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HOMOGENEITY OF PRICE DEVELOPMENT WITHIN COMMODITY GROUPS AND BY DEMAND COMPONENTS

Analysis of Input-Output Data for Austria 1964-1976 1)

Dr. Jiri Skolka

1. INTRODUCTORY REMARKS ON METHODOLOGY

Both in national accounts and in input-output tables, total resources (i.e., total output and total imports) are classified by commodity groups, which represent the characteristic output of industries. Input-output tables also give breakdown of domestic demand and exports, which is compatible with the production statistics.

Data about the volume of output and of imports in different years can be either nominal values (i.e., at current prices) or real values (i.e., at constant prices of a certain base year). The difference between the real and nominal values shows the price development between the base and the current year. Users of national accounting and input-output data have to assume that the index of price change for a commodity group is valid for all commodities composing the group. In the input-output table, this assumption of uniform price growth follows from the theoretical

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assumptions of the classical input-output model 2) :

(a) Each industry produces one product or one service only;
(b) Each industry uses only one (Leontief) production technology;
(c) Each product or service is produced in one industry only.

Statisticians compiling and economists using national accounts and input-output statistics know that the price development within commodity groups is not homogeneous. But they know little about the degree of its heterogeneity. The recent publication of the 1964 input-output table for Austria at 1964 and 1976 prices 3) allows to study the heterogeneity of price development within the commodity groups.

2. MEASURES OF PRICE CHANGE DERIVED FROM INPUT-OUTPUT TABLES

2.1 Austrian Input-Output Data about Price Development between 1964-1976

The repricing of the Austrian 1964 input-output table to 1976 prices was carried out in two steps. The original 1964 input-output table was in

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2) These theoretical assumptions make no distinction between the industry and commodity breakdowns of the output, they assume that these are identical. Different breakdowns by industries and commodities are considered in the 1968 System of National Accounts and also in input-output tables consistent with this system. The 1964 input-output table for Austria was not compiled according to the rules of the 1968 System of National Accounts.

3) H.W. Holub, J. Richter, R. Schwarzl, Die reale Input-Output Tabelle für Österreich 1964 zu Preisen 1976, Veröffentlichungen der Universität Innsbruck, No. 149, Innsbruck, 1984.

the first step adjusted 4) to the definitions 5) used in the more recent Austrian input-output table for 1976 6). In the second step, for each transaction in the table, two indices of the price change between 1964 and 1976, one for output, the other one for imports, were calculated from more disaggregated primary statistics. (Depending on available data, these were either of Paasche or of Laspeyres type.)

The result were two input-output tables for 1964, one at 1964, the other at 1976 prices, broken down by 54 commodity groups. (Both tables were also aggregated into a 19-commodity group breakdown corresponding to the industry classification used in the Austrian national accounts and also in the input-output dynamic model in the Austrian Institute for Economic Research. (The 54 and 19 commodity breakdowns can be seen in Tables 1,2,4 and 6 in this paper.)

2.2 Measures of the Homogeneity of Price Development

The 1964 input-output table at 1964 and 1976 prices allows to calculate for each entry two 1976/1964 indices of price change: one for domestic, another one for imported transactions. The topic of this paper is the

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4) Österreichisches Statistisches Zentralamt, Bundeskammer der gewerblichen Wirtschaft, Österreichisches Institut für Wirtschaftsforschung, Input-Output-Tabelle 1964, Vienna, 1973.

5) The 1964 input-output table, as mentioned in footnote 2), does not make a clear distinction between commodities and industries. It was not possible to impose this differentiation ex-post. But the columns and rows of the table are closer to commodity groups than to industries.

6) Österreichisches Statistisches Zentralamt, Input-Output-Tabelle 1976, Band 1, Güter- und Produktionskonten, ÖSZA, Vienna, 1985.

variability, or homogeneity, of these indices in each row of the 54 commodity groups and also in columns of total intermediate demand, of domestic final demand and of exports. For this purpose, the following measures 7) were used:

(a) Weighted arithmetic means;
(b) Weighted standard deviations;
(c) Coefficients of variation.

Considered was also the density of transactions 8) in the rows (defined as the share of the non-zero transactions in the maximum number of 60 transactions in the row), and the "importance of the commodity group" (defined as its share on total gross output or on total imports in 1964). Weights used in the calculation of the arithmetic means and standard deviations of the 1976/1964 price indices were the 1964 transaction volumes at 1964 prices. (Their magnitude differed markedly: The highest value of a domestic transaction was 24,567 Million AS, the highest value of an imported transaction was 2,108 Million AS. The lowest values in both transaction tables was one million AS.)

The uneven breakdown of output and imports into entries of the input-output table may have caused certain inaccuracies in the measures of the homogeneity of price development. Differencies in price indices of several small transactions reveal variability of price development which may be hidden in a single price index of a large transaction.

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7) The computer programme was written by Marianne Riese.

8) The hypothesis that the density of entries in rows of the table may be correlated with the coefficients of variation of the price indices was tested and rejected.

Indices for very small transactions can be biased by due to the rounding of all entries to one million AS.

Price development of domestic and imported transactions in the rows of the input-output table can be compared in two different ways. The "conventional" approach (used also in national accounts), compares the price indices of total domestic production and of total imports a certain commodity group. But only some cells of the input-output table include both domestic and imported transactions; these will be called "comparable transactions". Many cells include only domestic transactions, a few only imported transactions; these transactions have no "comparable" counterpart. (The delimitation of "comparable" and "non-comparable" transactions depends, of course, on the degree of disaggregation of the input-output table.) The domestic transaction matrix contains 2090 non-zero entries - out of a maximum of 3240 - its density is 64.5 percent, the import transactions matrix contains 573 non-zero entries, its density is 17.7 percent only. Average relative prices of all transactions at the one hand, and of transactions at the other, of course, differ.

In addition to these two alternative comparisons of the price development of output and of imports based on relations of absolute values, the arithmetic means and the standard deviations of the ratios of price increases of imported and of domestic transactions can be calculated from the price indices of individual transactions by weighting them by corresponding volumes of either imported or of domestic transactions. This approach gives problematic averages, but allows to estimate the volume of output exposed to foreign competition on the domestic market.

