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Product and Country Substitution in Imports: An Empirical Comparison of Theoretical Concepts

By

Ingeborg Menzler-Hokkanen and **Rolf J. Langhammer**

I. Introduction

The measurement of the quality of imports and the substitution among trading partners is a key question in current empirical trade literature [Aw and Roberts, 1986; 1988; Winters, 1990; Faini and Heimler, 1991a; 1991b; de Melo and Winters, 1993]. To analyze these questions, Aw and Roberts [1986] used the bilateral translog index number technique based on import unit values. The technique decomposes the changes in aggregate unit values (hereafter: @UV) into "pure price effects" (measured by the Törnqvist index; see Törnqvist [1981] and Aw and Roberts [1986]) and "quality effects" (measured as the difference between an unweighted price index and the Törnqvist index). The quality index is further decomposed into "country effects", "product effects", and an interaction term (using Törnqvist partial price indexes; see Aw and Roberts [1986]). The interpretation of the country effects was to contribute different rates of growth of unweighted and weighted indexes to trends towards countries exporting either more expensive or cheaper goods. Analogously, product effects indicate trends towards either more expensive or less expensive goods irrespective of supplying countries.

This methodology (hereafter: A&R method), however, suffers severely from the underlying limitations of the economic approach to the index number technique [Diewert, 1988, p. 28]. It poorly measures substitution among the supplying countries or product groups, as it is capable of detecting only the net changes in the market [see Menzler-

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Hokkanen, 1994; Menzler-Hokkanen, 1993]. This is a serious shortcoming, since the impacts of most changes in trade shares (TS) will offset each other, and thus remain undetected. In some cases, the A&R technique may imply no recomposition of the import market, even when clear shifts have taken place [see Menzler-Hokkanen, 1993].

A new method was introduced by Menzler-Hokkanen [1994], and Menzler-Hokkanen [1993] (hereafter: M-H method) to detect more accurately shifts in country and/or product group impacts in import markets. The method fully utilizes the information concerning changes in prices (approximated by unit values) as well as in trade shares.

The aim of this paper is first to assess the usefulness of results provided by the conventional application of the bilateral index technique in the sense of Aw and Roberts [1986], using the French import market for chairs as an example. Second, it strives to compare, based on actual trade data, the applicability of two methodologies: the extended A&R method, and the method developed in Menzler-Hokkanen [1994]. Third, it proposes a more meaningful way of analyzing shifts in product group and/or country impacts in import markets.

II. Critical Features of the A&R Bilateral Index Number Technique

The bilateral index number technique, as applied by Aw and Roberts [1986], is an empirical tool to decompose the change in aggregate unit values (@UV) into indexes representing changes in quality-adjusted prices (Törnqvist index), the product mix, and the supplying country mix (the latter two being the major components of the "quality" index as in A&R).

The growth in the aggregate unit-value index for a group of products and countries was measured by A&R as:

$$\partial P(t) = \ln P(t) - \ln P(t-1) \tag{1}$$

when

$$P(t) = \sum_g \sum_c V_{gc}(t) / \sum_g \sum_c Q_{gc}(t)\,, \tag{2}$$

where

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

∂: operator to sign the difference in natural logs
$g = 1, \ldots, G$: products or categories
$c = 1, \ldots, C$: supplying countries.

The pure price effect on the aggregate unit value was analyzed by A&R with the help of the Törnqvist index (for a detailed explanation see Aw and Roberts [1986]). The index was defined as the sum of the growth of the individual import product prices weighted by the value shares:

$$\partial P^*(t) = \sum_g \sum_c \overline{S_{gc}(t)} \quad \partial P_{gc}(t)\,, \tag{3}$$

where

$$\overline{S_{gc}(t)} = 1/2 \left[\frac{V_{gc}(t)}{\sum_g \sum_c V_{gc}(t)} + \frac{V_{gc}(t-1)}{\sum_g \sum_c V_{gc}(t-1)} \right] \tag{4}$$

and

$$\partial P_{gc}(t) = \ln(V_{gc}(t)/Q_{gc}(t)) - \ln(V_{gc}(t-1)/Q_{gc}(t-1))\,. \tag{5}$$

To identify the effects of changes in trade shares (which is a proxy of "quality" in the sense of A&R) of supplying countries, and similarly for products, partial price indexes were defined using Törnqvist indexes as above, but defined over a subset of data [see Aw and Roberts, 1986].

Several aspects can be pointed out, which may limit the applicability of the A&R bilateral index number technique. First, the economic approach to price and quantity measurement (or index number theory) is based on the assumption of optimizing behaviour of consumers and producers [Diewert, 1987, p. 770]. The assumption of cost-minimizing behaviour implies for the applicability of the A&R methodology that prices and trade shares are negatively correlated. For example, this requires that if prices are constant, trade shares are not allowed to change either. If this relationship is not fulfilled, theoretically the use of the bilateral index number technique as used by A&R is excluded. In actual trade data, however, prices and trade shares virtually never completely follow this requirement, and indeed, predominantly no correlation exists.[1] Therefore, when the A&R method is used on actual trade data, the results may be flawed due to the violation of the cost minimization requirement in the data.

[1] Correlations based on West German imports of chairs are available from the authors upon request. See also Menzler-Hokkanen [1994, p. 89].

