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Table of contents

List of Figures

List of Tables:

1. Introduction

Various index number techniques based on unit values (footnote 1) have commonly been used to estimate price and quality shifts (e.g. Aw and Roberts, 1986, 1988; Faini and Heimler, 1991 a, b). As the problems traditionally are dealt with at the level of aggregate unit values, the question of the possibility to utilize similar techniques for more detailed assessments - at the individual unit value level - arises. It may also be that in the process of aggregation, valuable information is lost, or at least the available information is not utilized fully. For example in the analysis of Aw & Roberts (1986) concerning the impact of trade restrictions on the composition of US footwear imports, the methodology and treatment of data stop after demonstrating the relatively large country and product effects, and the impact quotas have had on the composition of imports. An important question, however, remained unanswered: **which product groups, and which supplying countries**, are responsible for the observed shifts?

The aim of this paper is to examine the possibility of utilizing the index number techniques to find out facts behind the unit value index dynamics, and particularly to be able to evaluate the role of various contributing groups to the aggregate unit value (e.g. countries, product groups, trade blocks).

Furthermore, based on the initial assessment, we want to critically discuss some of the features of the bilateral index number technique, and its applicability as a base for multilateral index numbers.

2. Index numbers as a proxy of quality and price measurement: a critical assesment

The bilateral index number technique is used by Aw and Roberts (1986) to study changes in aggregate unit values between two points in time, e.g. in particular to detect shifts in the import composition. The basic underlying idea is to decompose the change into unit value indexes representing changes in

(i) quality-adjusted prices (Tornqvist index)
(ii) the product mix, and the
(iii) structure of supplying countries.

The bilateral index comparisons, however, lack transitivity across supplying countries as well as over longer periods of time. The lack of transitivity results because the bilateral comparison between any two observations uses information about only those two observations. For consistent cross-country comparisons of import prices and quality at the same or different points in time Aw and Roberts (1988) propose multilateral translog price index techniques, e.g. a multilateral index allows comparison of unit value (UV) changes over countries and years. The multilateral comparisons, however, can not be used to decompose the changes into its components, and they therefore serve for different purposes than the bilateral indexes.

2.1. Bilateral index number technique

The growth in an aggregate unit-value index of a group of products and countries is measured by Aw and Roberts (1986) in the following way:

$$\delta P(t) = \ln P(t) - \ln P(t-1) \qquad (2.1.1.a)$$

when

$$P(t) = \frac{\sum_g \sum_c V_{gc}(t)}{\sum_g \sum_c Q_{gc}(t)} \qquad (2.1.1.b)$$

where

$g = 1, \ldots, G$ products or categories

$c = 1, \ldots, C$ supplying countries

$V_{gc}(t)$ = is the value of imports of product g from country c in year t

$Q_{gc}(t)$ = is the corresponding quantity of imports of product g from country c in year t

δ = operator to sign the difference in natural logs.

Another index, called the Tornqvist index, has been used to study the effects of quality changes within imports on the aggregate unit values. For a group of products and supplying countries the Tornqvist index is defined as the value-share weighted sum of the growth of the individual import product prices:

$$\delta P^*(t) = \sum_g \sum_c \left[\overline{S_{gc}(t)} \;\; \delta P_{gc}(t) \right], \quad \text{where} \qquad (2.1.2.a)$$

(2.1.2.b)

$$\overline{S_{gc}(t)} = \frac{1}{2} \left[\frac{V_{gc}(t)}{\sum_g \sum_c V_{gc}(t)} + \frac{V_{gc}(t-1)}{\sum_g \sum_c V_{gc}(t-1)} \right]$$

and

(2.1.2.c)

$$\delta P_{gc}(t) = \ln \left(\frac{V_{gc}(t)}{Q_{gc}(t)} \right) - \ln \left(\frac{V_{gc}(t-1)}{Q_{gc}(t-1)} \right)$$

The growth in import prices, due to the recomposition of imports among products and countries, is measured as the difference between the growth in the unit-value index and the Tornqvist index:

(2.1.3) $$\delta q(t) = \delta P(t) - \delta P^{*}(t)$$

The unit-value index will grow faster than the Tornqvist price index when there is a shift towards relatively more expensive products and supplying countries. $\delta q(t)$, which is positive in this case, is a measure of quality change due to the recomposition of the import bundle or, equivalently, the bias in the unit-value index, which results from the fact that all products and supplying countries are treated as identical.

The disaggregation of quality change into its separate sources involves defining partial indexes of import prices, which are Tornqvist indexes defined over a subset of the import characteristics, in this case either country or product.

The Tornqvist partial price index for characteristic i is defined as the share-weighted growth in unit-value indexes defined over each category of characteristic i:

(2.1.4.a) $$\delta P^{*}_{i}(t) = \sum_{i} \left[\overline{S_i(t)} \;\; \delta P_i(t) \right], \text{ where}$$

(2.1.4.b)

$$\overline{S_i(t)} = \frac{1}{2} \left[\frac{\sum_j V_{ij}(t)}{\sum_i \sum_j V_{ij}(t)} + \frac{\sum_j V_{ij}(t-1)}{\sum_i \sum_j V_{ij}(t-1)} \right]$$

and

(2.1.4.c)

$$\delta P_i(t) = \ln \left(\frac{\sum_j V_{ij}(t)}{\sum_j Q_{ij}(t)} \right) - \ln \left(\frac{\sum_j V_{ij}(t-1)}{\sum_j Q_{ij}(t-1)} \right)$$

where $i, j = g, c$

The two partial price indexes can be used to define two main quality effects as

$$\delta\, q^{i}(t) = \delta\, P(t) - \delta\, P^{*}_{i}(t) \qquad (2.1.5)$$

where $i = g, c$

The quality index $\delta\, q^{c}(t)$ measures the effect of a changing mix of countries treating all varieties as homogeneous. If $\delta\, q^{c}(t)$ is positive it indicates that the import bundle has shifted towards supplying countries charging higher export prices. Similarly, a positive $\delta\, q^{g}(t)$ indicates the import bundle is increasingly composed of product groups bearing higher prices.

In addition, the substitution may be occurring towards both more expensive products and countries. In this case the term $(\delta\, q^{c}(t) + \delta\, q^{g}(t))$ will overestimate the total quality change. An interaction term can be defined as the difference between the total effect and the sum of the main effects:

(2.1.6)

$$\delta\, q^{cg}(t) =$$

$$(\delta P(t) - \delta P^{*}(t)) - (\delta P(t) - \delta P^{*}_{c}(t)) - (\delta P(t) - \delta P^{*}_{g}(t))$$

$$= \delta\, q(t) - \delta\, q^{c}(t) - \delta\, q^{g}(t)$$

Solving (2.1.6) for the total change in quality, substituting into (2.1.3), and solving for the growth in the unit-value index gives:

(2.1.7)

$$\delta P(t) = \delta P^{*}(t) + \delta q^{c}(t) + \delta q^{g}(t) + \delta q^{cg}(t)$$

Equation (2.1.7) shows that the growth in the aggregate unit-value index for a group of countries and products can be divided into a growth in quality-adjusted prices plus the sum of three quality terms:

(i) country mix-term,
(ii) product mix-term, and
(iii) interaction term.

2.2. Basic assumptions of the techniques

Bilateral and multilateral index number calculations based on unit values rely on three main assumptions:

(i) homogeneity of the commodity groups used;
(ii) degree of price dispersion;
(iii) positive correlation between price and quality.

The calculations presented in Aw and Roberts (1986, 1988) are based on the assumption that the products considered compete on the same market. Using import unit values as approximation of the prices of traded goods depends foremost on the aggregation level of the commodity group. "In general, the accuracy of unit-value indexes as measures of import or export price diminishes as the level of aggregation increases" (Aw and Roberts, 1988, p. 259), e.g. if the commodity groups are not narrowly and accurately specified, their UV can change even though all prices are constant, because of a shift from one quality or type of item to another.

Measurement approaches based on unit values indirectly assume that the sole and most important differentiation criterion of products is by country of origin, sometimes

referred to as the "Armington assumption". While the country of origin may be a differentiating characteristic, in reality products - especially consumer goods - are multidimensionally differentiated. Differences in style, in design, or in the need for market-specific sale forces strongly codetermine differentiation.

The extent to which product substitution can affect the average price of imports depends on the range of prices within the commodity group. If the product prices lie in a narrow range, then substitution among products will have little effect on unit-value indexes (Aw and Roberts, 1986). As the dispersion increases, the effect of substitution on unit-value indexes should become more noticeable. Changes in the aggregate unit values (@ UVs) are taken as a measure of quality change. The basic assumption made by Aw and Roberts (1986) is that quality is positively correlated with price, e.g. an increase in price is interpreted as an increase in quality. As noted by Molle (1991, p. 80) "... prices of imports do not differ only due to differences in quality of the goods; they may differ also due to differential responses to exchange rate movements, trade restrictions, quota premia, income distribution patterns, tastes, and market structures."

2.3. Identifying the sources of unit value index dynamics

To identify the sources of the shifts to a particular country and/or a product group, and to quantify them, the analysis needs further refinement. The procedure of Aw and Roberts (1986), described above, yields as an intermediate step the breakdown of the relative contribution of each country or product category to the overall price change. In principle, it should be possible to use these for estimating the sources of price change.

They are, however, inaccurate because the equation (2.1.4.b) does not detect the change in the market share from one year to the next; instead, it uses the mean of the two years under consideration (t and t-1).