2.3 Prices of Output and of Imports between 1964 and 1976

Input-output statistics about price development of output and of imports in Austria between 1964 and 1976 are given in Tables 1 and 2. The

Table 1

Variation of the price development of domestic output between 1964 and 1976

Commodity Groups	Coefficient of Variation (in percent)	Share on Total Gross Output (in percent)	Price Index 1976/1964 Intermediate Uses	Final Uses	Total Output	Transaction Density 1964 (in percent)	Variation Class
Total economy	29.62	100.00	1.743	1.826	1.796	64.51	
1 Agriculture and forestry	14.15	7.54	1.532	1.554	1.541	66.67	
101 Agriculture and forestry	14.15	7.54	1.532	1.554	1.541	66.67	xx
2 Mining	25.08	0.96	1.789	2.174	1.982	37.22	
102 Metal ore mining	33.24	0.16	1.766	2.493	1.847	18.33	x
103 Coal mining	28.62	0.28	1.366	2.015	1.607	60.00	x
104 Other mining	19.09	0.52	2.279	2.204	2.226	33.33	xx
3 Food, beverages, tobacco	17.10	9.62	1.533	1.546	1.544	38.33	
109 Meat and fish	11.92	2.36	1.743	1.560	1.595	51.67	xx
110 Grain milling and bakery products	11.48	1.98	1.548	1.642	1.611	41.67	xx
111 Dairy products	24.71	1.10	1.614	2.018	1.955	38.33	x
112 Sugar	5.00	0.49	1.287	1.202	1.239	30.00	xxx
113 Other food	16.06	1.50	1.439	1.241	1.295	48.33	xx
114 Beverages	3.50	1.33	1.468	1.544	1.519	45.00	xxx
115 Tobacco	3.91	0.85	1.333	1.357	1.356	13.33	xxx
4 Textiles, wearing apparel, leather	15.37	6.87	1.273	1.335	1.321	44.17	
116 Manufacture of textiles	14.66	2.67	1.163	1.411	1.303	68.33	xx
117 Knitting mills	6.68	0.84	1.244	1.384	1.378	16.76	xxx
118 Wearing apparel	14.47	2.21	1.528	1.197	1.216	80.00	xx
119 Footwear	5.07	0.76	1.326	1.361	1.361	43.33	xxx
120 Leather and furs	5.95	0.21	1.843	2.005	1.883	13.33	xxx
121 Leather products	8.76	0.18	1.726	1.799	1.792	43.33	xxx
5 Wood, wood products, furniture	17.10	3.27	1.535	1.498	1.509	70.00	
138 Sawmills	14.49	1.23	1.542	1.703	1.656	58.33	xx
139 Wood and cork products	17.61	2.04	1.532	1.376	1.420	81.67	xx
6 Paper, paper products	23.51	3.15	1.866	1.765	1.829	88.33	
140 Pulp and paper	12.41	1.38	1.572	1.700	1.628	83.33	xx
141 Paper products	11.61	0.58	1.381	1.622	1.447	93.33	xx
142 Printing and publishing	15.91	1.19	2.412	1.922	2.250	88.33	xx

Table 1a

Variation of the price development of domestic output between 1964 and 1976

Commodity Groups	Coefficient of Variation (in percent)	Share on Total Gross output (in percent)	Price Index 1976/1964 Intermediate Uses	Final Uses	Total Output	Transaction Density 1964 (in percent)	Variation Class
7 Chemicals (exclusive petroleum products)	17.86	3.87	1.509	1.399	1.456	66.25	
122 Rubber products	14.67	0.62	1.171	1.408	1.268	80.00	xx
123 Pharmaceuticals	8.99	0.39	1.354	1.212	1.235	16.67	xxx
124 Chemical products	17.90	2.50	1.608	1.446	1.531	98.33	xx
125 Plastic products	5.15	0.37	1.526	1.433	1.496	70.00	xxx
8 Petroleum and petroleum products	24.48	1.59	2.693	1.737	2.304	88.33	
105 Petroleum and petroleum products	24.48	1.59	2.693	1.737	2.304	88.33	x
9 Pottery, china, glassware	16.76	2.48	1.602	1.683	1.635	51.67	
106 Stone and clay products	15.13	1.64	1.672	1.792	1.718	68.33	xx
107 Cement	2.24	0.40	1.431	1.430	1.430	31.67	xxx
108 Glass and glass products	23.05	0.43	1.472	1.540	1.509	55.00	x
10 Basic metal industries	11.10	5.09	1.536	1.667	1.585	61.11	
126 Iron and steel	7.37	3.99	1.549	1.693	1.601	78.33	xxx
128 Foundries	26.99	0.31	1.477	2.185	1.608	41.67	x
129 Non-ferrous metals	15.95	0.79	1.478	1.514	1.498	63.33	xx
11 Metal products, machinery equipment	22.14	10.76	1.895	1.840	1.856	64.26	
130 Various metall products	21.93	2.11	1.659	2.104	1.933	90.00	x
131 Machinery (incl. railroad equipment)	13.67	2.32	1.955	1.961	1.960	93.33	xx
132 Farm maschinery and equipment	11.43	0.47	2.137	1.824	1.933	11.67	xx
133 Instruments and apparatus	9.33	0.41	2.188	1.990	2.025	50.00	xxx
134 Electrical motors and generators	23.93	0.74	1.727	1.609	1.642	73.33	x
135 Other electrical apparatus	24.70	1.89	1.525	1.511	1.514	90.00	x
136 Transport equipment (incl. agricultural tractors)	18.64	1.08	1.265	1.660	1.601	45.00	xx
137 Repair of motor vehicles	3.61	0.85	2.544	2.694	2.603	80.00	xxx
127 Structural metal products	17.90	0.89	2.212	1.737	1.791	45.00	xx
12 Electricity and water supply	35.70	2.21	1.671	1.918	1.787	87.50	
145 Electricity	36.42	1.73	1.467	1.995	1.719	93.33	x
146 Gas, steam and water supply	33.46	0.48	2.367	1.626	2.032	81.67	x
13 Construction	25.83	8.29	2.053	1.860	1.897	90.00	
143 Basic construction	14.12	5.28	2.007	1.728	1.764	88.33	xx
144 Finishing construction	31.97	3.01	2.087	2.150	2.130	91.67	x

