. Further typical imbalances - such as an overabundance of older industries and a relative lack of younger industries, institutional rigidity and a relative increase in the size of debt - were not remnarkable features about economic developments in Finland.

2. CHANGES IN THE FINNISH ECONOMY BETWEEN 1970 AND 1980

A background for the analysis of structural changes is provided by the description of developments in the 60's and the 70's in terms of macro-measures (Table 1). The following observations can then be made.

1. The growth rate of GDP decreased in the 70's.
2. The growth rate of domestic demand failed more than that of exports.
3. The consumption/investment ratio rose all the time. It was 2.24, 2.41, and 2.86 respectively in 1960, 1970 and 1980.
4. Government final consumption expenditure increased at about the same rate both in the 60's and the 70's. Private final expenditure increased clearly less in the 70's than in the 60's.
5. The share of imports in domestic demand increased all the time, but much less in the 70's than in the 60's. In 1960, 1970 and 1980 respectively it was 24 %, 31 % and 33 %.

TABLE 1 Expenditure on GDP in purchasers' values, 1980 prices

	FIM.mill.	percent- changes 1970/1960	changes 1980/1970	ratio between changes
Gross domestic product in purchasers' values	192556	59.8	42.8	0.72
Final consumption expenditure	138933	65.5	42.0	0.64
-private	104038	65.7	35.3	0.54
-government	34895	64.8	66.8	1.03
Gross fixed capital formation	48638	53.8	19.6	0.36
-private	42537	63.2	19.2	0.30
-government	6101	28.0	22.8	0.81
Domestic demand	194186	63.2	36.9	0.58
Exports of goods and services	63386	102.3	73.9	0.72
Imports of goods and services	65016	111.3	49.4	0.44
Increase in stocks	6287			
Statistical discrepancy	328			

[2]Central Statistical Office, National Accounts, Time series for 1960-1981.

Economic growth is not a smooth balanced process and it involves a changing relative importance of industries. Hence, a macro economic

perspective can only give a background for a disaggregated analysis of structural change. Changes are obvious when the growth rates of various industries for the 70's are examined. Industries are classified in table 2 into four categories according to their growth rates.

TABLE 2 Growth rates of output by industries 1980/1970, constant prices

I Growth > 1.60		II 1,60 > Growth > 1.40	
Manufacture of electrical machinery and related products	2.64	Manufacture of paper, and paperboard and of pulp, paper and paperboard articles	1.55
Manufacture of chemicals	2.42	Manufacture of transport equipment	1.55
Basic metal industries	2.09	Other manufacture of wood	1.53
Communication	2.04	Trade	1.53
Electricity, gas and water	1.94	Pottery, glass and earthen products	1.52
Manufacture of metal products and machinery	1.80	Petroleum refineries and miscellaneous products of petroleum and coal	1.48
Other real estate, financing, insurrance and business services	1.76	Mining and quarrying	1.45
Transport	1.70		
Sawing, planing and preserving	1.62		
III 1,40 > Growth > 1.20		**IV Growth < 1.20**	
Manufacture of chemical, rubber and plastic products	1.34	Private personal and social services	1.14
Printing and publishing	1.34	Other manufacturing industries	1.12
Food manufacturing	1.33	Restaurants and hotels	1.12
Letting and operating of dwellings and use of owner occupied dwellings	1.31	Forestry and logging	1.01
Textile, wearing apparels and leather industries	1.31	Other construction	1.00
Pulp mills	1.26	Agriculture, hunting and fishing	0.94
Building	1.25		
Beverage and tobacco industries	1.24		

Most of the fastest-growing industries were various engineering and metal manufacturing industries. The traditional Finnish industries,

i.e., the forest industries, were among those whose growth rates were in the medium-range. An interesting feature of developments was just the declining share of the forest industries and the growing role of the engineering and metal manufacturing industries. Developments of these industries will be given special attention in the following analyses.

3. COMPOSITION OF DISPROPORTIONAL GROWTH OF INDUSTRIES

How are the disproportional growth of output of industries affected by differences between the growth rates of final demand categories, by changes in the structure of demand and by changes in input-output technology? This is analysed through calculations as follows:

-growth: $B(0)(\bar{g} - 1)y(0)$

-structure of demand: $B(0)[y(t) - \bar{g}y(0)]$

-input-output technology: $[B(t) - B(0)]y(t)$

where $B(0)$ and $B(t)$ are the inverse matrices $(I - A)^{-1}$ for 1970 and 1980

$\bar{g}$ is the average growth of final demand gategory between 1980 and 1970: $\Sigma_i\, y_i(t) \,/\, \Sigma_i y_i(0)$

$y(0)$ and $y(t)$ are categories of final demand vectors for 1970 and 1980, $y_i(0)$ and $y_i(t)$ elements of the vectors.