A change in market share is just as important as a change in price as an explanatory factor for changes in unit values. For example, if the UVs of all products from all countries would remain constant, an increase in the market share (MS) of a country with higher than the average UV, at the expense of a country with a smaller UV, would increase the aggregate UV. This change would not be detected by the procedure of Aw & Roberts (1986) as a country effect, but would be hidden either in the product effect or in the interaction term. Similarly, if the UV of a subgroup is smaller than the aggregate UV, an increase in the MS means that the impact of the group is to decrease the aggregate UV. The changes in MS and UV for one country may also cancel out each other, so that no change in impact on the aggregate UV is evident, even when clear changes in the UVs and MSs have actually taken place.

As possible components, on which the calculation of aggregate unit values can be based, three types of "elements" were considered in this study:

(i) countries, for which all the product groups under consideration have been aggregated;

(ii) product groups, for which all the countries have been aggregated;

(iii) from each country each product group as an own element.

Other kinds of elements are also possible (e.g. trade blocks, or semi-aggregated product categories).

In order to precisely determine the contribution of any element to the aggregate UV (@UV), let us first consider how the @UV can be constructed using information of the market share and unit value of its elements.

(2.3.1)

$$@UV_{(t)} = MS_{(q)A(t)}\ UV_{A(t)} + MS_{(q)B(t)}\ UV_{B(t)} + \ldots + MS_{(q)N(t)}\ UV_{N(t)}$$

where
- $@UV_{(t)}$ = aggregate unit value at time (t)
- $MS_{(q)A(t)}$ = market share, based on quantity, of element A at time (t)
- $UV_{A(t)}$ = unit value of element A at time (t)
- B, ..., N = other elements of @UV

Aggregate unit value is, thus, the market share weighted sum of the unit values of its elements. The calculation for each of its elements, e.g. $MS_{(q)A(t)}\ UV_{A(t)}$, factually already gives the absolute contribution of element A at time (t) to the @UV.

Looking at the difference in aggregate UV from time (t-1) to (t) - analogous to the methodology given in Aw & Roberts (1986) - yields

(2.3.2)

$$d@UV = @UV_{(t)} - @UV_{(t-1)}$$

where
d = operator to sign the difference

Substituting (2.3.1) into (2.3.2) we get after rearrangement of terms:

(2.3.3)

$$d@UV = (MS_{A(t)}\ UV_{A(t)} - MS_{A(t-1)}\ UV_{A(t-1)}) + \ldots + (MS_{N(t)}\ UV_{N(t)} - MS_{N(t-1)}\ UV_{N(t-1)})$$

If we further consider that $MS_{A(t)}$ and $UV_{A(t)}$ can be defined as

(2.3.4)

$$MS_{(q)A(t)} = \frac{Q_{A(t)}}{\sum_{i=A}^{N} Q_{i(t)}}$$

(2.3.5)

$$UV_{A(t)} = \frac{V_{A(t)}}{Q_{A(t)}}$$

Substituting (2.3.4) and (2.3.5) into (2.3.3) yields (2.3.6). For obtaining equation (2.3.6) the market share must be based on volume terms (i.e. UVs must remain as ECU/kg).

(2.3.6)

$$d@UV = \left(\frac{Q_{A(t)}\ V_{A(t)}}{\sum_{i=A}^{N} Q_{i(t)}\ Q_{A(t)}}\right) - \left(\frac{Q_{A(t-1)}\ V_{A(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}\ Q_{A(t-1)}}\right) + \ldots +$$

$$\left(\frac{Q_{N(t)}\ V_{N(t)}}{\sum_{i=A}^{N} Q_{i(t)}\ Q_{N(t)}}\right) - \left(\frac{Q_{N(t-1)}\ V_{N(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}\ Q_{N(t-1)}}\right)$$

which can be simplified as: $d@UV =$

$$\left(\frac{V_{A(t)}}{\sum_{i=A}^{N} Q_{i(t)}} - \frac{V_{A(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}}\right) + \ldots + \left(\frac{V_{N(t)}}{\sum_{i=A}^{N} Q_{i(t)}} - \frac{V_{N(t-1)}}{\sum_{i=A}^{N} Q_{i(t)}}\right)$$

Therefore, the change in aggregate UV from (t-1) to (t) is the sum of the change in the absolute contribution of each of its elements to the @UV at the corresponding time. The absolute contribution of each of the elements to the @UV can simply be calculated by dividing the value of the element by the total quantity of all the elements (e.g. exports of Italy in category 9401.61-00 by total exports into the target market in the product categories under consideration).

Estimation of each element's effect on the **magnitude of change** in the @UV from time (t-1) to (t) requires that the results obtained above must still be modified. Since we base our calculations on relative market shares, this implies that when the market share of one element is changing, the element is either being substituted for, or is replacing another element. However, we have no way of knowing what the unit value of the other element is. Therefore in the calculation it must always be assumed to equal the @UV at time (t). Under this assumption all the possible errors cancel out as one sums the data across all elements.

Thus with (E_A) as the effect of one element on the change in aggregate unit value, we get:

(2.3.7) $$E_A = \left(\frac{V_{A(t)}}{\sum_{i=A}^{N} Q_{i(t)}} - \frac{V_{A(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}}\right) - \left(\frac{Q_{A(t)}}{\sum_{i=A}^{N} Q_{i(t)}} - \frac{Q_{A(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}}\right) @UV_t$$

where E_A = effect of one element on the change in aggregate unit value

and

(2.3.8) $$d@UV = \sum_{i=A}^{N} E_i$$

3. Data material

For the empirical parts of this study value and quantity data were obtained from Eurostat, External Trade, Analytical tables for the years 1980-1990 (see appendix 1). The customs value and quantity data are reported by country of origin for six-digit (1980-1987) and eight-digit (1988-1990) product categories (FRG and French imports of NIMEXE 9401.00-00). The data were collected as a part of a project on Scandinavian furniture exports. Chairs were chosen for this analysis, because the group fulfills the basic requirements discussed in section 2.2. The unit values are given on the cost - including freight - (CIF) import stage. The French and German trading partners included in this study are listed in appendix 2. Seats and chairs for specialized purposes (e.g. car seats, medical chairs) were excluded to increase homogeneity in the data material.

One difficulty when using the index methodology (as described in Aw & Roberts 1986) is that the construction of the Tornqvist price index between period (t) and (t-1) requires an import price for each product from each country for both years, even if imports in that category occurred in only one of the years. When the import series from a country is very volatile, prices must be arbitarily imputed for the missing years.

Aw and Roberts (1986, p. 51), in examining the changing quality composition of US footwear imports, solved this problem partly by taking the viewpoint of the importing country: they examined imports only from the major US trading partners over the period 1974-82. They focussed on the subset of only seven supplying countries, which are dominant in the US import bundle. These seven countries accounted for 87.1 % of the total value of US non-rubber footwear imports in 1982.

The methodological difficulty led them also to drop from the analysis 38 product categories, for which US imports from these countries either did not exist or were very small and irregular.

Of the 70 remaining categories, import prices for missing years were imputed using the growth rate of the import price for the five-digit product category from that country. In total they imputed 8.9 percent of the prices. According to their assessment, "all imputations were for products which were not imported on a regular basis and for goods which tended to have an extremly small share of import value. Because the Tornqvist index weighs the growth in price with the value share, goods with small shares have little impact on the final index."

We examined the effect of not imputing data for the 'missing' values, or actually not adding the non-existing values according to Aw & Roberts (1986, p.51). As an example we used French imports in chairs, including all the 29 exporting countries, and six chair categories, at 8-digit Nimexe-classification level, for the years 1989-90.

Out of 696 values, only 16 (2.3 %) had to be imputed. The results in Table 1 show that not imputing for the non-existing values made no difference in the index for 25 out of the 29 countries, and a total of -2.39 % difference in the final Tornqvist partial price index (when defined over countries). Actually only one country, the USA, caused this difference (irregular exports but a non-negligible share of the import value). The impact on the overall Tornqvist price index was virtually zero (-0.095 %), and on the partial price index, when defined over products, was -1.27 %.

Thus, for all practical purposes, in our data set the arbitary imputation of values does not seem necessary; therefore the effort was not made (except for this particular data set, used for Tables 1, 7, and 9).

Table 1. Comparison of the effect of imputing or not imputing data for non-existing values in the procedure of calculating Tornqvist indexes. Data on French imports of chairs in 1989 and 1990; calculation of the components (countries) and the total (TQPPI) of the partial price index. The last column indicates the effect of each component (in %) on the final difference in TQPPI. Differences beyond the 6th decimal were not considered.

	Index value when data ...		Effect in % on
	NOT imputed	Imputed	TQPPI
POL	-0.000151	-0.000231	+0.327
CSL	0.000016	0.000017	-0.000
SGP	-0.001140	-0.001133	+0.000
USA	-0.000991	-0.000336	-2.678
25 other countries	(no differences)		none
TQPPI	0.023874	0.024457	-2.386

4. Empirical Results and Discussion

4.1. Dynamics of aggregate unit values

The decomposition of the price change of chair imports for the German and French market is reported in Table 2 and in Figure 1. Several observations appear obvious from them. The aggregate UVs for imports into France have steadily and quite rapidly risen throughout the study period, whereas for imports into Germany they have increased only slightly (see Table 2.a). The @UVs are clearly higher on the French market than on the German market, in 1990 already by some 50%. From these figures, however, it is not possible to know whether the prices for equivalent products really are different in these two import markets, or whether the higher @UV is caused by a different composition of the import bundle.