Table 1b

Variation of the price development of domestic output between 1964 and 1976

Commodity Groups	Coeficient of Variation (in percent)	Share on Total Gross Output (in percent)	Price Index 1976/1964 Intermediate Uses	Final Uses	Total Output	Transaction Density 1964 (in percent)	Variation Class
14 Wholesale and retail trade	48.58	10.58	1.908	1.577	1.659	98.33	
147 Wholesale and retail trade	48.58	10.58	1.908	1.577	1.659	98.33	x
15 Restaurants and hotels	0.76	4.09	1.967	1.978	1.977	86.67	
151 Restaurants and hotels	0.76	4.09	1.967	1.978	1.977	86.67	xxx
16 Transport and communications	10.69	5.39	1.485	1.702	1.571	96.67	
148 Transport	11.04	4.32	1.471	1.688	1.558	98.33	xx
149 Communications	9.35	1.08	1.542	1.759	1.626	95.00	xxx
17 Financial services	17.74	4.42	1.979	2.410	2.181	86.67	
150 Financial Services	1.84	2.34	1.856	1.789	1.844	95.00	xxx
153 Real estate	0.86	2.08	2.559	2.558	2.558	78.33	xxx
18 Other Services	19.22	4.34	2.344	2.606	2.503	96.67	
152 Other services	19.22	4.34	2.344	2.606	2.503	96.67	xx
19 Public services	24.12	5.48	2.437	2.921	2.881	93.33	
154 Public services	24.12	5.48	2.437	2.921	2.881	93.33	x

Table 2

Variation of the price development of imports between 1964 and 1976

Commodity Groups	Coefficient of Variation (in percent)	Share on Total Imports (in percent)	Price Index 1976/1964 Intermediate Uses	Final Uses	Total Imports	Transaction Density 1964 (in percent)	Variation Class
Total Economy	33.73	100.00	1.641	1.521	1.588	17.69	
1 Agriculture and forestry	24.77	10.96	1.457	2.093	1.647	35.00	
101 Agriculture and forestry	24.77	10.96	1.457	2.093	1.647	35.00	x
2 Mining	15.12	5.32	2.140	1.772	2.080	26.11	
102 Metal ore mining	35.48	1.15	2.066	-	2.066	5.00	x
103 Coal mining	1.48	3.46	2.298	1.774	2.167	61.67	xxx
104 Other mining	11.99	0.71	1.683	1.000	1.682	11.67	xx
3 Food, beverages, tobacco	30.38	5.47	1.389	1.221	1.297	10.48	
109 Meat and fish	10.72	1.57	1.503	1.566	1.539	16.67	xx
110 Grain milling and bakery products	68.28	0.35	0.788	0.564	0.599	6.67	x
111 Dairy products	18.51	0.28	0.714	0.741	0.740	6.67	xx
112 Sugar	6.46	0.04	1.600	1.824	1.773	6.67	xxx
113 Other food	9.45	2.71	1.445	1.404	1.428	20.00	xxx
114 Beverages	53.59	0.41	0.647	0.520	0.571	11.67	x
115 Tobacco	16.95	0.12	1.000	0.812	0.814	5.00	xx
4 Textiles, wearing apparel, leather	19.15	10.60	1.174	1.303	1.206	9.44	
116 Manufacture of textiles	19.40	7.52	1.155	1.491	1.191	18.33	xx
117 Knitting mills	29.87	0.88	0.808	1.290	1.125	5.00	x
118 Wearing apparel	10.50	0.84	1.489	1.277	1.295	10.00	xx
119 Footwear	8.69	0.34	1.022	0.907	0.932	6.67	xxx
120 Leather and furs	17.14	0.84	1.476	1.544	1.482	10.00	xx
121 Leather products	22.99	0.18	0.750	1.096	1.083	6.67	x
5 Wood, wood products, furniture	17.22	1.49	1.335	1.165	1.231	17.50	
138 Sawmills	14.22	0.29	1.550	1.400	1.546	5.00	xx
139 Wood and cork products	11.25	1.20	1.133	1.163	1.156	30.00	xx
6 Paper, paper products	22.82	2.32	1.476	1.646	1.551	23.89	
140 Pulp and paper	25.08	0.81	1.535	1.879	1.559	31.67	x
141 Paper products	28.44	0.44	1.244	0.895	1.118	28.33	x
142 Printing and publishing	7.66	1.07	1.552	1.775	1.722	11.67	xxx
7 Chemicals (exclusive petroleum products)	19.46	10.59	1.411	1.213	1.372	30.83	
122 Rubber products	12.76	0.84	1.134	1.077	1.098	30.00	xx
123 Pharmaceuticals	3.62	0.82	1.403	1.475	1.466	10.00	xxx
124 Chemical products	20.03	8.56	1.422	1.034	1.398	76.67	x
125 Plastic products	14.42	0.37	1.333	1.155	1.179	6.67	xx

Table 2a

Variation of the price development of imports between 1964 and 1976

Commodity Groups	Coefficient of Variation (in percent)	Share on Total Imports (in percent)	Price Index 1976/1964 Intermediate Uses	Final Uses	Total Imports	Transaction Density 1964 (in percent)	Variation Class
8 Petroleum and petroleum product	36.78	7.10	2.205	2.286	2.224	85.00	
105 Petroleum and petroleum products	36.78	7.10	2.205	2.286	2.224	85.00	x
9 Pottery, china, glass-ware	39.22	1.78	1.862	1.480	1.785	20.56	
106 Stone and clay products	34.50	1.15	2.103	1.466	1.994	35.00	x
107 Cement	6.09	0.03	1.412	-	1.412	3.33	xxx
108 Glass and glass products	44.63	0.60	1.357	1.495	1.396	23.33	x
10 Basic metal industries	28.16	7.53	1.542	2.190	1.758	25.56	
126 Iron and steel	26.00	3.76	1.649	2.131	1.823	38.33	x
128 Foundries	25.65	0.30	2.079	2.228	2.144	11.67	x
129 Non-Ferrous metals	32.40	3.47	1.401	2.265	1.651	26.67	x
11 Metal products, machinery equipment	28.61	33.18	1.810	1.398	1.496	20.00	
130 Various metall products	33.00	3.05	1.742	1.488	1.612	63.33	x
131 Machinery (incl. railroad equip.)	13.57	11.11	1.833	1.554	1.606	31.67	xx
132 Farm maschinery, equipment	7.09	0.93	1.525	1.602	1.594	8.33	xxx
133 Instruments and apparatus	14.81	1.72	1.732	1.505	1.567	25.00	xx
134 Electrical motors and generators	33.76	1.00	1.171	1.941	1.478	6.67	x
135 Other electrical apparatus	50.08	4.58	2.638	1.291	1.775	23.33	x
136 Transport equipment (incl. agricultural tractors)	11.08	10.10	1.314	1.182	1.200	8.33	xx
137 Repair of motor vehicles	.	0.0	-	2.500	2.500	.	.
127 Structural metal products	41.40	0.68	1.550	1.400	1.546	11.67	x
12 Electricity and water supply	27.93	0.35	4.073	4.000	4.071	2.50	
145 Electricity	1.85	0.34	4.108	4.000	4.106	3.33	xxx
146 Gas, steam and water supply	.	0.01	1.667	-	1.667	.	
13 Construction	22.7	0.12	-	2.043	2.043	1.67	
143 Basic construction	.	0.08	-	1.860	1.860	.	.
144 Finishing construction	.	0.03	-	2.500	2.500	.	.

