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ABSTRACT

Porter's influential study on the competitive advantage of nations inspired a methodologically extended work on Austrian data. In contrast to Porter's analysis, competitiveness is determined endogenously by means of statistical cluster techniques. Avoiding his "cut-off" approach, "well" and "badly" performing industries are the objects of analysis. The resulting cluster centers constitute the typical pattern of competitiveness for the chosen trade indicators, while the classifications produce a "map" of Austrian industrial export performance. The results further show, that (i) "clustered" industries generally are rare in the case of Austria, (ii) that some of them are located in declining, crisis shaken sectors, and (iii) underlines the importance of transnational links (as opposed to narrow national boundaries) for the formation of successful industries.

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I. INTRODUCTION

Porter's (1990) influential study on the competitive advantage of nations inspired this methodologically extended work on Austrian data. Basically building upon Marshall's (1920) insights into the regional concentration of economic activities, Porter strongly emphasizes the importance of *industrial clusters*, characterized by the presence *of successful horizontally related firms as well as vertically supporting industries.* Dense informational structures with significant externalities, intense competition, lower transaction costs as well as cooperation and the greater weight in political lobbying feed a self-reinforcing process of dynamic competitive advantages and growth (for more details, see Hutschenreiter – Peneder, 1994).

However, a major methodological problem in Porter's analysis – where no cluster techniques in their literal (i.e. statistical) meaning are applied – is its determination of competitiveness of different industries by exogenously given boundaries on performance indicators (e.g. "*market shares x% above a country's average*"). In addition, all industries performing below this level are eliminated for the rest of the analysis, with the implication that no information on "badly" performing industries is retained.

Taking Porter's "cluster analysis" literally, competitiveness is determined endogenously by means of statistical cluster techniques in this paper. Furthermore, avoiding his "cut-off" approach, "well" and "badly" performing industries are the objects of analysis. As cluster techniques are descriptive by nature, what will be gained are better insights into the composition of competitive and non-competitive industries within a country, whereby the multidimensional character of the phenomenon "competitiveness" is explicitely acknowledged. This paper demonstrates on behalf of Austrian data, how clustering techniques can be applied to create a profile of a country's industrial performance. Finally, conclusions about the importance of "clustered" industries in Austria will be drawn.

II. ANALYSING PATTERNS OF INDUSTRIAL COMPETITIVENESS

Statistical clustering techniques produce a classification scheme of individual observations, depending on their relative similarity or nearness to an array of different variables. These classifications are determined endogenously by the individual data and the chosen cluster algorithm. The basic idea is one of dividing a country's overall performance profile into segments by creating maximum homogeneity within and maximum distance between groups of observations.

Although it is a frequent objective in applied economic research, competitiveness as a concept has stayed rather vague and lacks an universally accepted definition as well as a broad consensus on the appropriate empirical measure (Bellak, 1992). *The ability to earn sustainable and high incomes while at the same time being able to maintain and improve on social and environmental standards* (Aiginger, 1987) may be the best definition of industrial competitiveness on an abstract level, because it demands measurement that goes beyond the more quantity based indicators like trade specialization or market shares alone. The *"ability to earn sustainable and high incomes"* depends as well on quality indicators and accordingly on the level of prices that can be charged.

TABLE 1
Structural Relationships Between the Chosen Indicators of Trade Performance

unit / dimension of comparison:	vertical relationship (Austrian exports versus imports)	horizontal relationship (Austrian versus international data)
trade volumes	Trade Specialization $TSP_i = X_i^{aut} / M_i^{aut}$	International Marketshares $MAS_i = X_i^{aut} / X_i^{oecd}$
trade prices	Comparative Price Advantage $CPA_i = XUV_i^{aut} / MUV_i^{aut}$	Relative Export Unit Values $RUV_i = XUV_i^{aut} / XUV_i^{ic}$

X = Exports, M = Imports, XUV = Export Unit Values, MUV = Import Unit Values, i=index of 208 SITC product classifications, aut = Austria, oecd = OECD, ic = 12 selected industrial countries

TABLE 2
Correlation Coefficients of the Variables

	MAS	RUV	CPA	TSP
MAS	1,0000	,0551	-,0010	,6778**
RUV	,0551	1,0000	,6063**	,0304
CPA	-,0010	,6063**	1,0000	-,0689
TSP	,6778**	,0304	-,0689	1,0000

* - Signif. LE ,05   ** - Signif. LE ,01   (2-tailed)

Reflecting both, the quantitative as well as the qualitative dimension of competitiveness, four variables have been chosen, to enter the clustering algorithm in standardised form on the basis of its mean values for the years 1990 to 1992. Their underlying symmetric structure guarantees their equal implicit weighting in the clustering process and is displayed in table 1. Actually there is a significant correlation between two pairs of variables, namely between market shares and trade specialization as well as between comparative price advantage and relative export unit values (table 2). Both of them are no big surprise since each pair shares one common factor, which are export values and export prices respectively. But none of them could be labelled to be redundant: MAS offers information about the relative importance of an industry on an international and TSP on the national level. CPA gives analogous insights into the vertical composition of prices, while RUV does so horizontally.

After the set of variables has been chosen, an optimization cluster technique, based on the minimization of within group dispersion, is used to classify 208 product groups (SITC, three-digit) into clusters of maximum homogeneity according to these indicators of trade performance. In this first step of the analysis the set of observations is divided by a pre-defined number of clusters g. Then cluster-centers are estimated for each group, which are vectors with means of the corresponding values for each variable. The optimizatin criterion is given by the trace of the matrix of within group dispersion W (of dimension p x p variables), which consists of vectors x_{ij} for the jth observation in the ith group and the according cluster-centers:

(1) $$W = \frac{1}{n-g}\sum_{i=1}^{g}\sum_{j=1}^{n_i}(x_{ij}-\overline{x}_i)(x_{ij}-\overline{x}_i)'$$

Minimization of trace (W) is done by iterative algorithms, where the position of the cluster-centers are varied until the process converges. Convergence means that there is no additional alteration that improves the clustering criterion above a certain pre-specified value. However, the exogeneity of the total number of clusters *g* that shall be obtained and has to be chosen in advance by the researcher, remains as a serious problem with optimization techniques. In spite of the fact that this choice of *g* can have a major impact on the final results, there exists no general rule for its determination. To partly overcome this difficulty the following self-binding rule of thumb was applied in the current analysis: "*Choose the lowest number g that maximizes the quantity of individual clusters which include more than 5% of the observed cases.*" According to this rule of thumb the number *g* = 21 clusters, producing 8 clusters comprising more than 5 % of total observations, was identified to be able to represent the underlying structure best. The resulting outcome is an endogenous classification of all observations into the given number of 21 clusters.