It seems that overall, from 1980 to 1990, there has been a clear and continuous shift in the French chair import market towards products from high-priced supplying countries and/or more expensive product groups (Table 2b and Table 2c). A trend towards supplying countries charging higher export prices is obvious from Table 2e and 2f since about 1983, with practically no changes during the period 1980-1983. In the French import market also a slight trend towards importing more expensive product groups can be seen, but this is not as pronounced as the substitution of low-priced by high-priced supplying countries (see Table 2d and Table 2g). Because the trends were in similar directions both for the country effect and the product effect, their joint impact is overestimated by the calculations, and therefore have to be corrected by the interaction term (Table 2h).

In the German chair import market, on the other hand, such changes by substitution have been minimal; if anything, there has been a tendency towards importing chairs from lower-priced supplying countries and/or products. Substitution into lower-priced supplying countries took place until about 1989-1990. There has been a slight tendency also in the German market towards more expensive product categories (in 1986-87 particularly). As the main trends were slightly opposite, the interaction term is smaller than that for the French market (Table 2h).

Table 2. Sources of price change in the French and German chair imports from trading partners listed in appendix 2.

a. Aggregate UV change in chairs

1. Aggregate unit values in ECU/kg

	French imports	German imports
1980	3.80260	-
1981	4.03268	-
1982	4.16662	-
1983	4.35882	-
1984	4.56477	3.4578
1985	5.13396	3.4695
1986	5.23813	3.5741
1987	5.52275	3.5927
*) *)		
1988	5.25206	3.5357
1989	5.40621	3.6107
1990	5.60750	3.6792

*) reclassification of NIMEXE in 1988

2. **Price index change** (c.f. equation 2.1.1.a)

	French imports	German imports
ð P (1980-81)	0.058745	-
ð P (1981-82)	0.032673	-
ð P (1982-83)	0.045098	-
ð P (1983-84)	0.046165	-
ð P (1984-85)	0.117510	0.00337
ð P (1985-86)	0.020087	0.02972
ð P (1986-87)	0.052912	0.00519
ð P (1988-89)	0.028928	0.02097
ð P (1989-90)	0.036557	0.01881

b. Tornqvist price index change (c.f. eq.2.1.2.a)

	French imports	German imports
ð P^* (1980-81)	0.053446	-
ð P^* (1981-82)	0.045782	-
ð P^* (1982-83)	0.057281	-
ð P^* (1983-84)	0.016429	-
ð P^* (1984-85)	0.100637	0.05780
ð P^* (1985-86)	0.025597	0.01046
ð P^* (1986-87)	0.011138	0.00715
ð P^* (1988-89)	0.028587	0.03996
ð P^* (1989-90)	0.044868	-0.00197

Table 2, continued

c. Total quality change (=a-b) (c.f. eq. 2.1.3)

	French imports	German imports
δ q (1980-81)	0.0052992	-
δ q (1981-82)	-0.0131094	-
δ q (1982-83)	-0.0121826	-
δ q (1983-84)	0.0297360	-
δ q (1984-85)	0.0168730	-0.05444
δ q (1985-86)	-0.0055102	0.01926
δ q (1986-87)	0.0417733	-0.00197
δ q (1988-89)	0.0003407	-0.01899
δ q (1989-90)	-0.0083103	0.02078

d. Tornqvist partial price index change for products (c.f. eq. 2.1.4.a)

	French imports	German imports
δP^*_* product (1980-81)	0.054791	-
δP^*_* product (1981-82)	0.047871	-
δP^*_* product (1982-83)	0.056844	-
δP^*_* product (1983-84)	0.028548	-
δP^*_* product (1984-85)	0.102714	0.00422
δP^*_* product (1985-86)	0.030061	0.01986
δP^* product (1986-87)	0.032031	-0.00506
δP^*_* product (1988-89)	0.028973	0.02531
δP^* product (1989-90)	0.035749	0.02179

e. Tornqvist partial price index change for countries

	French imports	German imports
δP^*_* country (1980-81)	0.0600417	-
δP^*_* country (1981-82)	0.0386710	-
δP^*_* country (1982-83)	0.0466614	-
δP^*_* country (1983-84)	0.0279964	-
δP^*_* country (1984-85)	0.0909426	0.04885
δP^*_* country (1985-86)	-0.0009300	0.04462
δP^* country (1986-87)	0.0591827	0.00309
δP^*_* country (1988-89)	0.0180123	0.03678
δP^* country (1989-90)	0.0238737	0.00538

Table 2, continued

f. Change in country effect (= a-e) (c.f. eq. 2.1.5)

	French imports	German imports
$\delta\ q^c$ (1980-81)	-0.0012966	-
$\delta\ q^c$ (1981-82)	-0.0059989	-
$\delta\ q^c$ (1982-83)	-0.0015631	-
$\delta\ q^c$ (1983-84)	0.0181689	-
$\delta\ q^c$ (1984-85)	0.0265674	-0.04549
$\delta\ q^c$ (1985-86)	0.0210168	-0.01490
$\delta\ q^c$ (1986-87)	-0.0062709	0.00210
$\delta\ q^c$ (1988-89)	0.0109155	-0.01581
$\delta\ q^c$ (1989-90)	0.0126836	0.01343

g. Change in product effect (= a-d)

	French imports	German imports
$\delta\ q^g$ (1980-81)	0.0039543	-
$\delta\ q^g$ (1981-82)	-0.0151986	-
$\delta\ q^g$ (1982-83)	-0.0117456	-
$\delta\ q^g$ (1983-84)	0.0176168	-
$\delta\ q^g$ (1984-85)	0.0147960	-0.00086
$\delta\ q^g$ (1985-86)	-0.0099738	0.00986
$\delta\ q^g$ (1986-87)	0.0208810	0.01025
$\delta\ q^g$ (1988-89)	-0.0000454	-0.00434
$\delta\ q^g$ (1989-90)	0.0008079	-0.00298

h. Interaction term (c.f. eq. 2.1.6)

	French imports	German imports
$\delta\ q^{cg}$ (1980-81)	0.002642	-
$\delta\ q^{cg}$ (1981-82)	0.008088	-
$\delta\ q^{cg}$ (1982-83)	0.001126	-
$\delta\ q^{cg}$ (1983-84)	-0.006050	-
$\delta\ q^{cg}$ (1984-85)	-0.024490	-0.00809
$\delta\ q^{cg}$ (1985-86)	-0.016553	0.02430
$\delta\ q^{cg}$ (1986-87)	0.027163	-0.01431
$\delta\ q^{cg}$ (1988-89)	-0.010529	0.00116
$\delta\ q^{cg}$ (1989-90)	-0.021802	0.01033

Due to the reclassification of NIMEXE statistics in 1988 the change from 1987 to 1988 cannot be calculated.

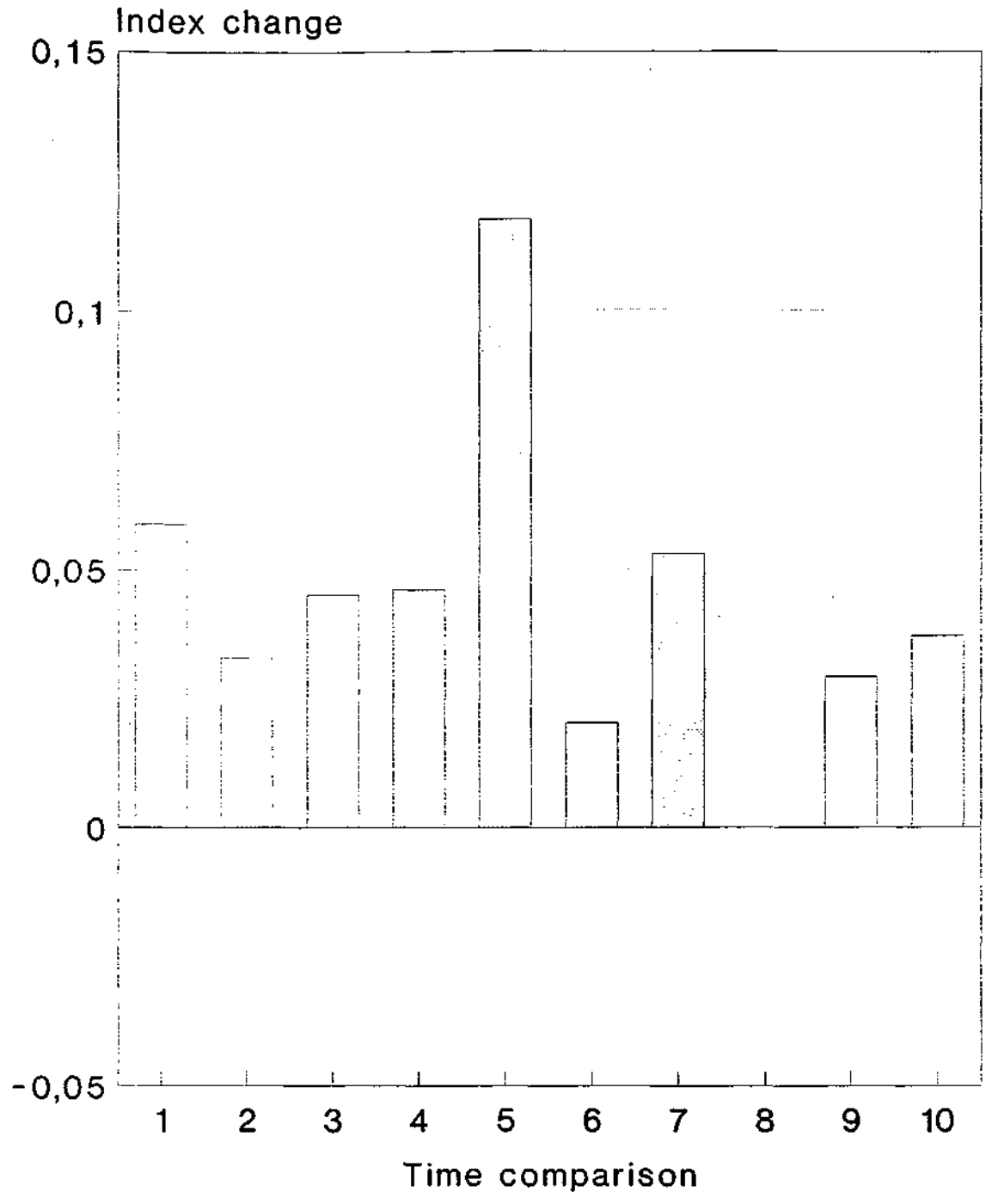

Fig 1.a. Dynamics of the aggregate price index for chairs in the French import market 1980-1990. See equation 2.1.1.a (text). 'Time comparison': 1 = 1980-1981, 2 = 1981-1982, etc. (no data available for 8, i.e. 1987-1988)