Table 2b

Variation of the price development of imports between 1964 and 1976

Commodity Groups	Coefficient of Variation (in percent)	Share on Total Imports (in percent)	Price Index 1976/1964 Intermediate Uses	Final Uses	Total Imports	Transaction Density 1964 (in percent)	Variation Class
14 Wholesale and retail trade	0.09	0.92	1.128	-	1.128	3.33	
147 Wholesale and retail trade	0.08	0.92	1.128	-	1.128	3.33	xxx
15 Restaurants and hotels	.	0.01	-	2.000	2.000	.	
151 Restaurants and hotels	.	0.01	-	2.000	2.000	.	.
16 Transport and communications	.	0.06	1.429	-	1.429	.	
148 Transport	-	-	-	-	-	-	-
149 Communications	.	0.06	1.429	-	1.429	.	.
17 Financial services	0.76	0.49	1.838	-	1.838	6.67	
150 Financial services	1.15	0.49	1.838	-	1.838	13.33	xxx
153 Real estate	-	-	-	-	-	-	-
18 Other Services	0.56	1.64	2.485	2.478	2.483	46.67	
152 Other services	0.56	1.64	2.485	2.478	2.483	46.67	xxx
19 Public services	1.40	0.07	2.800	2.857	2.850	3.33	.
154 Public services	1.40	0.07	2.800	2.857	2.850	3.33	xxx

(.) one item only)

framework of both tables 9) is similar. The first column of Table 1 contains values of coefficients of variation, (i.e., of the ratios of the standard deviation to the arithmetic mean) of the indices of the price increase of output (or of imports) from 1964 to 1976. Weights in the calculation of both measures were volumes of transactions in the corresponding cells of the input-output table. The second column in Table 1 gives the shares of commodity groups on total gross output (in Table 2, the shares on total imports). In the third, fourth and fifth column, there are average values of the 1976/1964 price indices for: (i) intermediate uses; (ii) final uses; and (iii) total uses (i.e., total output or total imports). Data in the sixth column show the transaction density, i.e.,the share of non-zero entries on the maximum of entries.

The seventh column contains one, two or three stars, indicating the "degree of homogeneity" of the price development. The stars were allocated according to the frequency distributions of the variation coefficients in Table 3. The "three stars" commodity groups with very homogeneous price development have variation coefficients lower than 0.1. Into this category fall 17 commodity groups of output (their share on total output is 20.7 percent) and imports in 12 commodity groups (their share on total imports is 12.9 percent). The "two stars" category includes commodity groups with variation coefficients between 0.1 and 0.2; this category covers output in 23 commodity groups (with a share of 49.4 percent on total output) and imports in 14 commodity groups (with a share of 37.5 percent on total imports). The "one star" non-homogeneous category includes output in 14 commodity groups (with a share of 29.9

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9) Tables presented in the paper were compiled by Susanne Kopal.

Table 3

Variability of price development 1964-1976

Coefficient of Variation	Domestic output		Imports	
	Number of Commodity Groups	Share on Total Output (in percent)	Number of Commodity Groups	Share on Total Imports (in percent)
0.00- 4.99	7	11.94	7	7.74
5.00- 9.99	10	8.72	6	5.12
10.00-14.99	13	32.96	10	28.75
15.00-19.99	10	16.49	4	8.76
20.00-24.99	7	13.34	3	19.70
25.00-29.99	2	0.59	5	6.19
30.00-34.99	3	3.65	4	8.67
35.00-39.99	1	1.73	2	8.25
40.00-44.99			2	1.28
45.00-49.99	1	10.58		
50.00-54.99			2	4.99
55.00-59.99				
60.00-64.99				
65.00-69.99			1	0.35
70.00-74.99				
75.00-79.99				
non-determined			8	0.19
Total	54	100.00	54	100.00

percent on total output and imports in 19 commodity groups (with a share of 49.4 percent on total imports). The variability of imports could not be determined for 8 commodity groups (with a share of 0.2 percent on total imports). Rows of two commodity groups (transport and real estate) include no imports. Standard deviations could not be calculated for imports in seven commodity groups; their rows in the input-output table contain less than three imported transactions.

No stars were given to the variation coefficients of the 19 aggregate commodity groups. The non-homogeneity of price development in the aggregate commodity groups is generally greater than in the narrower 54 commodity groups.

The variability of price development within most commodity groups is not negligible. It reflects the non-homogeneity of their commodity composition ("product mix") caused by the aggregation of detailed primary statistics on output, imports and prices into 54 commodity groups of the input-output table.

Data in Tables 1, 2 and 3 also show that the variability of price development of output between 1964 and 1976 was smaller than the variability of the price development of imports.The coefficient of variation of the 1976/1964 price indices of all domestic transactions was 29.6 percent and of all imported transactions 33.7 percent (upper right-hand corners of tables 1 and 2). This is surprising in view of the higher density of the domestic transaction matrix. The cause of this paradox is statistical: Primary statistics on prices of imports are available in the foreign trade statistics in a more detailed breakdown than data on prices of domestic production.