Input coefficients and final demand categories include both imported and domestically produced commodities. Only crude oil, natural gas and coal are treated as non-competitive imports and as primary inputs. The following final demand categories are distinquished: imputed

TABLE 3 Effects of average growth of final demand categories, millions of FIM at 1970 prices

industry	private consumption	government consumption	capital formation	domestic demand total	exports	imports	total
1	15669	1041	426	17136	7724	-8382	16478
2	1793	262	1039	3093	13176	-1733	14536
3	637	280	1304	2222	3055	-4175	1101
4	18470	1493	140	20103	8352	-5036	23418
5	1706	13	18	1738	367	-342	1763
6	7310	552	449	8362	8923	-8737	8547
7	338	176	696	1210	8221	-605	8826
8	924	47	1192	2162	4968	-684	6447
9	801	280	276	1357	17296	-1259	17394
10	1300	447	442	2189	21549	-1373	22365
11	2446	805	428	3680	1757	-1521	3916
12	3351	711	964	5026	8168	-10177	3018
13	2627	869	919	4415	5205	-5327	4294
14	2300	719	816	3835	2792	-3902	2726
15	724	334	1982	3040	1292	-1575	2757
16	3386	1638	8578	13602	18374	-27832	4144
17	3133	1580	9760	14473	13134	-17797	9811
18	1779	689	2672	5140	3909	-7130	1919
19	2390	325	3403	6118	7463	-9098	4482
20	612	101	71	784	542	-931	395
21	3382	1818	1479	6679	7202	-5451	8430
22	1396	720	14560	16676	663	-570	16770
23	241	2294	5128	7663	350	-162	7852
24	12247	1278	2630	16154	3779	-2052	17881
25	5352	32	105	5489	289	-328	5450
26	4924	1013	2120	8057	13713	-3822	17948
27	1600	506	278	2384	752	-538	2598
28	13319	0	0	13319	0	0	13319
29	3959	819	1358	6136	3204	-2422	6918
30	4945	397	382	5724	1537	-855	6407
Σ	123063	21238	63666	207967	187757	-133815	261909

[a]The names of the industries are presented in the appendix.

bank service charges, private consumption expenditure, final consumption expenditure of government services, gross fixed capital formation, exports, imports, increase in stocks and statistical discrepancy. All calculations were made at 1970 prices. The results of the calculations are presented in Tables 3-5.

TABLE 4 Effects of structural changes in final demand categories, millions of FIM at 1970 prices

industry	private consumption	government consumption	capital formation	domestic demand total	exports	imports	total
1	-1819	828	-1450	-2442	-6554	5305	-3691
2	2178	437	-226	2390	-8197	43	-5765
3	371	-15	328	683	3001	-1455	2229
4	-632	1604	-145	828	-10288	3548	-5912
5	-496	63	8	-425	304	74	-46
6	-4749	519	127	-4103	8096	-3841	152
7	406	100	-31	475	-122	261	613
8	716	685	-201	1199	-2270	-438	-1508
9	764	194	97	1055	-16921	-625	-16491
10	1332	340	234	1906	-14088	-959	-13142
11	379	-397	117	100	2463	-643	1920
12	1171	453	-38	1586	2518	-2397	1706
13	-537	-44	-53	-634	-1959	-809	-3402
14	150	-554	-150	-554	3473	3643	6563
15	164	-36	-167	-38	2369	-98	2232
16	2103	-206	2756	4653	26930	11100	42683
17	1387	-139	6961	8209	9229	1503	18940
18	2848	-358	1577	4067	10161	-6307	7920
19	836	216	-3068	-2016	-3439	3263	-2192
20	-587	-155	-41	-784	635	-136	-285
21	1933	32	208	2173	-629	1404	2948
22	-18	-178	982	787	-58	95	824
23	214	-2146	-6591	-8523	-82	-18	-8623
24	-5100	489	289	-4322	-85	-1555	-5962
25	-6034	108	4	-5922	59	368	-5495
26	5606	606	-663	5549	-5998	-895	-1345
27	465	374	23	862	207	-336	732
28	1624	-1374	0	250	0	0	250
29	-1423	1026	696	299	3918	-2020	2197
30	-2512	-953	-188	-3653	234	-592	-4011
Σ	740	1518	1394	3652	2904	7482	14039

[a]The names of the name of industries are presented in the appendix.

Table 3 describes how much the output of industries would have increased if each element in the final demand category under consideration had increased at the same rate as this category on average.