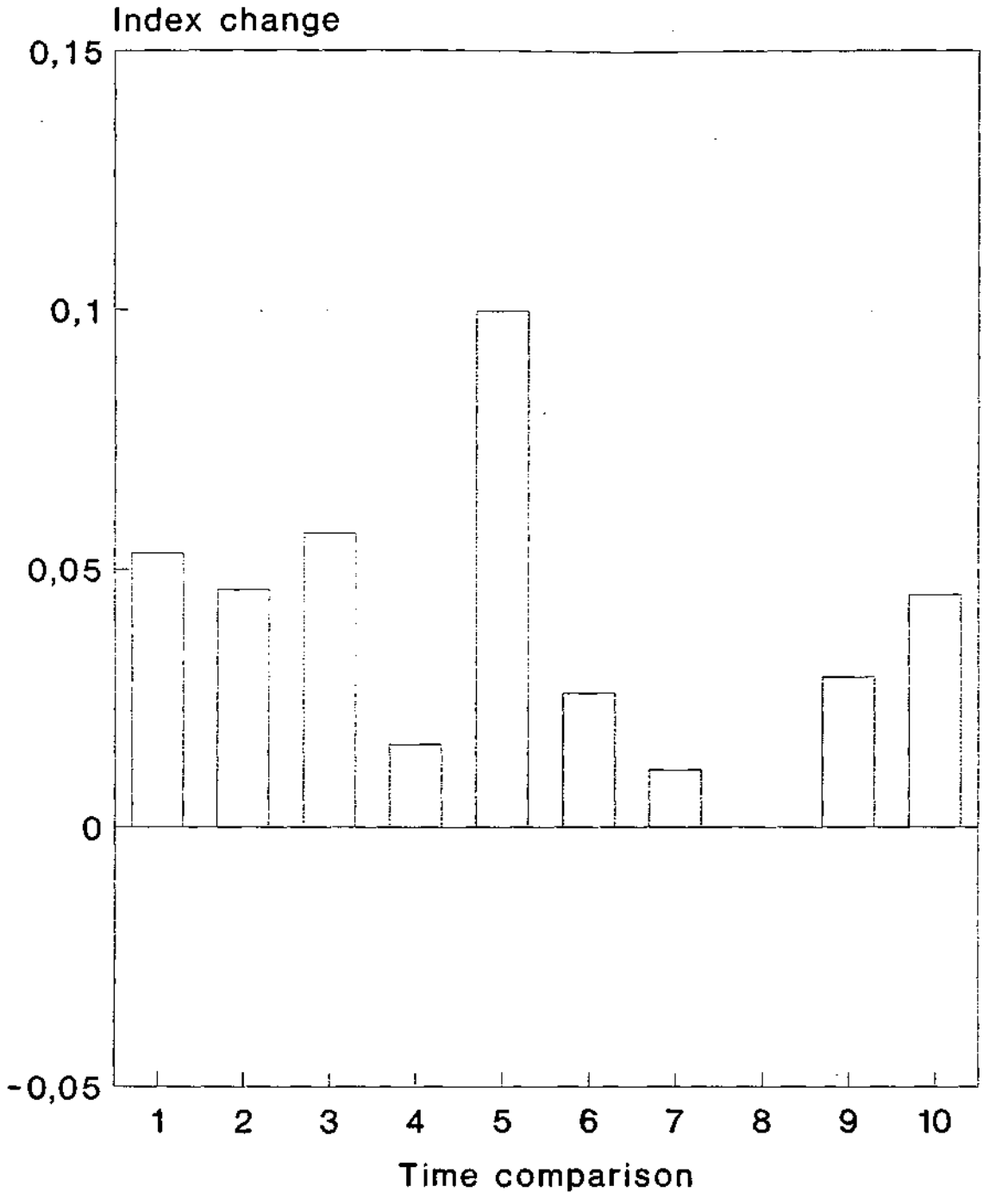

Fig 1.b. Dynamics of the Tornqvist price index for chairs in the French import market 1980-1990. See equation 2.1.2.a (text). 'Time comparison': 1 = 1980-1981, 2 = 1981-1982, etc. (no data available for 8, i.e. 1987-1988).

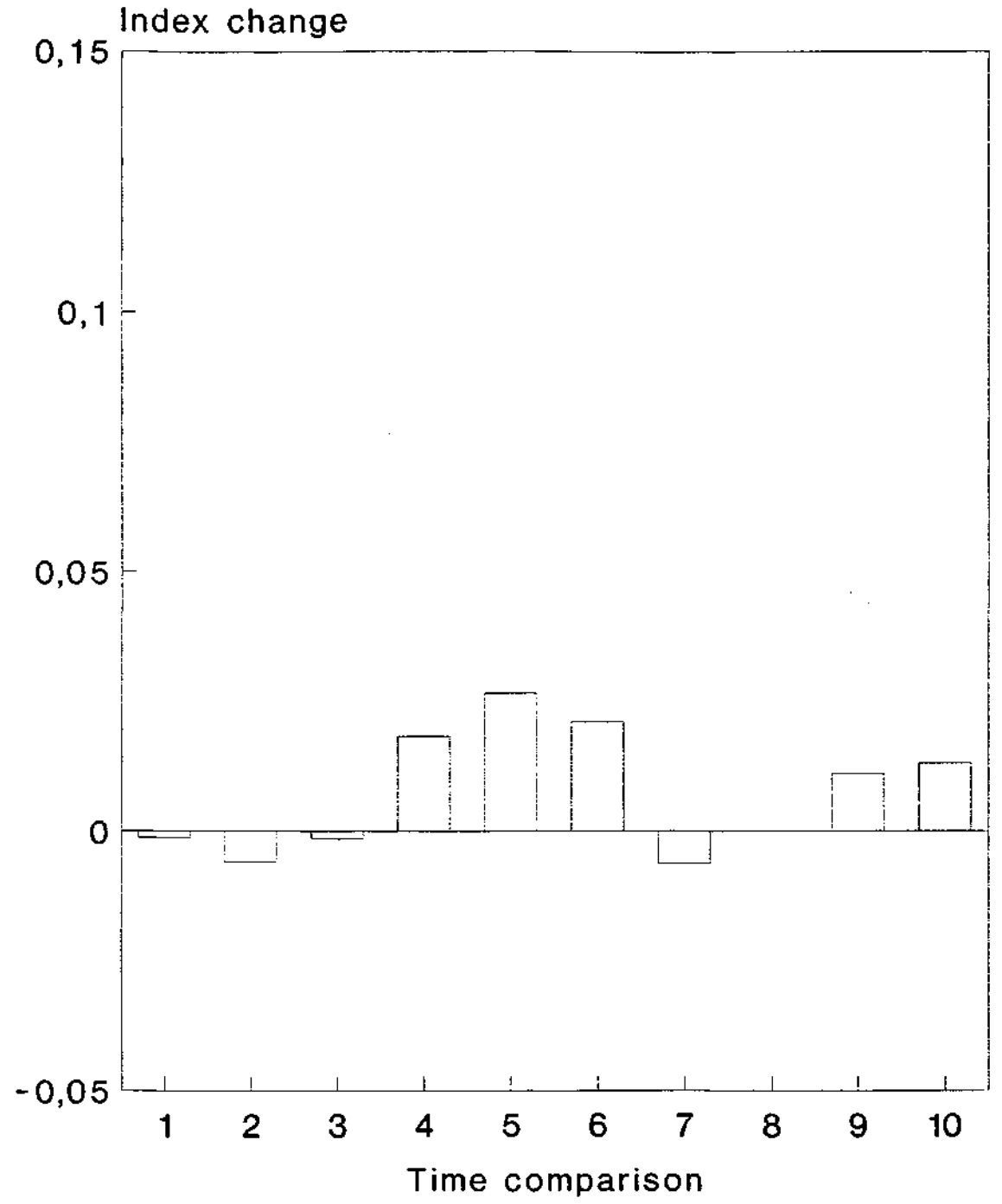

Fig 1.c. Change in the country mix term of the price index for chairs in the French import market 1980-1990. See equation 2.1.5 (text). 'Time comparison': 1 = 1980-1981, 2 = 1981-1982, etc. (no data available for 8, i.e. 1987-1988).