2.4 Price Development of Different Uses of Output and of Imports

Data in Tables 1 and 2 show also that between 1964 and 1976 the price development of of various uses of both output and of imports differed. Prices of output for intermediate consumption increased between 1964 and 1976 by 74.3 percent, prices of output for final consumption by 82.6 percent. Prices of intermediate imports increased by 64.1 percent, prices of final imports by 52.1 percent. These differences indicate that the composition of deliveries to various demand categories varies. (Services, which are predominantly of domestic origin, are heavily weighted in domestic output for final demand. Their prices usually rise more rapidly than prices of goods. Primary goods, i.e., crude oil, ores and minerals - the prices of which rose rapidly in the early seventies - have a relatively large share on intermediate imports.) But different commodity composition of demand categories does not fully explain the differences in price development of various uses of output and imports. Data the third and fourth columns in Tables 1 and 2 show that significant differences exist also within the commodity groups.

Table 4 contains additional information about prices of output, exports and imports 10). Prices of exports grew faster than prices of output, and the latter rose faster than prices of imports.

Table 5 contains estimates of average annual rates of price increase for different uses of output and of imports. The highest rate of price increase had exports. Ranking second was domestic production for

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10) The table contains a few extraordinary low ratios of price increases of imports to those of output. In the Food commodity groups (Nos. 110, 111 and 112) the imports were very low. In printing and publishing (142) domestic intermediate inputs include mainly advertising, the final uses mainly books and newspapers. In structural metal products (127) domestic intermediate inputs include mainly assembling.

Table 4

Price development of domestic output, exports and imports

Commodity Groups	Domestic Gross Output		Exports		Imports	
	Price Index	Share on Total Gross Output 1964 (in percent)	Price Index	Share on Total Exports 1964 (in percent)	Price Index	Share on Total Imports 1964 (in percent)
Total Economy	1.796	100.00	1.861	100.00	1.588	100.00
1 Agriculture and forestry	1.541	7.54	2.151	2.46	1.647	10.96
101 Agriculture and forestry	1.541	7.54	2.151	2.46	1.647	10.96
2 Mining	1.982	0.96	2.302	3.38	2.080	5.32
102 Metal ore mining	1.847	0.16	3.444	0.09	2.066	1.15
103 Coal mining	1.607	0.28	2.000	0.01	2.167	3.46
104 Other mining	2.226	0.52	2.271	3.29	1.682	0.71
3 Food, beverages, tobacco	1.544	9.62	1.564	2.31	1.297	5.47
109 Meat and fish	1.595	2.36	2.224	0.47	1.539	1.57
110 Grain milling and bakery products	1.611	1.98	5.429	0.02	0.599	0.35
111 Dairy products	1.955	1.10	1.236	1.29	0.740	0.28
112 Sugar	1.239	0.49	1.162	0.09	1.773	0.04
113 Other food	1.295	1.50	2.010	0.25	1.428	2.71
114 Beverages	1.519	1.33	1.413	0.18	0.571	0.41
115 Tobacco	1.356	0.85	1.000	0.00	0.814	0.12
4 Textiles, wearing apparel, leather	1.321	6.87	1.471	12.25	1.206	10.60
116 Manufacture of textiles	1.303	2.67	1.541	7.01	1.191	7.52
117 Knitting mills	1.378	0.84	1.276	1.62	1.125	0.88
118 Wearing apparel	1.216	2.21	1.277	2.23	1.295	0.84
119 Footwear	1.361	0.76	1.396	0.83	0.932	0.34
120 Leather and furs	1.883	0.21	2.028	0.44	1.482	0.84
121 Leather products	1.792	0.18	2.113	0.13	1.083	0.18
5 Wood, wood products, furniture	1.509	3.27	1.718	9.01	1.231	1.49
138 Sawmills	1.656	1.23	1.758	7.15	1.546	0.29
139 Wood and cork products	1.420	2.04	1.566	1.86	1.156	1.20
6 Paper, paper products	1.829	3.15	1.724	6.63	1.551	2.32
140 Pulp and paper	1.628	1.38	1.755	5.09	1.559	0.81
141 Paper products	1.447	0.58	1.764	0.61	1.118	0.44
142 Printing and publishing	2.250	1.19	1.526	0.94	1.722	1.07

Table 4a

Price development of domestic output, exports and imports

Commodity Groups	Domestic Gross Output		Exports		Imports	
	Price Index	Share on Total Gross Output 1964 (in percent)	Price Index	Share on Total Exports 1964 (in percent)	Price Index	Share on Total Imports 1964 (in percent)
7 Chemicals (exclusive petroleum products)	1.456	3.87	1.427	7.75	1.372	10.59
122 Rubber products	1.268	0.62	1.502	1.59	1.098	0.84
123 Pharmaceuticals	1.235	0.39	1.427	0.31	1.466	0.82
124 Chemical products	1.531	2.50	1.407	5.78	1.398	8.56
125 Plastic products	1.496	0.37	1.407	0.07	1.179	0.37
8 Petroleum and petroleum products	2.304	1.59	2.576	0.49	2.224	7.10
105 Petroleum and petroleum products	2.304	1.59	2.576	0.49	2.224	7.10
9 Pottery, china, glass-ware	1.635	2.48	1.869	2.80	1.785	1.78
106 Stone and clay products	1.718	1.64	2.426	1.06	1.994	1.15
107 Cement	1.430	0.40	1.364	0.05	1.412	0.03
108 Glass and glass products	1.509	0.43	1.534	1.68	1.396	0.60
10 Basic metal industries	1.585	5.09	1.684	16.23	1.758	7.53
126 Iron and steel	1.601	3.99	1.710	12.39	1.823	3.76
128 Foundries	1.608	0.31	2.719	0.34	2.144	0.30
129 Non-ferrous metals	1.498	0.79	1.490	3.49	1.651	3.47
11 Metal products, machinery, equipment	1.856	10.76	2.146	26.91	1.496	33.18
130 Various metall products	1.933	2.11	2.389	4.39	1.612	3.05
131 Machinery (incl. railroad equipment)	1.960	2.32	2.184	9.49	1.606	11.11
132 Farm machinery, equipment	1.933	0.47	1.898	0.29	1.594	0.93
133 Instruments and apparatus	2.025	0.41	2.017	1.61	1.567	1.72
134 Electrical motors and generators	1.642	0.74	2.121	1.75	1.478	1.00
135 Other electrical apparatus	1.514	1.89	1.993	5.03	1.775	4.58
136 Transport equip-ment (incl. agri-cultural tractors)	1.601	1.08	2.099	2.13	1.200	10.10
137 Repair of motor vehicles	2.603	0.85	-	0.01	2.500	.
127 Structural metal products	1.791	0.89	2.037	2.12	1.546	0.68