From the results of this first step in the clustering procedure alone it is difficult to interpret the underlying performance pattern. Therefore a second step in the clustering process is executed, in which the resulting 21 clusters of the first step enter a hierarchical clustering algorithm as observations with their according cluster centers as values. Hierarchical techniques are based on a quadratic *distance matrix* D (of dimension n x n observations) that contains a chosen measure of relative distance d_{ij} between any pair of n observations according to their attributes. Distances can be calculated in a variety of ways (Romesburg, 1984; Everitt, 1993). The measure most commonly used and also applied in this analysis are *squared Euclidean distances*, which measures the dissimilarity of two observations i and j with respect to the chosen set of p variables as follows:

(2) $$d_{ij} = \sqrt{\frac{1}{p}\sum_{k=1}^{p}(x_{ik}-x_{jk})^2} \qquad 0 \le d_{ij} < \infty$$

TABLE 3
Cluster Centers and Number of Cases

****************** K-Means Cluster Analysis: 21 Clusters; 208 Cases **********************

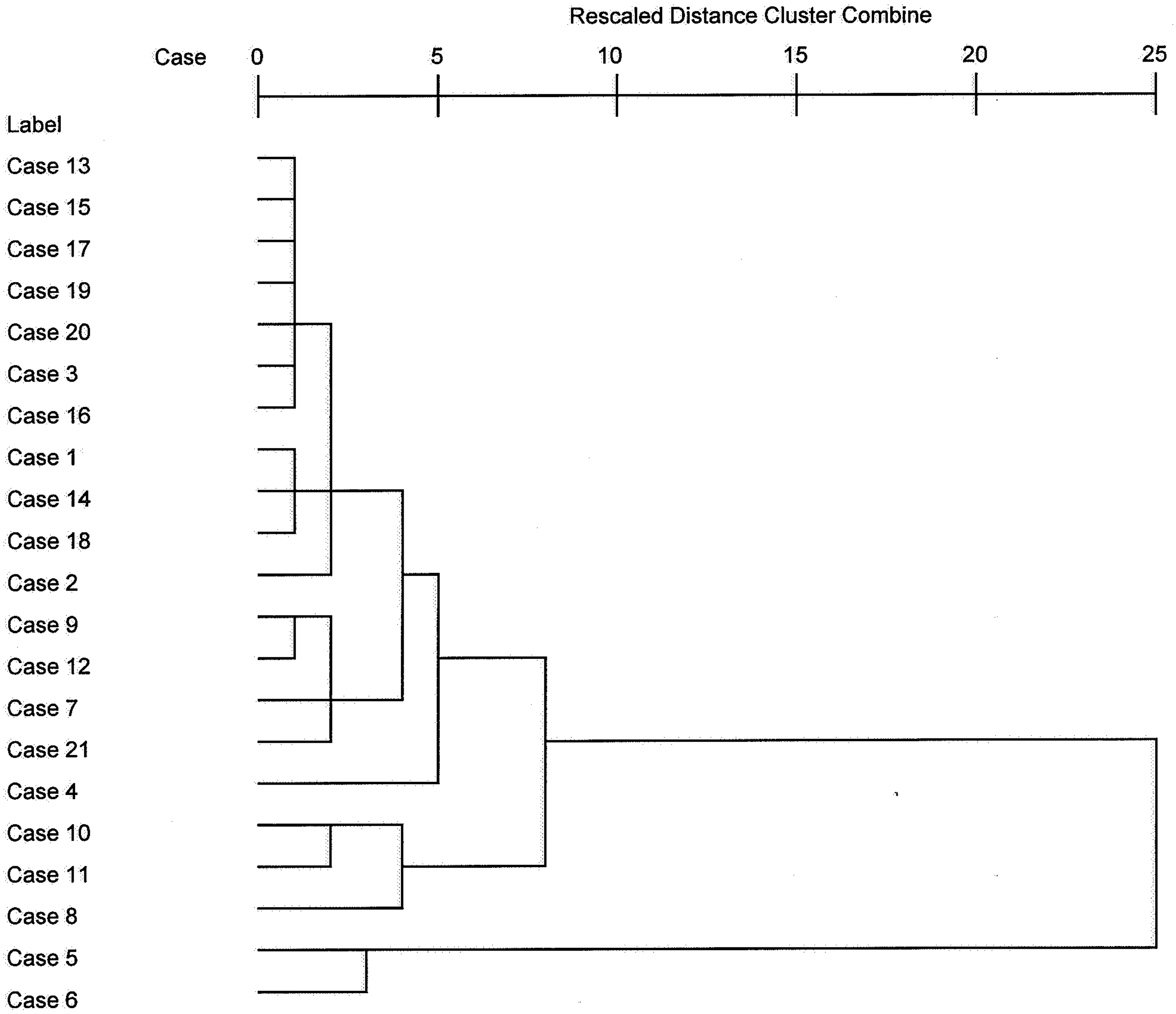
Final Cluster Centers.

Cluster	MAS	RUV	CPA	TSP	number of cases
1	1,3194	,9267	1,0863	,1756	4
2	-,4175	-,5578	-1,3431	1,9147	2
3	-,6964	,0321	1,3402	-,2113	13
4	3,8265	2,0531	1,4155	,3622	1
5	7,9470	,1855	-,5182	9,1582	1
6	4,1934	-,1630	-,4663	9,8620	1
7	-,7956	5,1680	-,7032	,5508	1
8	1,4356	1,2685	5,8901	,2605	1
9	-,6343	3,6165	,1558	-,3172	2
10	-,1431	5,5890	5,2333	,0428	1
11	-,7415	3,4286	3,6396	-,3471	2
12	,0848	2,3884	-,3968	-,1648	1
13	-,5277	-,5052	-,3304	-,2252	30
14	1,8286	-,1661	-,2393	,2229	11
15	-,5106	,0911	-,0448	-,2449	32
16	-,4364	1,1331	1,1653	-,2385	14
17	,2530	-,4531	-,4892	-,0158	43
18	,2919	,2221	,7198	1,8226	1
19	,5121	,1749	,2784	-,0782	22
20	-,6195	-,9844	-1,0295	-,2443	24
21	1,4075	3,6536	-,5631	1,3899	1

In the following agglomerative algorithm of hierarchical cluster analysis initially all observations are treated as independent single clusters. So there are as many clusters as observations. In the iterative process distances of all pairs are compared and those with minimum distance are clumped together to form a common cluster. *Average linkage* measures the distance of the newly formed agglomeration by the average distance of all single pairs between an observation outside and each observation inside the cluster. At any step of the iteration the new distance matrix loses one row and one column, so that its new dimension is n–1. This process is continued until all observations are part of one big single agglomeration – this is when the algorithm finds its natural end. It is important to note that, contrary to optimization methods, the process of hierarchical clustering is irreversible. The outcome is a hierarchical structure, beginning with many single observations that finally join each other at different levels until they are all united by one single trunk.