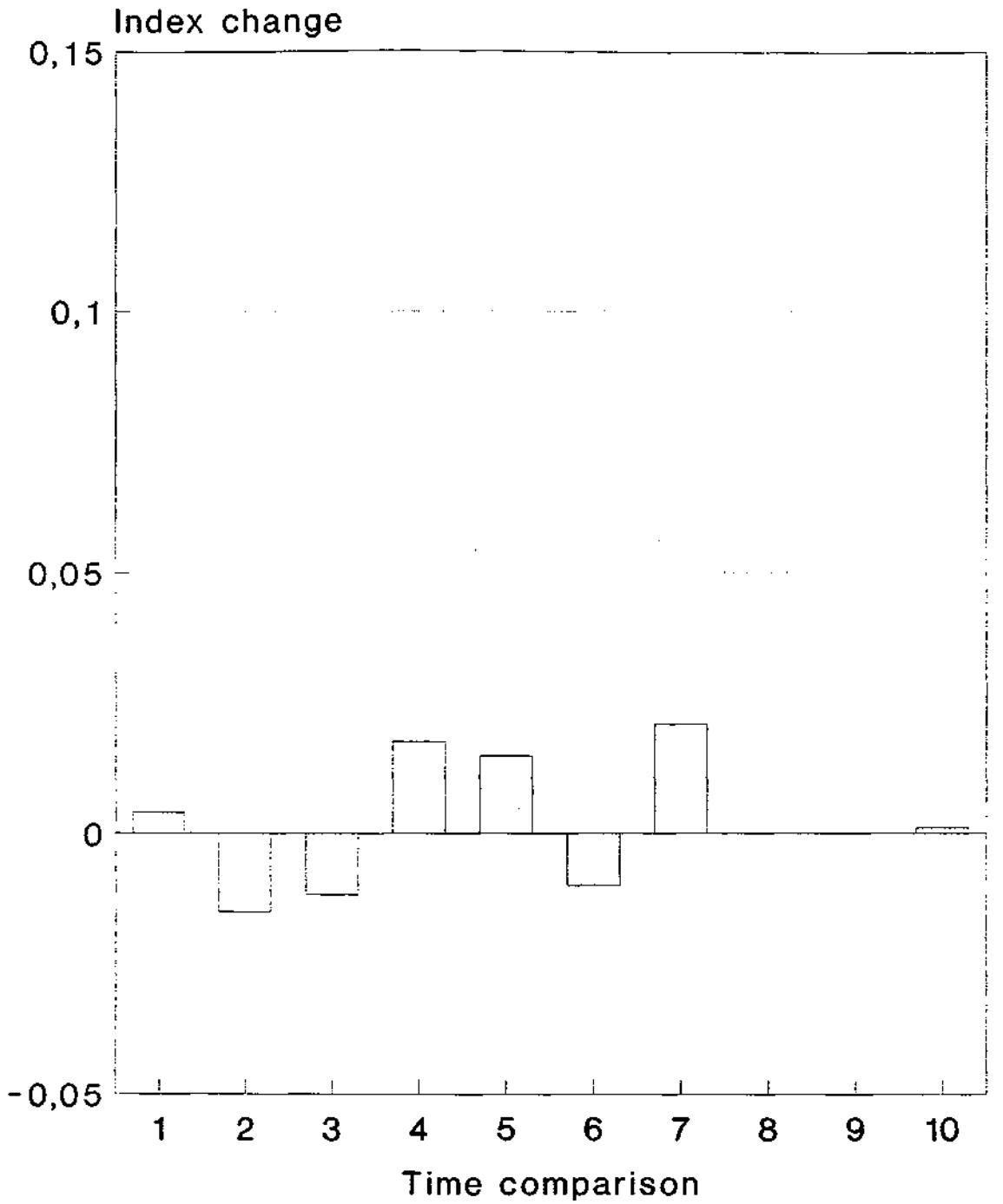

Fig 1.d. Change in the product mix term of the price index for chairs in the French import market 1980-1990. See equation 2.1.5 (text). 'Time comparison': 1 = 1980-1981, 2 = 1981-1982, etc. (no data available for 8, i.e. 1987-1988).

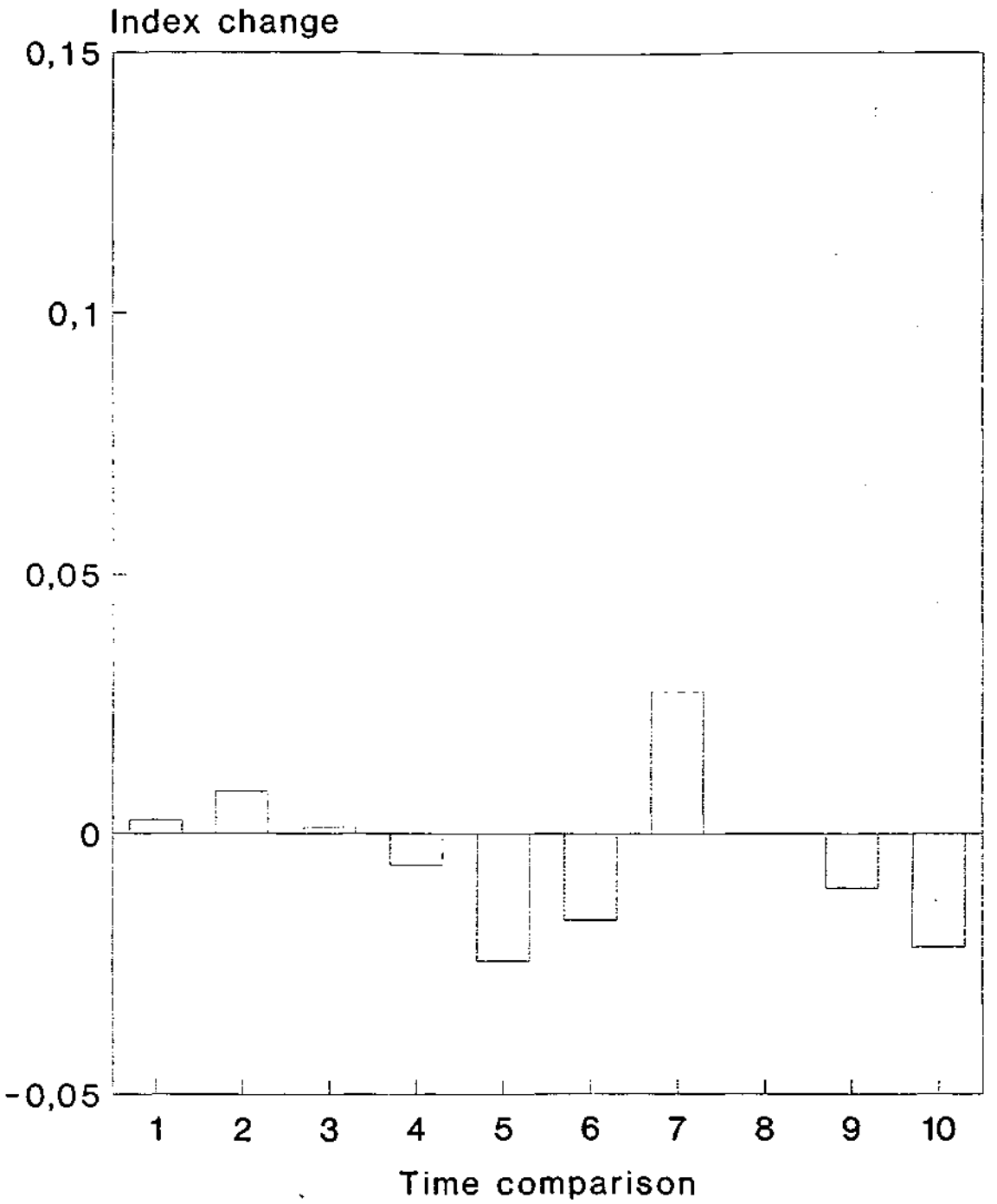

Fig 1.e. Change in the interaction term of the price index for chairs in the French import market 1980-1990. See equation 2.1.6 (text). 'Time comparison': 1 = 1980-1981, 2 = 1981-1982, etc. (no data available for 8, i.e. 1987-1988).

4.2. Sources of unit value changes

The above analysis rises the question, which countries and product groups are responsible for these changes? Are there counteracting changes within the country and product categories? These components are detailed in Tables 3-6, where the contribution of each product group and selected countries to the Tornqvist partial price index are given. Complete tables including the results for all analysed trading partners are given in Appendixes 3 and 4. Comparative results, based on the methodology developed in this study, are shown in Tables 7-9.

4.2.1. Results based on bilateral index

Table 3 indicates that both on the German as well as on the French market the country dominating the prevailing price changes is Italy. In some years (e.g. 1984/85, 1986/87 in the German market; 1985/86 in the French market) the impact of Italy was equalled or exceeded by other trading partners such as Denmark, the Netherlands and Romania. Interestingly the effect of Italy is inconsistent on the German market, but on the French market over the 10-year period its effect was almost invariably to increase the price index considerably. On the German market, imports from France throughout 1984-1990 tended to decrease the price index (Table 3a). Chair imports from the Netherlands increased the price index constantly on the German market, but not so on the French market.

Table 3.a: Components of the change in the Tornqvist partial price index for German imports of chairs, when defined over countries for the years 1984 to 1990 (see equation 2.1.4.a), selected countries.