Table 4b

Price development of domestic output, exports and imports

Commodity Groups	Domestic Gross Output		Exports		Imports	
	Price Index	Share on Total Gross Output 1964 (in percent)	Price Index	Share on Total Exports 1964 (in percent)	Price Index	Share on Total Imports 1964 (in percent)
12 Electricity and water supply	1.787	2.21	3.161	2.35	4.071	0.35
145 Electricity	1.719	1.73	3.165	2.35	4.106	0.34
146 Gas, steam and water supply	2.032	0.48	1.500	-	1.667	.
13 Construction	1.897	8.29	1.860	0.25	2.043	0!12
143 Basic construction	1.764	5.28	1.860	0.25	1.860	0.08
144 Finishing construction	2.130	3.01	-	-	2.500	0.03
14 Wholesale and retail trade	1.659	10.58	2.159	2.66	1.128	0.92
147 Wholesale and retail trade	1.659	10.58	2.159	2.66	1.128	0.92
15 Restaurants and hotels	1.977	4.09	2.000	0.02	2.000	0.01
151 Restaurants and hotels	1.977	4.09	2.000	0.02	2.000	0.01
16 Transport and communications	1.571	5.39	1.528	2.72	1.429	0.06
148 Transport	1.558	4.32	1.527	2.56	-	-
149 Communications	1.626	1.08	1.537	0.17	1.429	0.06
17 Financial services	2.181	4.42	1.842	0.62	1.838	0.49
150 Financial services	1.844	2.34	1.842	0.62	1.838	0.49
153 Real estate	2.558	2.08	-	-	-	-
18 Other Services	2.503	4.34	2.482	1.16	2.483	1.64
152 Other services	2.503	4.34	2.482	1.16	2.483	1.64
19 Public services	2.881	5.48	-	-	2.850	0.07
154 Public services	2.881	5.48	-	-	2.850	0.07

(.) One item only)

domestic final use (i.e., consumption and accumulation). Intermediate use of domestic production ranked last. Prices of imports were rising slower than prices of domestic production. One would expect that slower price increases of imports than of domestic production stimulated import penetration of the Austrian market, and that this penetration was stronger in final demand (where the annual rates of price increase were 3.6 percent for imports and 5.1 percent for output) than in intermediate uses (the rates of price increases were 4.2 and 4.7 percent respectively). A comparison of the import shares in 1964 and 1976 11) (both at 1976 prices) supports this hypothesis. The share of intermediate imports on total intermediate transactions increased from 18.2 percent in 1964 to 22.1 percent in 1976, i.e., by a factor of 1.2. Import share of final demand increased from 8.0 percent in 1964 to 10.4 percent in 1976, i.e., by a factor of 1.3 12) .

The differences in price increases of imports and exports (Table 5) also suggest that between 1964 and 1976 Austrian foreign trade helped to slow down domestic inflation and that Austria enjoyed gains in terms of trade. But all price indices calculated from the 1964 input-output table valued at the 1964 and 1976 prices are Laspeyres indices. These indices do not consider shifts in the composition of both output and imports between 1964 and 1976 (as Paasche or Fisher price indices do).

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11) The figures for 1976 are taken from an aggregated final version of the 1976 input-output table (see footnote 6), prepared for the Austrian Institute for Economic Research by the Austrian Central Statistical Office.

12) Stronger import penetration of the Austrian domestic market in final demand was also found in the analysis of structural change between 1964 and 1976 (Skolka J.V.,"Input-Output Anatomy of Changes in Employment Structure in Austria between 1964 and 1976", in Empirica - Austrian Economic Papers, No. 2, 1984, pp.105-233).

Table 5

Price development of components of total resources

Components of total resources	Price increase	
	Index 1976/1964	Annual compound rate of price increase (in percent)
a) All transactions:		
Domestic output:	1.796	4.9
out of which: Exports	1.861	5.3
Domestic uses:	1.788	5.0
out of which: Intermediate uses	1.743	4.7
Domestic final uses	1.819	5.1
Imports:	1.588	3.9
out of which: Intermediate imports	1.641	4.2
Final imports	1.521	3.6
b) Comparable transactions:		
Domestic output	1.665	4.3
Imports	1.585	3.9
c) Non-comparable transactions:		
Domestic output	1.917	5.6

It is difficult to estimate the impact of the shifts in the composition of imports, exports and of domestic production on the price indices without information about the 1976 volumes at 1964 prices, which is not and will not be available in the input-output breakdown. Indirectly, price indices calculated from the input-output table can be compared with price indices (deflators) in the national accounts. The difference between the indices from the input-output and national accounts data is minor for domestic production: The annual rate of price increase between 1964 and 1976 is 4.9 percent according to the repriced 1964 input-output table, and 5.0 percent according to the national accounts. There is no difference for imports, both annual rates of price increase are equal to 3.9 percent. For exports, the national accounts give for the period 1964 - 1976 annual rate of price increase of 3.2 percent, the input-output data give an annual rate of price increases of 5.3 percent. This difference is large and difficult to explain. Different weights used in the Laspeyres index formula, applied to the input-output data (i.e, the 1964 volumes of exports) and in the Paasche index formula in the price statistics (i.e., the 1976 volumes of exports) can hardly be the sole reason of such a discrepancy.

2.5 Comparable Output and Imports

The density of the matrices of domestic and of imported transactions is different. Many domestic transactions have no counterpart in imports; a few imported transactions have no counterpart in domestic transactions. A proper comparison of the price development of imports and of domestic output can be carried out for "comparable" entries only, i.e., for transactions in those cells of the input-output table which include both domestic and imported transactions. The share of comparable domestic transactions in 1964 (at 1964) prices on total output was 48.0 percent, the share of comparable imported transactions on total imports was 97.3 percent.