The graphical representation of the hierarchical clustering algorithm in figure 1 shows the hierarchical structure of relative closeness in their performance patterns. The sooner individual clusters are clumped together by the vertical lines, the more similar is their performance pattern. Unfortunately, seven of the eight clusters with more cases than 5% of the overall observations are clumped together in one single agglomeration at the top of the figure. This second step in the clustering process has merely structured the relative similarity of those small clusters that usually include only one or few observations that constitute very special cases in terms of international competitiveness.

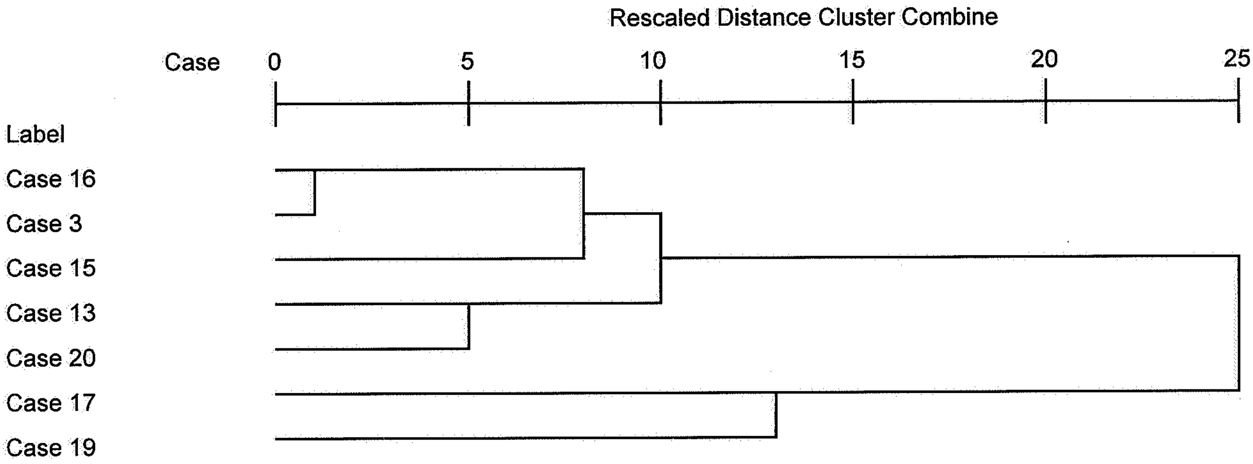
FIGURE 1
Hierarchical Cluster Analysis:
Dendrogram using Average Linkage (between Groups) and Squared Euclidean Distances



To gain further information about the performance patterns of the majority of cases a third and final run of the clustering process had to be executed including only those seven clusters mentioned above. Its result is shown in figure 2. Distance is measured by *Chebychev metric*, for which the distance between two cases i and j is the maximum absolute difference in values for any variable k:

(3)
$$cheb_{ij} = MAX_k \left| x_{ik} - x_{jk} \right|_{k=1 \ldots p}$$

FIGURE 2
Hierarchical Cluster Analysis
Dendrogram using Average Linkage (between Groups) and Chebychev Metric



III. PANORAMA OF AUSTRIAN TRADE PERFORMANCE

The overall profile of Austrian industrial performance for the years 1990 to 1992 is shown in figure 3 and table 2. The panorama results from a regrouping of the 21 clusters defined in step one of the clustering process according to their relative relatedness in performance levels discovered in steps two and three. For all of the four performance indicators the surface of this panorama exhibits the mean values of the standardised data for each cluster. Since the four variables are based on the distinction between export volumes and export prices, the resulting pattern of different levels of competitiveness also exhibits the same dichotomy. The number of observations comprised in each cluster is given in brackets. Analogous to population densities in "alpine" regions, to locate near the top is tough and only a very small number of "peak" performer can afford to live there. The majority of product groups belongs to the lower regions of industrial performance (*levels Ixv, N, 0, Ixp*). Mountainous "peaks" to the left refer to those clusters, which show extraordinaryly high values in terms of export volumes (*level IIxv and III*); those to the right refer to high values in terms of export prices (*level IIxp*). The different performance levels, which have resulted from the regrouping of the 21 clusters according to the information gained in step two and three, are interpreted as follows:

- *Level N* – "*Non-performer*": According to figure 2 clusters 20 and 13 can be combined into a common performance level. Together they comprise 54 cases, where Austrian manufacturing can best be labeled as non-performing. Examples are some base metals like *lead* or *zinc*, *perfumery & cosmetics*, *computers*, *road motor vehicles* and *aircraft*.

- *Level Ixp* – *"Badly" performing industries, that hold at least an average position in terms of export prices*: Cluster 15 includes 32 cases which perform badly according to market shares and trade specialization but at least got average relative export unit values and values for comparative price advantage. Examples are *fertilizers*, *feeding stuff for animals*, *office machinery*, *parts of motor vehicles* or *instruments for medical, surgical and dental purposes*.

- *Level IIxp* – *Industries competing in small niches of the product spectrum, characterised by high price levels but low export volumes*: Clusters 3 and 16 are characterised by high values in terms of export prices and low values in terms of export volumes. Those industries generally cannot compete on an international level, but at least perform some high priced quality strategy in small niches of the product spectrum. However, interpretation must be cautious, since data on unit values can be very erratic in cases of small trade volumes. The same argument applies to a number of very heterogeneous clusters (7, 9, 10, 11 and 12), that have been integrated into this level, too. Examples include *iron and steel bars*, *crude minerals, articles of textile fabrics*, *optical instruments*, *electro-diagnostic apparatus*.