Country	1984-85	1985-86	1986-87	1988-89	1989-90
ITA	-0.0005	0.0196	-0.0122	0.0221	0.0111
ROM	-0.0022	0.0044	0.0065	0.0047	0.0005
NLD	0.0034	0.0018	0.0023	0.0006	0.0069
DEN	0.0159	0.0052	0.0111	0.0025	-0.0134
AUT	-0.0007	0.0063	0.0115	0.0052	-0.0027
FRA	-0.0007	-0.0002	-0.0008	-0.0107	-0.0076

Table 3b: Components of the change in the Tornqvist partial price index for French imports of chairs, when defined over countries for the years 1980 to 1990 (see equation 2.1.4.a), selected countries.

Country	1980-81	1981-82	1982-83	1983-84	1984-85
ITA	0.0392	0.0225	0.0300	0.0160	0.0500
B/L	0.0044	-0.0065	0.0063	0.0075	0.0130
FRG	0.0032	0.0075	0.0057	-0.0042	0.0083
ESP	0.0068	0.0010	-0.0023	0.0024	0.0048
NLD	0.0021	0.0010	0.0025	0.0004	0.0043
ROM	0.0007	0.0007	-0.0006	0.0003	0.0012

Country	1985-86	1986-87	1988-89	1989-90
ITA	-0.0140	0.0592	0.0129	0.0129
B/L	0.0103	-0.0007	0.0073	0.0073
FRG	0.0068	0.0121	-0.0042	-0.0042
ESP	0.0030	0.0002	-0.0002	-0.0002
NLD	0.0042	-0.0078	-0.0037	-0.0037
ROM	0.0004	-0.0008	0.0005	0.0012

Of the product groups analysed only the product group 9401.70 (or 9401.80-00), chairs of e.g. artificial plastic material, decreased consistently on both markets the price index. The price increases, on the other hand, were generally due to chairs in groups 9401.25, 9401.31, 9401.35, 9401.39, 9401.41, and 9401.45 in both countries up to 1987, and to the group 9401.61-00 for the years 1988-90. Till the year 1987 there is one distinctive difference in the effect of product groups on the changes of aggregate unit values between the German and the French markets: 9401.49 (padded, stuffed or upholstered seats and chairs with wooden frames) decreased the price index more than any other group on the German market, but on the French market it increased the price the most (Tables 4-6).

Table 4. Components of the change in the Tornqvist partial price index for the FRG imports of chairs, when defined over products ($S_i \delta P_i$) for the years 1984-87 (see equation 2.1.4.a), and the total effect from 1984 to 1987. The product categories are ranked based on the %-share of the total effect.

NIMEXE	1984-85	1985-86	1986-87	Sum84-87	%
9401-25	0.0508	0.0007	0.0029	0.0544	77.9
9401-39	0.0072	0.0067	-0.0008	0.0131	18.8
9401-45	0.0048	0.0059	0.0019	0.0126	18.0
9401-41	0.0032	0.0024	0.0031	0.0088	12.6
9401-31	0.0009	0.0021	-0.0016	0.0014	2.0
9401-60	0.0023	-0.0002	-0.0022	-0.0001	-0.1
9401-70	-0.0025	-0.0015	-0.0040	-0.0081	-11.5
9401-49	-0.0118	0.0038	-0.0044	-0.0123	-17.6
Sum	0.0551	0.0199	-0.0051	0.0699	100

Table 5. Components of the change in the Tornqvist partial price index for FRG imports of chairs, when defined over products for the years 1988-1989 (see equation 2.1.4.a). Sorted from highest increasing to highest decreasing effect on the index.

Product category	1988-89	1989-90
9401.61-00	0.0309184	0.0071265
9401.69-00	0.0175906	-0.0009922
9401.79-00	-0.0047475	-0.0003514
9401.71-00	-0.0059223	0.0159166
9401.80-00	-0.0125259	0.0000931
Sum	0.025313	0.021793

Table 6a. Components of the change in the Tornqvist partial price index for French imports of chairs, when defined over products ($S_i \delta P_i$) for the years 1980-87 (see equation 2.4.1.a), and the total effect from 1980 to 1987. The product categories are ranked based on the %-share of the total effect.

NIMEXE	1980-81	1981-82	1982-83	1983-84
9401.49	0.01607	0.04365	0.03568	0.01076
9401.35	0.01130	0.00216	0.00295	0.00897
9401.31	0.00187	0.00252	0.00246	0.00084
9401.41	0.00437	0.00534	0.00428	0.00231
9401.45	0.00026	0.00205	0.00021	0.00263
9401.60	0.00303	0.00217	0.00309	0.00294
9401.70	0.01790	-0.01000	0.00818	0.00010
Sum	0.05480	0.04787	0.05684	0.02855

Table 6a: continued

NIMEXE	1984-85	1985-86	1986-87	Sum 1980-87	% share
9401.49	0.08405	0.05768	-0.00950	0.23837	67.56
9401.35	0.02084	0.01109	0.04075	0.09807	27.79
9401.31	0.00622	-0.00924	0.01148	0.01613	4.57
9401.41	0.00022	-0.01088	0.00893	0.01457	4.13
9401.45	0.00139	-0.00054	-0.00230	0.00370	1.05
9401.60	-0.00150	-0.00427	-0.00254	0.00290	0.82
9401.70	-0.00851	-0.01378	-0.01479	-0.02089	-5.92
Sum	0.10271	0.03006	0.03203	0.35286	100.0

Table 6b: Same as 6a, but for years 1988-90

NIMEXE	1988-89	1989-90	Sum 1988-90	%- share
9401.61-00	0.02381	0.02669	0.05050	78.03
9401.69-00	0.00389	0.00797	0.01186	18.33
9401.50-00	0.00437	0.00441	0.00877	13.55
9401.71-00	0.00562	-0.00155	0.00407	6.29
9401.79-00	0.00134	0.00075	0.00209	3.23
9401.80-00	-0.01005	-0.00252	-0.01252	-19.42
Sum	0.02898	0.03575	0.06477	100.0

4.2.2. Results based on the new index

Tables 7 and 8 illustrate in detail the level of precision possible to obtain about the impact of supplying countries and product groups on the change in the aggregate unit value using the methodology developed in section 2.1.1.

For example, 73 % of the @UV change (total increase of 0.205 ECU/kg) in the French import market for chairs from year 1989 to 1990, was due to one single source ('element'): chairs from Italy in commodity group 9401.61-00 (upholstered seats with wooden frames). Similarly, 14% of the @UV increase was due to chairs from Belgium/Luxembourg in commodity group 9401.61-00. Many individual elements, however, had a decreasing effect. Note that the effects of all the elements sum up to 100 % (= 0.205 ECU/kg) (Table 7).

For the change in the previous year (1988 to 1989), Italy (57%), Romania (36%), and Belgium/Luxembourg (21%) together increased the aggregate unit value more than what it actually rose, while the Netherlands (-23%) and Germany (-19%) had the biggest decreasing impact on the index (Table 8).

Table 7: The contribution of each product group from all the exporting countries on the change in the aggregate unit value of chairs imported into France in 1989-90. Nimexe groups 9401.50-00 to 9401.80-00 are considered. The impact of each group is given as percentage (Imp.%.50 = impact in % for 9401.50-00) of the change in aggregate UV, which was +0.205 ECU/kg. The last column gives the percent-share of the change due to each exporting country (= product categories summed up).

Country	Imp.%.50	Imp.%.61	Imp.%.69	Imp.%.71	Imp.%.79
B/L	0.4519	13.8253	-2.4097	1.6095	-1.0636
NLD	0.6715	-0.0652	-3.6158	3.4054	7.1547
ITA	-1.0033	72.7272	20.7743	6.4604	-1.6901
FRG	0.5401	-0.0319	-0.2377	-4.4041	5.6695
UKD	0.0000	3.2328	0.5697	0.8444	0.1557
ESP	-1.5726	1.9459	6.2383	1.0711	1.9906
DEN	-0.0045	0.2541	-0.4632	0.4592	-0.2781
SWE	0.0000	0.9841	0.0786	-0.0001	-0.1042
NOR	0.0000	3.3216	0.0730	-0.3167	0.0000
FIN	0.0000	0.1150	0.0659	0.1376	0.0000
SWI	0.0000	-1.1783	0.3804	-0.8886	0.4722
AUT	0.0000	0.5508	-0.0785	-1.2663	-0.0415
GDR	0.0000	2.6992	4.0214	6.5252	8.2201
YUG	0.0717	-12.4164	7.3177	0.0000	-0.2435
SOV	0.0000	-1.2830	-0.9657	-0.1639	0.0000
HUN	0.0000	0.4640	-0.5006	-1.6819	1.0647
POL	-0.0107	-0.2688	-0.4952	0.0000	-2.4735
CSL	0.0000	-0.4085	-0.1279	0.0000	0.1681
BUL	0.0000	0.0000	0.3769	0.0000	0.0000
ROM	0.0000	6.5252	36.8963	1.7262	1.5793
PRC	-0.6350	0.0000	-6.6587	0.0000	-4.4907
ROC	0.8381	0.8860	7.3353	-1.0797	-2.3584
THL	8.8209	-1.2838	-0.1970	-15.3090	-1.2465
MAL	-0.9306	0.0000	-0.0586	0.0000	0.0000
IND	-3.9285	0.0000	-1.0737	0.0000	0.0000
SGP	-0.2452	-2.0731	-0.0237	0.0000	0.0000
PHI	14.6650	0.0000	-0.2164	0.0000	0.0000
JAP	0.0000	0.0000	0.0000	0.0000	0.0000
USA	0.0000	-0.3299	-0.0029	-0.0099	-0.0639
Total	17.73	88.19	67.00	-2.88	12.42