The total effect on the forest industries (7-10) would then have been FIM 55032 million, and the growth rate would have been 1.63. The output of the engineering and metal manufacturing industries (16-19) increased by FIM 20356 million, giving 1.23 for the growth rate. It may thus be concluded that the average growth rate of the final demand categories, without structural changes within the categories, would have been very favourable for the forest industries.

Table 4 shows how much the output in industries would have changed if only structural changes had taken place in the various final demand catagories. A positive figure indicates that the increase in the item concerned due to structural changes in the final demand category under consideration would have been greater than the average. A minus-sign indicates, correspondingly, that the change would have been less than the average. Imports form an exception to this rule, in that negative figures indicate greater than average and positive figures smaller than average changes.

The effects of structural changes on output in the forest industries and in the engineering and metal manufacturing industries are opposite in direction to the effects of growth. Owing to structural changes, the output of the forest industries decreased by FIM 30528 million, whereas output in the engineering and metal manufacturing industries grew by FIM 67356 million. These changes were mainly due to structural changes in export demand. The structural changes in domestic demand had a positive effect on output in both industry groups. The increase in imports of metal and engineering products was also less than the average increase in imports.

TABLE 5 Effects of changes in input-output technology, millions of FIM at 1970 prices

industry	private consumption	government consumption	capital formation	domestic demand total	exports	imports	total
1	-12495	-725	200	-13020	-2042	3087	-11975
2	-3862	76	373	-3414	-2328	453	-5288
3	-484	-154	-2376	-3014	-3410	3528	-2896
4	11656	724	844	13224	2644	-2849	13018
5	896	88	294	1278	541	-439	1380
6	-2029	-141	4	-2166	-2025	2294	-1898
7	107	78	877	1062	161	-28	1194
8	-322	40	1174	892	51	5	945
9	2104	350	793	3246	2624	-734	5136
10	5133	849	1723	7705	9436	-2527	14614
11	-355	-43	-41	-439	-205	431	-212
12	3126	717	3272	7115	3398	-2427	8087
13	1525	397	1935	3857	1332	-1258	3931
14	-4503	-367	-1646	-6515	-2099	1403	-7211
15	598	66	1478	2143	365	-223	2285
16	-2997	-777	-9481	-13254	-14119	15673	-11701
17	138	112	915	1166	-2515	3409	2060
18	2799	724	6456	9979	3477	-3795	9660
19	-924	-48	-232	-1204	-817	668	-1353
20	13	7	122	141	184	-229	96
21	5481	1323	-238	6566	2693	-562	8697
22	-123	-185	-3673	-3980	-224	426	-3778
23	74	-2	55	127	138	-33	232
24	3262	668	2805	6735	3093	-2981	6847
25	1590	238	728	2555	1524	-787	3292
26	3088	462	1382	4931	1575	-343	6163
27	1282	107	423	1813	478	-329	1962
28	0	0	0	0	0	0	0
29	2708	392	2141	5242	3136	-2784	5594
30	742	27	110	879	-198	-43	638
Σ	18229	5002	10417	33648	6868	9002	49518

[a]The names of the industries are presented in the appendix.

Table 5 shows how much the output of the various industries changes owing to changes in the input-output coefficients. Here, positive figures indicate increases and negative figures decreases, except in the case of imports, where the former indicate decreases and the latter increases.

The input-output coefficients related to the demand for forest industry products had increased. The total effect on output was FIM 21889 million. The input-output coefficients related to the demand for metal and engineering products had decreased. The total effect on output was FIM -1334 million. The decrease was particularly notable in the case of the basic metal industries (16).

When the effects outlined above are combined, the following equations are obtained: In 1980 the output of the forest industries was composed of the effects in question as follows: 133891 = 87496 + 55032 - 30528 + 21889. The corresponding composition for the engineering and metal manufacturing industries was 174883 = 88513 + 20353 + 67351 - 1334.

The results indicate how much the output of the various industries changed, in millions of Finnish marks at 1970 prices between 1970 and 1980 owing to the following effects:

1. the growth effect of final demand categories, Table 3,
2. changes in the structure of final demand categories, Table 4,
3. changes in the input-output coefficients between 1970 and 1980, Table 5.

The following Table 6 gives the figures for selected industries.