- *Level Ixv* – *Industries competing on behalf of their 'low cost & low price' position, which perform at least "modestly" in terms of export volumes, but "weak" in terms of export prices*: Cluster 17 covers industries which maintain an average competitive position on international markets mainly by means of their "*low cost & low price*" position. While market shares lie modestly above and trade specialization about the average, the standardized values for the price dependent variables are distinctly negative. Examples include *tubes of iron and steel*, *plates of plastic*, *paper & paperboard (uncut)*, *ball bearings*, *agricultural machinery*, *textile yarn*, *musical instruments*.

- *Level IIxv* – "*Good" performer, mainly in terms of market shares:* Cluster 19 is characterised by market shares that lie well above, and a degree of trade specialization that is near the average performance. The price dependent variables again are modestly above the average in most cases. The small and singular cluster 2 has been included at this level for sake of simplicity. Among others, *tools*, *food-processing machines*, *fruit & vegetable juices*, *cotton fabrics*, *footware*, *furniture, clay construction materials* and *mineral manufactures belong to this level.*

- *Level III* – <u>"Champions" of industrial competitiveness</u>*, which show high performance in terms of quantity as well as quality based indicators*: Level III covers the three relatively homogeneous clusters 1, 14 and 18, characterised by high values in terms of export volumes and above or about average price levels. The rest of the product groups contained in this performance level (clusters 4, 5, 6, 8, 21) is very heterogeneous but exhibits a common level of excellence. Comprising 23 cases, this level represents 22.84% of total Austrian exports. Industries belonging to Level III are mainly spread around the sectors of *materials & metals*, *forest products*, *transport* and *textiles* (numbers in brackets give the according SITC-code):

– In the area of basic industries an internationally successful cluster grew out of rich endowments of wood and covers *simply worked wood* (SITC 248), *particle boards* (634) and *wood manufactures* (635) as well as *paper and paperboard* (642).

– Another cluster of successful related and supporting industries includes *steam or other (vapour generating) boilers* (711), *manufactures of based metal* (699) as well as *structures of iron, steel or aluminium* (691).

FIGURE 3
Panorama of Austrian Industrial Performance
1990 – 1992

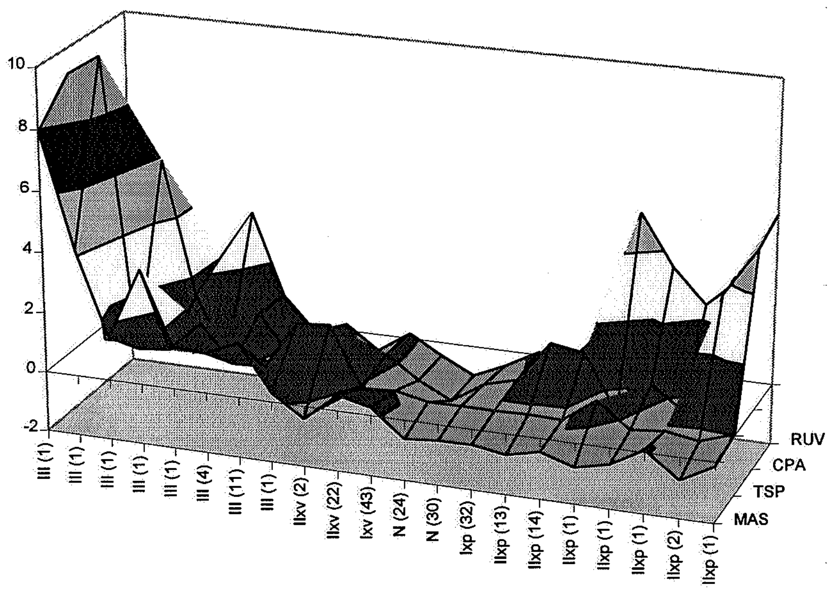


TABLE 4
Performance Patterns of Austrian Industries and Their Share in Total Exports in %
1990 – 1992

	Perfomance Levels							
	III	IIxv	Ixv	N	Ixp	IIxp	others	Sum
Materials/Metals	3.87	3.07	6.21	0.23	0.08	1.56	0.04	15.06
Petrol/Chemicals	0.15	–	4.18	2.02	1.66	0.42	0.68	9.11
Forest Products	3.96	0.22	4.75	0.04	0.30	0.00	–	9.27
Office	1.81	–	1.17	0.40	0.10	–	–	3.48
Multiple Business	–	–	6.97	1.10	1.01	0.10	–	9.18
Transportations	5.23	0.61	1.61	0.88	6.03	0.31	–	14.67
Semiconductors/Computers	–	–	–	0.74	0.74	–	–	1.48
Telecommunications	–	–	–	–	1.11	–	–	1.11
Defense	–	–	–	–	–	0.28	–	0.28
Power Generation & Distribution	–	–	0.76	–	–	–	–	0.76
Food/Beverage	0.26	1.13	0.41	1.40	0.41	0.19	0.48	4.28
Textiles/Apparel	1.66	3.75	2.35	0.94	–	1.40	0.00	10.10
Housing/Household	1.58	4.31	1.29	1.61	1.80	1.92	–	12.51
Health Care	1.16	0.48	–	0.70	0.22	0.15	–	2.71
Personal	–	–	–	0.21	–	–	0.52	0.73
Entertainment/Leisure	3.16	–	1.41	–	0.09	0.59	–	5.25
Sum	22.84	13.57	31.11	10.27	13.55	6.92	1.72	99.98

- *Rails and railway track construction materials of iron or steel* (677) together with *railway maintenance vehicles* (791) form an especially competitive product group in the domain of public transport.

- The production of *internal combustion piston engines* (713) is one of the most successful areas of Austrian industrial activity. Besides the innovative capacity of some of the Austrian manufacturers, this extraordinary performance is mainly due to successful transnational links to the international automobile industry.

- The crisis shaken textile industry still plays an important but continuously diminishing role in Austrian manufacturing. Particularly successful product groups are *man made fibres for spinning* (276), *manufactures of leather and saddleries* (612) and *knitted and crocheted fabrics* (655) together with *tulles, laces etc.* (656).

- *Television receivers* (761) are the most successful product group in the electronics industry. Again transnational links via foreign ownership are a major determinant of export performance.

- Other successful product groups are *baby carriages, toys, games and sporting goods* (894), *glassware* (665), *lightning fixtures and fittings* (813) *monfilament* (583), *medicinal and pharmaceutical products* (541) and *non-alcoholic beverages* (111).