Table 7, continued

Country	Imp.%.80	Imp.in ECU/kg	%-of-Imp.
B/L	-5.4609	0.0143	6.9525
NLD	-9.7483	-0.0045	-2.1976
ITA	-35.7713	0.1261	61.4972
FRG	-1.9652	-0.0009	-0.4294
UKD	-0.1782	0.0095	4.6243
ESP	-29.5778	-0.0408	-19.9045
DEN	-0.4676	-0.0010	-0.5000
SWE	0.5555	0.0031	1.5139
NOR	-0.0407	0.0062	3.0372
FIN	0.0000	0.0007	0.3184
SWI	0.7011	-0.0011	-0.5132
AUT	-0.2352	-0.0022	-1.0707
GDR	0.0000	0.0440	21.4659
YUG	-0.1211	-0.0110	-5.3916
SOV	0.0000	-0.0049	-2.4125
HUN	0.2946	-0.0007	-0.3591
POL	0.0000	-0.0067	3.2481
CSL	0.0000	-0.0008	-0.3684
BUL	0.0000	0.0008	0.3769
ROM	0.0836	0.0960	46.8104
PRC	0.3321	-0.0235	-11.4522
ROC	-0.5333	0.0104	5.0880
THL	-0.2543	-0.0194	-9.4697
MAL	0.0000	-0.0020	-0.9892
IND	-0.0320	-0.0103	-5.0343
SGP	0.0000	-0.0048	-2.3421
PHI	0.0000	0.0296	14.4486
JAP	0.0000	0.0000	0.0000
USA	-0.0447	-0.0009	-0.4513
Total	-82.46	+0.205	100.0

Table 8. The contribution, in ECU/kg and in percent, of all the exporting countries on the change in the aggregate unit value (total 0.154 ECU/kg) of chairs imported into France in 1988-89; all product categories summed up.

Country	Imp. in ECU/kg	%-of-Imp.
B/L	0.0321	20.851
NLD	-0.0357	-23.163
ITA	0.0882	57.297
FRG	-0.0289	-18.741
UKD	0.0025	1.618
ESP	0.0063	4.076
DEN	-0.0008	-0.499
SWE	0.0027	1.767
NOR	-0.0076	-4.923
FIN	-0.0000	-0.020
SWI	0.0167	10.849
AUT	0.0025	1.609
GDR	0.0020	1.296
YUG	0.0108	6.999
SOV	-0.0088	-5.727
HUN	0.0001	0.617
POL	-0.0049	-3.186
CSL	-0.0034	-2.179
BUL	0.0005	0.319
ROM	0.0557	36.186
PRC	0.0032	2.059
ROC	-0.0043	-2.773
THL	0.0135	8.747
MAL	0.0000	0.055
IND	-0.0040	-2.612
SGP	0.6041	2.659
PHI	0.0014	0.907
JAP	0.0000	0.000
USA	0.0091	5.910
Total	0.154	100.0

A comparison between the methodology provided in Aw & Roberts (1986) (A&R), and the methodology presented in this paper in section 2.1.1., of estimating the country-impact on the dynamics of the aggregate unit values, is made in Table 9. As the calculations in A&R are partly in logarithmic scale (the numbers in Table 9 are based on the value of $S_i \delta P_i$, equation 2.4.1.a, where P_i is expressed as logarithms of unit value), the figures in Table 9 are not strictly comparable. It becomes evident, however, that although the results seem similar, there are significant differences: even the direction of impact (i.e. increasing or decreasing effect on the aggregate UV) is different in many cases.

These differences are solely due to the effect of changing market share, which is ignored in the methodology of A&R. In some cases it results in large discrepancy between the two methods, as in the case of Belgium. A price increase from 1989 to 1990, associated with a relatively high average market share, yields a large impact on the @UV change with the A&R methodology. Because the market share of Belgium decreased, however, from 1989 to 1990, the effect of the price increase was almost compensated by that decrease, resulting only in a small overall impact on the @UV change. Similarly for Romania the impact figures are quite different: a small price increase was associated with a large decrease in market share, which in this case further emphasized the increasing effect of Romania on the index change (UV much below the @UV).

Even when Aw & Roberts (1986) did not use their methodology for the interpretation of the individual country effects, errors behind the calculations (A&R used the summed-up individual country effects) such as described above, cast doubts over the accuracy of their end result as well. However, we believe that their end result is likely to be closer to the real value than the

large deviations in some individual components would suggest (errors may compensate for each other).

On the other hand, in some hypothetical situations country effect calculations based on the A&R methodology may give quite wrong results. If we assume, for example, no changes at all in individual UVs, but great shifts in market shares, we obtain zero for the country impact by the A&R methodology, but a more accurate value by our method.

Table 9: Difference in the country-impact on the increase of the aggregate unit value for imported chairs in the French market 1989-90, based on calculation after Aw & Roberts (1986), and the methodology given in section 2.1.1 of this paper.

Country	Impact% after Aw & Roberts	Impact% after this paper	Difference in the direction of impact
B/L	30.75	6.95	
NLD	-15.42	-2.20	
ITA	54.00	61.50	
FRG	-17.64	-0.43	
UKD	5.24	4.62	
ESP	-0.63	-19.90	
DEN	-1.30	-0.50	
SWE	4.40	1.51	
NOR	8.63	3.04	
FIN	5.03	0.32	
SWI	0.50	-0.51	yes
AUT	0.38	-1.07	yes
GDR	0.50	21.47	
YUG	4.06	-5.39	yes
SOV	1.17	-2.41	yes
HUN	0.08	-0.36	yes
POL	-0.63	-3.25	
CSL	0.08	-0.37	yes
BUL	0.17	0.38	
ROM	4.86	46.81	
PRC	-2.26	-11.45	
ROC	2.60	5.09	
THL	-7.96	-9.47	
MAL	-0.42	-0.99	
IND	2.68	-5.03	yes
SGP	-4.78	-2.34	
PHI	1.42	14.45	
JAP	0.00	0.00	
USA	-4.15	-0.45	
Sum	100.0	100.0	

5. Conclusions

A new way of utilizing the information produced by the conventional bilateral index number technique (Aw & Roberts, 1986) is presented in this paper, enabling to estimate individual country and/or product group effects on the unit value dynamics. The methodology used by Aw and Roberts (1986) is accurate, however, only under the hypothetical circumstance that market shares remain constant (for commodities other than those whose unit values precisely match the aggregate unit values in both years under consideration). The effects of market share and price changes are further complicated, because in reality **both** the market share **and** the individual unit values are changing.

The inaccuracy in the bilateral index technique stems from ignoring the impact of changing market share on the dynamics of the aggregate unit values. This, however, can be as important a factor than an actual price change in explaining unit value movements.

A more precise methodology was developed to measure the contribution of various elements to @ UVs, and substitution effects between them. A case study analysing imports of chairs into the German and French markets illustrates this technique. The findings of our study raise the question whether the results of Aw and Roberts (1986), presenting general trends based on "country effects" or "product effects", are not misleading. In our paper, for example, only one chair group exported from Italy to the French market, was practically responsible for all the changes ('trends') in the aggregate UV. Most other chair groups from Italy had quite different effects on the @ UV. When in reality such generalized effects do not exist, we conclude that it is incorrect to refer to a "country effect" or a "product effect".

Footnote:

(1): The impact of differences in unit values, and the associated methodological difficulties, is emphasized by Maizels (1970) in his seminal study on growth and trade (see page 170, and particularly pages 203-206).

"The reasons for these divergent results is, of course, the very different movements in unit values of the various commodities. There are two main reasons for these differences. First, technological progress tends to be faster in some industries than in others, with consequent effects on relative unit costs, and on relative prices. ... Second, relative prices may change for purely competitive reasons; the obvious case is the sharp relative devaluation of the Japanese currency in the 1930s ..." (Maizels, 1970, p. 170).

These arguments and criticism relate to **explaining** the forces behind observed changes in UVs. What our paper is aiming at, however, is to develop a method to identify **what changes** have taken place, and **what countries and product groups** had the main impact on them. After determining the main sources, by applying the methodology developed in our paper, it may be easier to explain the changes in a second step with arguments such as those of Maizels (1970, p. 170, 203-206) or Molle (1991, p. 80). For example, in product group 9401.80-00 the decline in price, observed in this study, may well be due to technological advances. On the other hand, technological advances can not serve as an explanation for the large price increase in Nimexe group 9401.61-00.