The price increases of the comparable and non-comparable transactions between 1964 and 1976 were not identical. Prices of total output increased by a factor of 1.796 (see Tables 1, 4 and 5). Prices of comparable output increased by a factor of 1.665; prices of non-comparable output by a factor of 1.917. The annual rate of the price increase of output of 4.9 percent can thus be disaggregated into two different annual rates of of 4.3 percent for comparable output and of 5.6 percent for non-comparable output (Table 5).

Prices of comparable imports increased between 1964 and 1976 by a factor of 1.585 (i.e., 3.7 percent a year). Their increase was identical with the price increase of total imports by a factor of 1.588 (see Tables 4 and 2). The ratio of the indices of the price increase of comparable domestic production and of comparable imports between 1964 and 1976 was 0.952. The difference between this ratio and 1.000 (i.e., indicating a parallel increase in prices of imports and of output) is smaller that the difference between 1.000 and the ratio of 0.884 (which relates the price development of total output and of total imports). Price development of comparable output and of imports was more similar than price development of total output and of imports.

2.6 Exposed and Sheltered Sector of the Austrian Economy in 1964

The size of the exposed sector of an economy can be measured by the share of the output exposed to foreign competition on total output. The exposed sector has two components:

(i) Exported output, which competes with the output of foreign producers abroad;
(ii) Output sold on the domestic market, which competes with the output of foreign producers on the domestic market.

Table 6

Ratios of price increases of imports to the price increases of domestic output

Commodity Groups	Ratios of Price Increase of Imports to Domestic Output Calculated from Row Totals			Share of Competitive Imports (in percent)
	Total Uses	Intermediate Uses	Final Uses	
Total Economy	0.884	0.942	0.832	31.61
1 Agriculture and forestry	1.069	0.951	1.347	33.22
101 Agriculture and forestry	1.069	0.951	1.347	33.22
2 Mining	1.049	1.196	0.815	27.03
102 Metal ore mining	1.119	1.170	.	73.02
103 Coal mining	1.348	1.682	0.880	20.28
104 Other mining	0.755	0.739	0.454	.
3 Food, beverages, tobacco	0.840	0.906	0.790	22.66
109 Meat and fish	0.965	0.862	1.004	62.78
110 Grain milling and bakery production	0.372	0.509	0.344	0.00
111 Dairy products	0.378	0.443	0.367	0.00
112 Sugar	1.431	1.243	1.517	0.00
113 Other food	1.102	1.004	1.131	9.49
114 Beverages	0.376	0.440	0.337	0.00
115 Tobacco	0.600	0.750	0.598	0.00
4 Textiles, wearing apparel, leather	0.913	0.922	0.976	60.90
116 Manufacture of textiles	0.914	0.993	1.056	85.35
117 Knitting mills	0.816	0.649	0.933	1.32
118 Wearing apparel	1.065	0.975	1.067	3.15
119 Footwear	0.685	0.771	0.666	0.00
120 Leather and furs	0.787	0.801	0.770	0.00
121 Leather products	0.605	0.435	0.610	0.00
5 Wood, wood products, furniture	0.816	0.870	0.778	4.11
138 Sawmills	0.933	1.006	0.822	2.87
139 Wood and cork products	0.814	0.740	0.844	4.41
6 Paper, paper products	0.848	0.791	0.933	23.23
140 Pulp and paper	0.958	0.977	1.105	41.03
141 Paper products	0.772	0.901	0.552	21.67
142 Printing and publishing	0.765	0.643	0.923	10.51
7 Chemicals (exclusive petroleum products)	0.942	0.935	0.867	5.74
122 Rubber products	0.866	0.969	0.766	27.75
123 Pharmaceuticals	1.186	1.036	1.217	11.94
124 Chemical products	0.913	0.885	0.715	3.08
125 Plastic products	0.788	0.874	0.806	3.13

Commodity Groups	Ratios of Price Increase of Imports to Domestic Output Calculated from Row Totals			Share of Competitive Imports (in percent)
	Total Uses	Intermediate Uses	Final Uses	
8 Petroleum and petroleum products	0.965	0.819	1.316	2.36
105 Petroleum and petroleum products	0.965	0.819	1.316	2.36
9 Pottery, china, glass-ware	1.091	1.163	0.879	17.74
106 Stone and clay products	1.161	1.161	0.818	25.25
107 Cement	0.987	0.987	.	64.71
108 Glass and glass products	0.925	0.922	0.971	1.11
10 Basic metal industries	1.108	1.004	1.314	25.21
126 Iron and steel	1.139	1.065	1.259	4.55
128 Foundries	1.334	1.408	1.020	15.56
129 Non-ferrous metals	1.102	0.948	1.496	48.44
11 Metal products, machinery equipment	0.806	0.955	0.760	39.28
130 Various metall products	0.834	1.050	0.707	7.08
131 Machinery (incl. railroad equipment)	0.820	0.938	0.792	80.68
132 Farm machinery, equipment	0.825	0.714	0.879	0.00
133 Instruments and apparatus	0.774	0.792	0.756	10.01
134 Electrical motors and generators	0.900	0.678	1.206	0.00
135 Other electrical apparatus	1.173	1.729	0.854	42.68
136 Transport equipment (incl. agricultural tractors)	0.750	1.039	0.712	12.02
137 Repair of motor vehicles	0.961	.	0.928	.
127 Structural metal products	0.792	0.348	0.937	74.45
12 Electricity and water supply	2.278	2.438	2.086	.
145 Electricity	2.388	2.800	2.005	.
146 Gas, steam and water supply	0.820	0.704	.	.
13 Construction	1.077	.	1.099	.
143 Basic construction	1.054	.	1.076	.
144 Finishing construction	1.174	.	1.163	.
14 Wholesale and retail trade	0.680	0.591	.	0.00
147 Wholesale and retail trade	0.680	0.591	.	0.00

Table 6b

Commodity Groups	Ratios of Price Increase of Imports to Domestic Output Calculated from Row Totals			Share of Competitive Imports (in percent)
	Total Uses	Intermediate Uses	Final Uses	
15 Restaurants and hotels	1.012	.	1.011	.
151 Restaurants and hotels	1.011	.	1.011	.
16 Transport and communications	0.909	0.962	.	.
148 Transport	-	-	-	-
149 Communications	0.879	0.926	.	.
17 Financial services	0.843	0.929	.	1.00
150 Financial services	0.997	0.991	.	1.00
153 Real estate	-	-	-	-
18 Other Services	0.992	1.060	0.951	94.84
152 Other services	0.992	1.060	0.951	94.84
19 Public services	0.989	1.149	0.978	1.00
154 Public services	0.989	1.149	0.978	1.00