IV. Conclusions

Careful examination of the listing above (results are displayed in more detail in Peneder, 1994) leads to the conclusion that national clusters as proposed by Porter – and defined by a strong network of related and supporting industries at the same time showing above average performance – are relatively rare in the case of Austria, especially in comparison with other countries like Germany (Van der Linde, 1992) or Switzerland (Borner, et.al., 1991). One exception is the highly competitive *wood processing* industry, where *simply worked wood, particle boards, wood manufactures as well as paper and paperboard and articles of paper* form the international spearheads of a broad national cluster based on the common primary resource and acquired skills. Another example is located in the sector of public transportation with the production of *rails and railway track construction materials* on the one hand and *railway maintenance vehicles* on the other.

The results also indicate at least two main reasons for the lack of dynamic and successful national industrial clusters in Austria:

⇒ Some of the most successful Austrian product groups belong to "old" industries going through deep structural crisis, e.g. *textiles* and to a lesser extent *steel production*. Their example is a warning, how successful clusters in the present can form the crisis shaken industrial conglomerates of the future. For these industries many factors directly affected by their characteristics as clusters (e.g. strong influence on political decision making, endowment with specialized factors) can inhibit necessary structural change and therefore dampen prospects of overall industrial development.

⇒ For a small open economy like Austria national boundaries can be too narrow to establish broad cluster relations. Globalisation is an at least equally important factor for success as are clusters of related and supporting industries (Rugman – Verbeke, 1992). Some of the most successful industries in Austria can be interpreted as parts of bigger transnational clusters, like the highly competitive production of *internal combustion piston engines*.

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Appendix

table 5

Materials/Metals
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
691	structures, parts of struc. of iron, steel or alu	1,23	0,05	-0,22	-0,27	14	III	0,99
699	manufactures of based metal	1,1	0,03	-0,26	-0,39	14	III	2,39
711	steam or other (vapour generating) boilers	0,29	1,82	0,22	0,72	18	III	0,12
	Sum							3,50
677	rails and railway track construction material	7,95	9,16	0,19	-0,52	5	IIIxv	0,37
684	aluminium	0,32	-0,09	0,11	0,18	19	IIxv	1,47
692	metal containers for storage or transport	0,27	-0,14	0,07	0,13	19	IIxv	0,29
693	wire products	0,39	-0,14	-0,2	0,49	19	IIxv	0,19
695	tools	0,56	-0,01	-0,09	-0,04	19	IIxv	0,84
733	machine-tools for working metal, without removing mat.	0,11	-0,03	0,48	0,48	19	IIxv	0,28
	Sum							3,07
673	flat-rolled prod. of iron or non-alloy steel not clad, plated	0,53	0,51	-0,26	-0,44	17	Ixv	1,45
674	flat-rolled prod. of iron or non-alloy steel, clad, plated	0,36	0,32	-0,33	-0,46	17	Ixv	0,75
675	flat-rolled products of alloy steel	-0,08	-0,03	-0,46	-0,74	17	Ixv	0,47
678	wire of iron or steel	0,18	-0,06	-0,41	-0,17	17	Ixv	0,15
679	tube, pipes a. hollow profiles of iron or steel	0,6	0,12	-0,48	-0,68	17	Ixv	1,36
682	copper	0,02	-0,18	-0,19	-0,2	17	Ixv	0,66
712	steam turbines and other vapour turbines	0,14	0,16	-0,45	-0,36	17	Ixv	0,10
731	machine-tools working by removing metal or other mat.	-0,03	-0,18	-0,44	-0,39	17	Ixv	0,54
735	parts of 731 and 733	-0,01	-0,19	-0,56	-0,27	17	Ixv	0,23
737	metalworking machinery	0,56	0,23	-0,53	-0,31	17	Ixv	0,52
	Sum							6,21
685	lead	-0,78	-0,38	-0,32	-0,18	13	N	0,01
686	zinc	-0,85	-0,37	-0,27	-0,39	13	N	0,01
694	nails, screws, nuts, bolts etc.	-0,18	-0,25	-0,34	-0,56	13	N	0,21
	Sum							0,23
683	nickel	-0,74	-0,31	0,12	0,12	15	Ixp	0,03
689	miscellaneous non-ferrous base metals	-0,1	-0,22	0,01	0,03	15	Ixp	0,06
	Sum							0,08
28	metaliferous ores and scrap	-0,63	-0,31	1,95	2,27	16	IIxp	0,32
676	iron and steel bars, rods, angles, shapes, sections	0,29	-0,02	1,05	1	16	IIxp	0,95
671	pig iron, granules & powders, ferro-alloys	-0,14	0,04	5,59	5,23	10	IIxp	0,24
672	ingots and other primary forms	-0,71	-0,35	3,2	4,27	11	IIxp	0,05
687	tin	-0,74	-0,37	3,71	-0,08	9	IIxp	0,00
	Sum							1,56
681	silver, platinium						n.v.	0,04