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Appendix 1: NIMEXE groups analysed in the study:

1984-1987:

9401.25	Padded, stuffed or upholstered seats and chairs, with backrest and variable height adjustment, and fitted with casters
9401.31	Seats and chairs with base metal frame, not padded, stuffed or upholstered
9401.39	Padded, stuffed or upholstered seats and chairs with base metal frame, other than with backrest and variable height
9401.41	Seats and chairs with frame of straight wood, not padded, stuffed or upholstered
9401.45	Seats and chairs with frame of bent wood, not padded, stuffed or upholstered
9401.49	Padded, stuffed or upholstered seats and chairs with wooden frame, other than with backrest and variable height adjustment, not for motor vehicles
9401.60	Seats and chairs of cane, osier, bamboo or similar materials
9401.70	Seats and chairs other than of cane, osier, bamboo or similar materials

1988-1990:

9401.30-10	Swivel seats with variable height adjustments, upholstered, with backrest and fitted with castors or glides
9401.30-90	Swivel seats with variable height adjustment
9401.40-00	Seats (other than garden seats or camping equipment), convertible into beds, (excl. those of 94.02)
9401.50-00	Seats of cane, osier, bamboo or similar material
9401.61-00	Upholstered seats, with wooden frames (other than those of heading N 94.02), (Excl. 9401-10 to 9401.40-00)
9401.69-00	Seats with wooden frames, non -upholstered (other than those of heading N 94.02), (Excl. 9401.10-10 to 9401.40-00)
9401.71-00	Upholstered seats, with metal frames, (other than those of heading N 94.02) (Excl. 9401.10-10 to 9401.40-00)
9401.79-00	Seats with metal frames, non -upholstered (other than those of heading N 94.02), (Excl. 9404.10-10 to 9404.40-00)
9401.80-00	Seats, other than those of heading N 94.02, excl. 9401.10-10 to 9401.79-00

Appendix 2: List of countries included in the study

AUT	Austria	NOR	Norway
B/L	Belgium+Luxembourg	PHI	Philippines
BUL	Bulgaria	POL	Poland
CSL	Czechoslovakia	PRC	China, P. R.
DEN	Denmark	ROC	Taiwan
ESP	Spain	ROM	Romania
FIN	Finland	SGP	Singapore
FRA	France	SOV	Soviet Union
GDR	East Germany	SWE	Sweden
HUN	Hungary	SWI	Switzerland
IND	Indonesia	THL	Thailand
ITA	Italy	UKD	United Kingdom
JAP	Japan	USA	United States
MAL	Malaysia	YUG	Yugoslavia
NLD	Netherlands		

Appendix 3. Components of the change in the Tornqvist partial price index for the FRG imports of chairs, when defined over the countries for the years 1984-1990, (see equation 2.1.4.a). The countries are ranked based on the total effect 1984-1990.

Country	1984-85	1985-86	1986-87	1988-89	1989-90
DEN	0.0159	0.0052	0.0111	0.0021	-0.0120
AUT	-0.0007	0.0063	0.0115	0.0043	-0.0024
ESP	0.0049	0.0040	0.0005	0.0086	0.0019
ROM	-0.0022	0.0044	0.0065	0.0039	0.0004
NLD	0.0034	0.0018	0.0023	0.0005	0.0063
ITA	-0.0005	0.0196	-0.0122	0.0185	0.0100
SWE	0.0076	-0.0008	-0.0007	0.0019	-0.0010
B/L	0.0069	0.0054	-0.0061	-0.0018	0.0005
SWI	0.0027	0.0040	-0.0022	-0.0073	0.0088
SOV	0.0004	0.0033	0.0008	-0.0011	-0.0008
HUN	0.0025	0.0016	-0.0013	0.0004	0.0025
CSL	0.0012	-0.0001	0.0009	-0.0003	0.0005
UKD	0.0052	-0.0007	-0.0041	-0.0006	-0.0013
NOR	0.0010	-0.0001	-0.0005	-0.0008	0.0011
BUL	0.0001	0.0001	-0.0003	-0.0003	-0.0002
FIN	0.0005	-0.0001	-0.0007	0.0003	0.0000
IND	-0.0005	0.0004	-0.0001	0.0000	-0.0002
PRC	0.0004	-0.0009	0.0002	-0.0002	-0.0003
POL	-0.0007	-0.0003	0.0004	0.0019	-0.0073
PHI	0.0004	-0.0004	-0.0008	0.0000	0.0001
USA	-0.0001	-0.0003	-0.0008	-0.0003	-0.0000
THL	-0.0002	-0.0009	-0.0004	-0.0001	0.0002
FRA	-0.0007	-0.0002	-0.0008	-0.0090	-0.0068
YUG	-0.0002	0.0003	-0.0021	0.0026	0.0009
ROC	0.0014	-0.0070	0.0020	0.0023	0.0006
Sum	0.0489	0.0446	0.0031	0.0255	0.0013

Appendix 4: Components of the change in the Tornqvist partial price index for French imports of chairs, when defined over the countries for the years 1980-1990, (see equation 2.1.4.a), and the total effect from 1980 to 1990. The countries are ranked based on the %-share of the total effect.

Country	1980-81	1981-82	1982-83	1983-84
ITA	0.03920	0.02247	0.02998	0.01597
B/L	0.00443	-0.00648	0.00632	0.00745
FRG	0.00321	0.00749	0.00565	-0.00419
ESP	0.00678	0.00102	-0.00227	0.00241
PHI	0.00119	0.00052	0.00121	0.00025
GDR	0.00005	0.00094	0.00083	0.00203
NLD	0.00212	0.00102	0.00254	0.00035
ROM	0.00071	0.00068	-0.00055	0.00032
USA	0.00044	0.00202	0.00060	0.00017
SWI	0.00177	0.00150	0.00047	-0.00123
DEN	-0.00046	0.00074	0.00126	-0.00003
SWE	0.00032	0.00103	-0.00258	0.00163
PRC	0.00004	0.00116	0.00065	0.00013
NOR	0.00074	-0.00024	0.00086	0.00021
ROC	0.00032	0.00142	-0.00095	-0.00018
UKD	-0.00198	0.00200	0.00054	0.00040
IND	0.00005	0.00007	-0.00004	0.00004
FIN	-0.00003	0.00018	0.00001	0.00116
CSL	0.00002	0.00004	0.00002	0.00026
BUL	0.00018	0.00013	-0.00005	0.00004
AUT	0.00021	-0.00014	-0.00007	-0.00019
HUN	-0.00018	0.00054	0.00016	0.00004
JAP	0.00000	0.00000	0.00002	0.00003
POL	0.00023	0.00045	-0.00002	0.00021
MAL	-0.00011	0.00000	0.00000	0.00000
SGP	0.00003	-0.00003	0.00000	0.00000
YUG	-0.00031	-0.00023	0.00090	-0.00022
SOV	0.00005	-0.00001	0.00001	-0.00000
THL	0.00105	0.00040	0.00118	0.00092
Sum	0.06004	0.03867	0.04666	0.02800

Appendix 4, continued:

Country	1984-85	1985-86	1986-87	1988-89
ITA	0.04973	-0.01401	0.05920	0.01289
B/L	0.01289	0.01030	-0.00073	0.00734
FRG	0.00832	0.00683	0.01205	-0.00421
ESP	0.00480	0.00300	0.00020	-0.00015
PHI	0.00003	-0.00080	-0.00015	0.00034
GDR	0.00676	0.00100	-0.00334	0.00030
NLD	0.00426	0.00420	-0.00775	-0.00368
ROM	0.00123	0.00043	-0.00078	0.00053
USA	0.00007	0.00062	-0.00126	0.00157
SWI	0.00172	-0.00063	-0.00373	0.00346
DEN	0.00095	-0.00048	0.00163	-0.00036
SWE	0.00245	-0.00130	-0.00070	0.00049
PRC	0.00016	-0.00059	-0.00011	0.00101
NOR	0.00039	0.00022	-0.00014	-0.00262
ROC	0.00001	-0.00058	0.00007	0.00036
UKD	-0.00062	-0.00736	0.00700	-0.00024
IND	0.00004	-0.00007	0.00005	0.00003
FIN	-0.00081	-0.00001	0.00014	0.00001
CSL	-0.00001	0.00009	0.00014	0.00002
BUL	-0.00020	-0.00002	0.00023	0.00008
AUT	0.00009	0.00023	0.00013	-0.00004
HUN	0.00007	0.00019	-0.00066	0.00012
JAP	-0.00001	0.00000	0.00000	0.00000
POL	-0.00001	-0.00015	-0.00022	-0.00039
MAL	0.00000	-0.00000	0.00004	0.00001
SGP	0.00000	0.00000	0.00000	0.00096
YUG	0.00067	-0.00039	-0.00047	0.00068
SOV	0.00001	0.00004	-0.00005	-0.00016
THL	-0.00233	-0.00163	-0.00162	-0.00015
Sum	0.09094	-0.00093	0.05918	0.01801

Appendix 4, continued

Country	1989-90	Sum 80-90	%
ITA	0.01289	0.23805	65.32
B/L	0.00734	0.03935	10.80
FRG	-0.00421	0.03525	9.67
ESP	-0.00015	0.01032	2.83
PHI	0.00034	0.00893	2.45
GDR	0.00012	0.00866	2.38
NLD	-0.00368	0.00431	1.18
ROM	0.00116	0.00373	1.02
USA	-0.00099	0.00354	0.97
SWI	0.00012	0.00345	0.95
DEN	-0.00031	0.00294	0.81
SWE	0.00105	0.00239	0.66
PRC	-0.00054	0.00193	0.53
NOR	0.00206	0.00147	0.40
ROC	0.00062	0.00108	0.30
UKD	0.00125	0.00100	0.28
IND	0.00064	0.00081	0.22
FIN	0.00012	0.00076	0.21
CSL	0.00002	0.00059	0.16
BUL	0.00004	0.00042	0.12
AUT	0.00009	0.00031	0.09
HUN	0.00002	0.00030	0.08
JAP	0.00000	0.00004	0.01
POL	-0.00015	-0.00005	-0.01
MAL	-0.00010	-0.00017	-0.05
SGP	-0.00114	-0.00018	-0.05
YUG	-0.00097	-0.00032	-0.09
SOV	-0.00028	-0.00039	-0.11
THL	-0.00190	-0.00408	-1.12
Sum	0.02387	0.36445	100.0

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