TABLE 6 Effects of growth, structural change and technological change[a] in selected industries, millions of FIM at 1970 prices

	Food manufacturing	Pulp mills	Basic metal industries	Transport
1. Growth effect	23418	17394	4144	17948
domestic demand	20103	1357	13602	8057
exports	8352	17296	18374	13713
imports	-5036	-1259	-27832	-3822
2. Structural change	-5912	-16491	42683	-1345
domestic demand	828	1055	4653	5549
exports	-10288	-16921	26930	-5998
imports	3548	-625	11100	-895
3. Technological change	13018	5136	-11701	6163
domestic demand	13224	3246	-13254	4931
exports	2644	2624	-14119	1575
imports	-2849	-734	15673	-343
Total increase between 1970 and 1980	30524	6039	35126	22566

[a]The figures do not include the effects of imputed bank services, increases in stocks and statistical discrepancy.

Pulp mills would have increased their output considerably if no structural changes had taken place in the final demand categories. Structural changes played a remarkable role in decreasing the output of pulp mills. Changes in the input-output coefficients had positive effects on the output of pulp mills. Output in the basic metal industries increased mainly because of structural changes, but decreases in the input-output coefficients had negative effects on the output of this industry.

Technological change was finally examined more thoroughly. First the most sensitive coefficients for changes were found out. The following measure was then applied.

$$d_{rs} = 1/a_{rs}(\max_i(b_{ir}/x_i)x_s + 0{,}01b_{sr}) \qquad (1)$$

The measure d_{rs} indicates by how many percent an input coefficient a_{rs} may change so that the output of any industry does not change by more than one percent. Final demand is supposed to be constant. The smaller the value of d_{rs} is, the more sensitive the coefficient a_{rs} (b_{ir} and b_{sr} are coefficients of Leontief's inverse matrix $B = (I - A)^{-1}$

The number of coefficients having a d-measure less than 10 was 62. The changes in these coefficients between 1970 and 1980 were determined using the measure:

$$\ln(a_{ij}(80 \;/\; a_{ij}(70)) = e \qquad (2)$$

The distribution of the changes in the coefficients was as follows:

	number of coefficients
$e > 0.60$	4
$0.60 > e > 0.40$	7
$0.40 > e > 0.20$	8
$0.20 > e > 0.10$	8
$0.10 > e > 0.00$	7
$-0.10 < e < 0.00$	8
$-0.20 < e < -0.10$	9
$-0.40 < e < -0.20$	3
$-0.60 < e < -0.40$	5
$e < -0.60$	3
Total	62

We may conclude that the number of very sensitive coefficients was rather small, but the changes in the coefficients were notable. Some of the changes in these coefficients were so great that various classification rules must have been applied to these cases between 1970 and 1980.

From this preliminary study of changes in the industrial structure of the Finnish economy, the following conclusions can be drawn.

1. A simple input-output model is a useful framework for decomposing the different factors conducive to structural changes in an economy.
2. The driving forces behind structural changes in the various final demand categories should be further examined.
3. The input-output coefficients are the links which transmit changes between the industries. The links themselves are related to technological changes and are, thus, an important central area for dynamic analysis of structural changes.

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[4]Other observations about changes of input-output coefficients in the Finnish economy are presented in Forssell 1983.

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Appendix 1.

The breakdown of the production sectors, by the kind of economic activity, is as follows (for the codes in brackets, see: Central Statistical Office, handbooks n:o 4, Standard Industrial Classification (SIC), Helsinki 1972):

Industries

01 Agriculture, hunting and fishing (11,13)
02 Forestry and logging (12)
03 Mining and quarrying (2)
04 Food manufacturing (311,312)
05 Beverage and tobacco industries (313,314)
06 Textile, wearing apparels and leather industries (32)
07 Sawing, planing and preserving (33111)
08 Other manufacture of wood (33113,33119,3312,3319,332)
09 Pulp mills (34111)
10 Manufacture of paper and paperboard and of pulp, paper and paperboard articles (34112,34113,3412,3419)
11 Printing and publishing (342)
12 Manufacture of chemicals (351)
13 Manufacture of chemical, rubber and plastic products (352,355,356)
14 Petroleum refineries and miscellaneous products of petroleum and coal (353,354)
15 Pottery,glass and earthenware products (36)
16 Basic metal industries (37)
17 Manufacture of metal products and machinery (381,382)
18 Manufacture of electrical machinery and related products (383,385)
19 Manufacture of transport equipment (384)
20 Other manufacturing industries (39)
21 Electricity, gas and water (4)
22 Building (51)
23 Other construction (52)
24 Trade (61,62)
25 Restaurants and hotels (63)
26 Transport (71)
27 Communication (72)
28 Letting and operating of dwellings and use of owner-occupied dwellings (8311)
29 Other real estate, financing, insurance and business services (8312,8313,832,833)
30 Private social and personal services (92,93,94,95)

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