Petrol/Chemicals
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
583	*monfilament*	1,77	-0,02	0,16	0,23	14	III	0,15
513	*carboxylic acids and their anhydrides*	0,03	0,2	-0,32	-0,4	17	Ixv	0,46
571	*polymers of ethylene in primary forms*	0,32	0,02	-0,47	-0,6	17	Ixv	0,57
581	*tubes, pipes and hoses of plastic*	0,64	-0,14	-0,45	-0,63	17	Ixv	0,25
582	*plates,sheets of plastic*	0,27	-0,03	-0,55	-0,64	17	Ixv	1,06
621	*materials of rubber*	0,59	-0,03	-0,73	-0,84	17	Ixv	0,30
629	*articles of rubber*	0,05	-0,19	-0,64	-0,75	17	Ixv	0,24
524	*other inorganic chemicals*	0,68	0,12	-1,05	-1,08	17	Ixv	0,14
893	*articles of plastic*	0,18	-0,16	-0,22	-0,36	17	Ixv	1,17
	Sum							4,18
511	*hydrocarbons*	-0,89	-0,37	-0,89	-0,78	20	N	0,04
515	*organo-inorganic compounds*	-0,46	0	-1,11	-0,72	20	N	0,38
523	*metallic salts and peroxysalts*	-0,5	-0,22	-0,74	-1,05	20	N	0,11
533	*pigments, paints, varnishes*	-0,26	-0,24	-1,27	-1,28	20	N	0,41
575	*other plastics in primary forms*	-0,24	-0,16	-1,03	-0,93	20	N	0,68
514	*nitrogen-function compounds*	-0,64	-0,19	-0,41	-0,75	13	N	0,20
531	*synthetic organic colouring matter and colour lakes*	-0,84	-0,36	-0,53	0,16	13	N	0,03
572	*polymers of styrene*	-0,62	-0,34	-0,23	-0,26	13	N	0,08
573	*polymers of vinyl chloride*	-0,58	-0,27	-0,27	-0,17	13	N	0,07
579	*waste, parings and scrap, of plastic*	-0,42	-0,04	-0,76	-0,35	13	N	0,01
	Sum							2,02
32	*coal, coke and briquettes*	-0,94	-0,41	0,48	-0,29	15	Ixp	0,00
522	*inorganic chemical elements*	-0,22	-0,19	0,33	-0,4	15	Ixp	0,33
562	*fertilizers*	-0,27	0,14	-0,1	-0,1	15	Ixp	0,30
574	*polyacetals etc.*	-0,36	-0,27	0,04	-0,07	15	Ixp	0,23
591	*insecticides etc.*	-0,39	-0,09	-0,06	0,21	15	Ixp	0,19
592	*starches, inulin and wheat gluten*	-0,72	-0,3	0,04	-0,31	15	Ixp	0,05
593	*explosives and pyrotechnic products*	-0,08	-0,18	-0,1	-0,07	15	Ixp	0,04
597	*prepared additives for mineral oils and the like*	-0,8	-0,34	0,35	0,05	15	Ixp	0,04
598	*miscellaneous chemical products*	-0,39	-0,24	-0,07	-0,04	15	Ixp	0,48
	Sum							1,66
33	*petroleum and petroleum products*	-0,86	-0,38	0,7	0,62	16	IIxp	0,33
34	*gas, natural and manufactured*	-0,93	-0,41	1,71	1,53	16	IIxp	0,00
532	*dyeing and tanning extracts*	-0,83	-0,36	1,49	1,68	16	IIxp	0,00
512	*alcohols, phenols etc.*	-0,89	-0,38	0,25	2,43	3	IIxp	0,01
516	*other organic chemicals*	-0,72	-0,23	0,16	1,22	3	IIxp	0,07
	Sum							0,42
35	*electric current*						n.v.	0,66
525	*radio-active and associated materials*						n.v.	0,02
	Sum							0,68

table 5, continued

Forest Products
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
248	*wood, simply worked*	2,3	0,83	0,18	-0,48	14	III	2,32
634	*veneers, plywood, particle board, etc.*	2,53	0,5	-0,42	-0,91	14	III	1,02
635	*wood manufactures*	1,76	-0,06	-0,32	0,03	14	III	0,63
	Sum							3,96
247	*wood in the rough*	0,03	-0,32	-0,06	0,7	19	IIxv	0,22
641	*paper and paperboard*	0,82	0,41	-0,39	-0,71	17	Ixv	4,19
725	*paper mill and pulp mill machinery*	0,79	0,09	-0,53	-0,47	17	Ixv	0,56
	Sum							4,75
245	*fuel wood*	-0,67	-0,4	-1,13	0,07	13	N	0,00
246	*wood in chips and wood waste*	-0,11	-0,19	-0,95	-0,19	13	N	0,04
	Sum							0,04
251	*pulp and waste paper*	-0,53	-0,29	-0,21	0,15	15	Ixp	0,30
244	*cork, natural, raw and waste*	-0,92	-0,39	0,25	1,26	3	IIxp	0,00

Office
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
642	*cut paper and paperboard, articles of paper*	1,51	0,2	-0,63	-0,74	14	III	1,81
892	*painted matter*	0	-0,26	-0,54	-0,73	17	Ixv	0,87
895	*office and stationery supplies*	0,56	0,11	-1,07	-1	17	Ixv	0,30
	Sum							1,17
726	*printing and bookbinding machinery*	-0,22	-0,17	-0,46	-0,62	13	N	0,40
751	*office machinerys*	-0,74	-0,33	0,12	-0,08	15	Ixp	0,10

Multiple Business
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
728	*other machinery specialized for particular industries*	0,52	0,09	-0,51	-0,09	17	Ixv	2,66
741	*heating and cooling equipment*	-0,09	-0,1	-0,5	-0,44	17	Ixv	1,01
743	*pumps, air or other gas compressors and fans*	-0,09	-0,1	-0,76	-0,63	17	Ixv	0,88
744	*mechanical handling equipment*	0,4	-0,01	-0,18	-0,16	17	Ixv	1,29
749	*non-electrical parts of machinery*	-0,02	-0,1	-0,11	-0,51	17	Ixv	0,36
771	*electric power machinery*	0,58	-0,07	-0,43	-0,75	17	Ixv	0,67
873	*meters and counters*	-0,04	-0,13	-0,3	-0,37	17	Ixv	0,09
	Sum							6,97
742	*pumps for liquids, liquid elevators*	-0,15	-0,17	-0,27	-0,38	13	N	0,48
745	*other non electrical machinery*	-0,17	-0,22	-0,81	-0,57	13	N	0,62
	Sum							1,10
874	*measuring, checking and analysing instruments*	-0,4	-0,19	-0,32	0,28	15	Ixp	1,01
871	*optical instruments*	-0,2	-0,05	0,73	0,83	16	IIxp	0,10

table 5, continued

Transportations
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
713	*internal combustion piston engines*	1,67	0,42	0,02	0,31	14	III	4,70
791	*railway vehicles*	1,44	0,26	1,27	5,89	8	III	0,53
	Sum							5,23
748	*transmission shafts and cranks*	0,39	-0,19	0,03	0,41	19	IIxv	0,61
625	*rubber tyres*	0,13	-0,06	-0,03	-0,3	17	Ixv	0,78
746	*ball or roller bearings*	0,44	-0,07	-0,24	-0,12	17	Ixv	0,47
786	*trailers and semi-trailers*	0,44	-0,14	-0,48	-0,18	17	Ixv	0,36
	Sum							1,61
23	*crude rubber*	-0,77	-0,36	-0,96	-0,85	20	N	0,04
783	*road motor vehicles*	-0,55	-0,3	-0,63	-1,03	20	N	0,15
792	*aircraft*	-0,9	-0,34	-1,43	-1,45	20	N	0,14
714	*enginees, motors*	-0,89	-0,2	-0,5	0,16	13	N	0,06
747	*taps cocks, valves an similar appliances*	-0,18	-0,23	-0,39	-0,61	13	N	0,50
	Sum							0,88
723	*civil engineering a. contractors' plant and equipment*	-0,03	-0,01	0,04	-0,07	15	Ixp	0,97
781	*motor cars*	-0,78	-0,36	-0,2	-0,14	15	Ixp	1,47
782	*motor veh. for the transp. of goods a. special mot. veh.*	-0,05	-0,09	0,09	-0,24	15	Ixp	1,73
784	*parts of motor vehicles*	-0,5	-0,16	-0,08	0,01	15	Ixp	1,86
	Sum							6,03
785	*motorcycles, cycles*	-0,58	-0,32	0,74	0,72	16	IIxp	0,16
793	*ships, boats etc*	-0,8	0,55	5,17	-0,7	7	IIxp	0,15
	Sum							0,31