(.) one item only

Table 7

Comparable Transactions:
Frequency distribution of the 1976/1964 ratios of price increases of imports to the price increases of domestic output

Ratio of the price increase of imports to the price increase of domestic output *)	Value of comparable transactions at 1964 prices (million AS)	
	Domestic Output	Imports
a) Lower than 0.92		
0.00 - 0.10	36	242
0.10 - 0.50	14582	1389
0.50 - 0.80	27649	9926
0.80 - 0.90	18083	10600
0.90 - 0.92	3394	1660
b) Between 0.92 - 1.08		
0.92 - 0.94	3680	287
0.94 - 0.96	3110	5382
0.96 - 0.98	2639	1527
0.98 - 1.00	7045	1582
1.00 - 1.02	13568	4378
1.02 - 1.04	7605	1571
1.04 - 1.06	9702	188
1.06 - 1.08	19933	4411
c) Over 1.08		
1.08 - 1.10	1317	103
1.10 - 1.20	23057	5802
1.20 - 1.50	27971	6133
1.50 - 2.00	4655	3261
2.00 -	2737	183
Total	190763	58625

*) The upper limit is included in the interval.

The share of the first component of the exposed sector, i.e., of exports, on total gross output value of the Austrian economy in 1964 (at 1964 prices) was 10.2 percent.

The second component,i.e., the output exposed to foreign competition on the domestic market, is more difficult to to delimit. One possibility is is to assume that it is identical with the output "comparable" with imports. Its share on total gross output value in 1964 (at 1964 prices) was 48.0 percent. The share of the sum of exports and of the competitive domestic production on total output, which is 58.2 percent,would then measure the size of the exposed sector of the Austrian economy in 1964; the size of the sheltered (non-exposed) sector would be 42.8 percent.

Data available in the 1964 input-output table for Austria valued at the 1964 and 1976 prices allow to delimit the exposed and sheltered sectors more exactly. The ratios of price increases of imports to price increases of domestic output in the cells of the input-output table can be weighted either by corresponding volumes of "comparable" output or by corresponding volumes of "comparable" imports. Frequency distributions of the ratios of price increases between 1964 and 1976 (Table 7) can be divided into three segments:

(i) The price rise of imports was slower than the price rise of the comparable output;
(ii) The price rise of both was roughly parallel;
(iii) The price rise of imports was faster than the price rise of output.

The "parallel" price increase was defined as a ratio of price increase of imports to price increase of output in the interval between 0.92 and 1.08.

The shares of the three groups on total output or on total imports in Austria in 1964 were roughly identical. The first group with a slower price increase of imports included 35.3 percent of output and 41.1 percent of imports. The third group with faster price increases of imports included 31.3 percent of output and 26.4 percent of imports. The group with parallel price increase included 33.4 percent of output and 32.5 percent of imports: One third of imports in 1964 competed with Austrian production, and about a third of comparable domestic output, i.e., about one sixth of total output (exactly 16.9 percent) was exposed to foreign competition.

According to this narrower, but more precise delimitation, the exposed sector of the Austrian economy in 1964 was composed of 10.2 percent of exported output and of 16.9 percent of output competing with foreign production on the domestic market. The share of the exposed sector on total output was 27.1 percent, 72.9 percent of total output were sheltered from foreign competition, 67.5 percent of imports were not competing with domestic production.

The last column of table 6. gives information about the shares of output exposed in 1964 to foreign competition on the Austrian domestic market in particular commodity groups.

3. CONCLUSIONS

The 1964 input-output table for Austria, valued both at 1964 and 1976 prices, allowed us to study the homogeneity of price developments within the 54 commodity groups, separately for domestic production and for imports. Price indices calculated from the transaction volumes in both tables, are Laspeyres indices, in which the 1964 volumes (at 1964 constant prices) serve as weights.

Between 1964 and 1976 prices of total output increased by an annual rate of 4.9 percent, prices of imports by an annual rate of 3.9 percent. Price increases in particular commodity groups differed markedly from these average values. The variability of price development within the commodity groups and also the differences in the price development of various uses of the output and of imports were large. Prices of exported goods were rising faster than prices of domestic production sold on the domestic market. Among the latter, prices of goods for final uses were rising faster than prices of intermediate goods. Prices of intermediate imports were rising faster than prices of goods imported for final use.

The variability of price development within the 54 commodity groups revealed the non-homogeneity of their composition, caused by the aggregation of detailed data on output and of even more detailed data on imports into the 54 commodity breakdown of the input-output table.

The share of non-zero entries on total number of entries in the transaction matrices of output and imports of the 1964 Austrian input-output table differs: The degree of density was 64.5 percent in the former and 17.7 percent in the latter matrix. About one-half (52 percent) of the domestic gross output had no counterpart in imported transactions, 2.7 percent of total imports had no counterpart in domestic transactions. Output in cells of the matrix of domestic transactions which had a counterpart in identical cells of the matrix of imported transactions was considered to be output "comparable" with imports, its share on total output was 48 percent. Prices of the comparable domestic output increased between 1964 and 1976 by 4.3 percent, prices of the "non-comparable" output by 5.6 percent a year. Prices of comparable imports increased by 3.9 percent a year. The ratio of the price increase of comparable imports to that of comparable output was 0.955. The ratios of price increases of imports to price increases

of domestic production in the cells of the input-output table differ markedly. A "parallel" increase (i.e., ratios of the 1976/1964 price indices of imports to domestic production between 0.92 and 1.08) had only one-third of imports and one-third of comparable (i.e., one-sixth of total) output. Exports and domestic product with price increases parallel to price increases of imports delimit the sector of the economy exposed to foreign competition. Its share on total gross output value of the Austrian economy in 1964 (at 1964 prices) was estimated at 27 percent, the share of the output sheltered from foreign competition at 73 percent.

The assumption of the homogeneity of price development within commodity groups of the input-output table is a weak assumption. Such a conclusion is valid for the 1964 input-output table for Austria and is probably true for all input-output tables of similar size.