Semiconductors/Computers
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
752	*automatic data processing machines*	-0,69	-0,31	-0,47	-0,59	13	N	0,74
759	*parts and accessories for 751 and 752*	-0,61	-0,26	0,32	0,24	15	Ixp	0,74

Telecommunications
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
764	*telecommunication equipment*	-0,51	-0,24	-0,34	0,57	15	Ixp	1,11

Defense
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
891	*arms and ammunition*	-0,06	0,04	1,05	0,88	16	IIxp	0,28

Power Generation & Distribution
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
716	*rotating electric plant*	-0,08	-0,1	-0,69	-0,71	17	Ixv	0,56
718	*other power generating machinery*	0,18	-0,11	-0,73	-0,21	17	Ixv	0,20
	Sum							0,76

table 5, continued

Food/Beverages
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
111	*non-alcoholic beverages*	1,41	1,39	3,65	-0,56	21	III	0,26
00	*live animals*	-0,43	1,71	-0,69	-1,28	2	IIxv	0,18
011	*meat of bovine animals*	-0,41	2,12	-0,43	-1,41	2	IIxv	0,35
059	*fruit and vegetabels juices*	1,25	-0,04	0,44	-0,06	19	IIxv	0,23
727	*food-processing machines*	0,47	0,17	-0,1	0,16	19	IIxv	0,37
	Sum							1,13
721	*agricultural machinery*	0,03	-0,14	-0,37	-0,1	17	Ixv	0,41
017	*meat, prepared or preserved*	-0,76	-0,18	-0,87	-0,87	20	N	0,03
09	*miscellaneous edible products*	-0,59	-0,26	-1,27	-1,47	20	N	0,18
112	*alcoholic beverages*	-0,75	-0,2	-1,16	-1,1	20	N	0,19
29	*crude animals and vegetable materials*	-0,79	-0,37	-1,2	-1,45	20	N	0,08
43	*animal or vegetable fats, processed*	-0,67	-0,33	-1,11	-1,19	20	N	0,02
022	*milk, cream*	-0,7	0,11	-0,8	-0,21	13	N	0,12
024	*cheese, curd*	-0,34	0,04	-0,49	-0,78	13	N	0,26
025	*eggs*	-0,93	-0,4	-0,13	-0,9	13	N	0,00
054	*vegetables*	-0,85	-0,38	-0,1	-0,84	13	N	0,05
057	*fruit and nuts*	-0,8	-0,38	-0,66	-0,31	13	N	0,09
07	*coffee, tea, cocoa, spices*	-0,09	-0,28	-0,52	0,17	13	N	0,36
41	*animal oils and fats*	-0,6	0,52	-0,52	-0,79	13	N	0,02
	Sum							1,40
03	*fish, crustaceans*	-0,93	-0,4	0,42	0,11	15	Ixp	0,01
056	*vegetables, prepared or preserved*	-0,87	-0,36	0,6	0,07	15	Ixp	0,02
062	*sugar confectionery*	-0,51	-0,29	0,06	-0,2	15	Ixp	0,05
08	*feeding stuff for animals*	-0,75	-0,34	0,03	-0,14	15	Ixp	0,10
22	*oil speeds*	-0,84	-0,2	0,33	-0,92	15	Ixp	0,04
722	*tractors*	-0,27	-0,22	0,37	-0,01	15	Ixp	0,20
	Sum							0,41
012	*other meat*	-0,84	-0,3	1,41	0,28	16	IIxp	0,07
016	*meat, salted or dried*	-0,92	-0,25	1,15	2,7	16	IIxp	0,00
023	*butter*	-0,9	0,78	-0,12	1,86	3	IIxp	0,01
058	*fruit preserved*	-0,75	-0,36	0,22	0,82	3	IIxp	0,03
061	*sugars, molasses, honey*	-0,61	-0,12	-0,03	2,05	3	IIxp	0,08
42	*fixed vegetable fats and oils*	-0,91	-0,39	0,35	1,11	3	IIxp	0,01
	Sum							0,19
041	*wheat, unmilled*						n.v.	0,09
042	*rice*						n.v.	0,00
043	*barlex, unmilled*						n.v.	0,05
044	*maize, unmilled*						n.v.	0,07
045	*other cereals, unmilled*						n.v.	0,02
046	*meal a. flour of wheat*						n.v.	0,00
047	*other cereal meals a. flours*						n.v.	0,00
048	*cereal preparations, preparations of flour*						n.v.	0,24
	Sum							0,48

Textiles/Apparel
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
612	manufactures of leather, saddlery	1,36	0,19	0,92	1,57	1	III	0,05
655	knitted or crocheted fabrics	1,97	0,06	-0,02	-0,23	14	III	0,54
656	tulles, lace etc	3,83	0,36	2,05	1,42	4	III	0,53
	Sum							1,12
267	other man-made fibres	4,19	9,86	-0,16	-0,47	6	IIIxv	0,54
611	leather	0,44	0	0,74	-0,18	19	IIxv	0,41
652	cotton fabrics, woven	0,88	0,08	0,72	0,36	19	IIxv	0,81
658	made-up articles	0,09	-0,23	0,37	0,04	19	IIxv	0,23
842	articles of textile fabrics for women and girls	0,03	-0,3	0,49	0,19	19	IIxv	0,58
844	articles of textile fabrics for women and girls, knitted	0,6	-0,18	0,58	0,13	19	IIxv	0,34
846	clothing accessories	0,7	-0,1	0,1	0,15	19	IIxv	0,40
851	footwear	0,31	-0,2	0,11	0,34	19	IIxv	0,98
	Sum							3,75
266	synthetic fibres suitable for spinning	0,23	-0,06	-0,43	-0,88	17	Ixv	0,17
651	textile yarn	0,37	-0,13	-0,34	-0,57	17	Ixv	1,02
653	fabrics, woven, of man-made textile materials	0,1	-0,02	0,02	-0,24	17	Ixv	0,74
657	special yarns etc	-0,1	-0,14	-0,37	-0,64	17	Ixv	0,42
	Sum							2,35
263	cotton	-0,88	-0,38	-0,83	-1,07	20	N	0,01
265	vegetable textile fibres	-0,81	-0,38	-1,02	-1,07	20	N	0,00
268	wool and other animal hair	-0,92	-0,39	-0,52	-0,91	20	N	0,00
269	worn clothes	-0,67	0,38	-1,17	-1,17	20	N	0,01
613	furskins, tanned or dressed	-0,71	-0,29	-0,93	-0,9	20	N	0,01
724	textile a. leather machinery	-0,52	-0,15	-0,71	-0,78	20	N	0,42
848	articles of apparel of other than textile fabrics	-0,22	-0,3	-0,91	-0,74	20	N	0,14
21	hides, skins and furskins	-0,63	-0,13	-0,8	-0,51	13	N	0,08
654	other textile fabrics, woven	-0,23	-0,21	-0,6	0,2	13	N	0,22
831	cases, bags	-0,69	-0,37	-0,52	0,43	13	N	0,04
	Sum							0,94
261	silk	-0,93	-0,4	-0,22	1,6	3	IIxp	0,00
841	articles of textile fabrics for men or boys	-0,04	-0,28	1,15	0,81	16	IIxp	0,44
843	articles of textile fabrics for men or boys, knitted	0,04	-0,2	0,74	0,9	16	IIxp	0,09
845	articles of apparel	0,06	-0,25	0,8	0,93	16	IIxp	0,87
	Sum							1,40
264	jute and other textile bast fibres						n.v.	0,00

Housing/Household
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
665	glassware	1,93	0,47	1,11	0,75	1	III	0,89
813	lightning fixtures a fittings	1,86	0,01	-0,22	-0,09	14	III	0,68
	Sum							1,58
662	clay construction materials	1,05	0	0,08	0,25	19	IIxv	0,73
663	mineral manufactures	1,38	0,18	0,12	0,56	19	IIxv	0,97
773	equipment for distribuiting electricity	0,81	0,06	-0,16	-0,02	19	IIxv	1,13
811	prefabricated buildings	0,22	-0,1	-0,19	0,94	19	IIxv	0,10
821	furniture, bedding	0,15	-0,23	0,11	0,5	19	IIxv	1,38
	Sum							4,31
775	household type	0,17	-0,19	-0,34	-0,38	17	Ixv	1,02
812	sanitary, plumbing and heating fixtures a. fittings	0,53	-0,13	-0,8	-0,88	17	Ixv	0,27
	Sum							1,29
778	electrical machinery a. apparatus	-0,35	-0,2	-0,91	-1,05	20	N	1,07
554	soap,cleansing a. polishing preparations	-0,4	-0,27	-0,52	-0,59	13	N	0,19
633	cork manufactures	-0,85	-0,38	-0,57	0,16	13	N	0,00
664	glass	-0,54	-0,27	-0,34	-0,35	13	N	0,17
697	household equipment of base metal	-0,22	-0,28	-0,46	-0,37	13	N	0,17
	Sum							1,61
696	cutlery	-0,74	-0,36	0,13	0,33	15	Ixp	0,02
659	floor coverings	-0,12	-0,25	0,27	-0,48	15	Ixp	0,26
772	elec. apparatus for switching or protecting elec. circuits	-0,07	-0,12	-0,13	0,22	15	Ixp	1,52
	Sum							1,80
776	cathode valves or tubes	-0,36	-0,15	0,1	1,18	3	IIxp	1,32
666	pottery	-0,63	-0,33	0,5	0,79	3	IIxp	0,05
27	other crude minerals and crude fertilizers	0,08	-0,16	2,39	-0,4	12	IIxp	0,42
661	lime, cement, etc	-0,53	-0,27	3,52	0,39	9	IIxp	0,12
	Sum							1,92

table 5, continued

Health Care
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
541	*medicinal a. pharmaceutical products*	0,56	0	1,11	1,09	1	III	1,16
884	*optical goods*	0,81	0,11	0,09	0,4	19	IIxv	0,48
542	*medicaments*	-0,38	-0,27	-0,92	-1,12	20	N	0,70
872	*instruments for medical, surgical a. dental purposes*	-0,58	-0,29	0,13	0,06	15	Ixp	0,22
774	*electro-diagnostic apparatus*	-0,6	-0,26	1,19	1,15	16	IIxp	0,15

Personal
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share
551	*essential oils, perfume a. flavour materials*	-0,64	-0,25	-1,02	-0,81	20	N	0,05
553	*perfumery, cosmetics*	-0,64	-0,32	-0,99	-0,91	20	N	0,16
	Sum							0,21
667	*perls, precious and semi-precious stones*						n.v.	0,07
885	*watches, clocks*						n.v.	0,14
896	*works of art*						n.v.	0,08
897	*jewellery*						n.v.	0,23
	Sum							0,52

Entertainment/Leisure
1990-1992

SITC		MAS	TSP	RUV	CPA	Cluster	PFL	Share tx (%)
761	*television receivers*	2,43	0,43	-0,09	-0,06	14	III	1,82
894	*baby carriages, toys, games, sporting goods*	1,42	0,04	0,56	0,94	1	III	1,34
	Sum							3,16
763	*sound recorders or reproducers*	0,02	0,32	-0,42	-0,05	17	Ixv	0,58
898	*musical instruments*	-0,04	-0,16	-0,39	-0,59	17	Ixv	0,83
	Sum							1,41
881	*photographic apparatus*	-0,67	-0,32	0,21	-0,28	15	Ixp	0,09
883	*cinemantograph film, exposed a.developed*	-0,84	-0,37	0,02	-0,07	15	Ixp	0,00
	Sum							0,09
12	*tobacco and tobacco manufactures*	-0,85	-0,27	-0,42	0,76	3	IIxp	0,07
762	*radio-broadcast receivers*	-0,17	-0,22	-0,64	0,91	3	IIxp	0,20
899	*miscellaneous manufactured articles*	-0,39	-0,28	0,02	1,43	3	IIxp	0,22
882	*photographic a. cinematographic supplies*	-0,78	-0,34	3,66	3,01	11	IIxp	0,10
	Sum							0,59

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