Second, the outcome based on the calculations (given above) may be inaccurate, since the A&R methodology in comparing data from two points in time is a one-step process pooling the trade share (TS) information from these two points into an average value (see equation 4). Thus, information on the TS change is lost in that process, and cannot be accurately accounted for in the subsequent calculations. Changes in trade shares, however, affect the @UV as severely as differences in individual unit values. For example, if the UVs of all products from all countries remained constant, an increase in the TS of a trading partner with higher UV than the average, at the expense of a trading partner with a smaller UV, would lead to an increase in the @UV.

Third, by the A&R methodology only net effects are reported. As the changes in TS and UV for countries may cancel out each other, no difference in impact on the aggregate UV may be evident, even when sizeable movements in the UVs and TSs have actually taken place in the trade data. With the A&R calculation method there is no possibility of breakdown beyond the aggregate "country effect", "product effect", and the "pure price effect". As pointed out above, TS movements cannot be related to their sources, i.e. individual countries and/or product groups.[2]

III. An Improved Technique to Identify the Sources of Aggregate Unit Value Index Dynamics

The key feature of the method introduced in Menzler-Hokkanen [1994] is that for each country and product group the impact on the $@UV$ in periods $(t-1)$ and (t) is calculated separately. Obviously, the difference in the two results is the change in the direct impact for the relevant variable (e.g. product group, country; hereafter: element).

As pointed out in Menzler-Hokkanen [1993], the change in $@UV$ ($\partial @UV$) from $(t-1)$ to (t) is the sum of the changes in the absolute contribution of each of its elements to the $@UV$ at the corresponding time, i.e.

$$\partial @UV = \left[\frac{V_{A(t)}}{\sum_{i=A}^{N} Q_{i(t)}} - \frac{V_{A(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}}\right] + \ldots + \left[\frac{V_{N(t)}}{\sum_{i=A}^{N} Q_{i(t)}} - \frac{V_{N(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}}\right], \tag{6}$$

[2] The above mentioned hypotheses were examined using simplified, hypothetical data in Menzler-Hokkanen [1993].

where V = value, Q = quantity, and $A \ldots N$ = different elements comprising the @UV.

Estimates of each element's contribution to the change in the $@UV$ from time $(t-1)$ to time (t) require one further consideration: calculation of the substitution effect. Since trade shares are relative measures, a change in the share of one element implies that the element is either being substituted for, or is replacing another element. However, there is no precise way to specify the magnitude of the unit value of the other element(s). In this calculation, therefore, it is assumed to be equal to the $@UV$ at time (t). Under this assumption, possible small errors in assumptions will cancel out each other as the data are summed across all the elements.

Thus, the effect of one element on the change in the aggregate unit value (E_A) becomes a function of two components: change in the absolute contribution to the $@UV$ from $(t-1)$ to (t), and the substitution effect:

$$E_A = \left[\frac{V_{A(t)}}{\sum_{i=A}^{N} Q_{i(t)}} - \frac{V_{A(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}} \right] - \left[\frac{Q_{A(t)}}{\sum_{i=A}^{N} Q_{i(t)}} - \frac{Q_{A(t-1)}}{\sum_{i=A}^{N} Q_{i(t-1)}} \right] @UV_t, \tag{7}$$

where E_A is the effect of one element on the change in aggregate unit value and the total change in $@UV$ will then be the sum of the effects of each of the elements:

$$\partial @UV = \sum_{i=A}^{N} E_i . \tag{8}$$

A further breakdown, similar to the concepts of "pure price effect" and "quality effect" of A&R, can be obtained by combining information from (3) and (7). In this case, the breakdown is possible for each individual element, rather than for the aggregate figure only as yielded by the methodology presented in Aw and Roberts [1986].

IV. Empirical Assessment of Theoretical Concepts

1. Empirical Data

For the empirical part of this study, the value and quantity data were obtained from Eurostat, External Trade, Analytical Tables for the Years 1980–1990. The cif import value and volume data are reported by country of origin for 6-digit (1980–1987) and 8-digit (1988–1990)

product categories (see the Appendix). The French trading partners included in this study are listed in the Appendix. Seats and chairs for specialized purposes (e.g. car seats, medical chairs) were excluded to allow for greater homogeneity in the data set.

When using the index methodology as described in Aw and Roberts [1986] there is the difficulty that the construction of the Törnqvist price index requires an import price for each product from each country for both years. When the imports from a partner country are very volatile, which is typical for small import volumes, prices must be arbitrarily imputed for the missing years. Aw and Roberts calculated import prices for the missing years based on the growth rate of the import price for the five-digit product category from that country.

We examined the effect of ignoring the "missing" values, or not adding the non-existing values according to Aw and Roberts [1986, p. 51]. As an example, we took the French imports of chairs, including all the 29 partner countries, and six chair categories, at 8-digit CN-classification level, for the years 1989–1990. Out of 696 values, only 16 (2.3 per cent) had to be imputed. Not imputing the non-existing values made no difference in the index for 25 out of the 29 countries, and a total of −2.39 per cent difference in the final Törnqvist partial price index (when defined over countries). Only one country, the USA, caused this difference (irregular exports but a non-negligible share of the import value). The impact on the overall Törnqvist price index was virtually zero (−0.095 per cent), and on the partial price index, when defined over products, −1.27 per cent. Thus, for all practical purposes, in our data set the arbitrary imputation of values does not seem necessary; therefore the effort was not made.

In the following section, first the conventional bilateral index technique (A&R method) is applied to our data set, and compared to the actual changes in the market from 1989 to 1990. Then a detailed comparison of the M-H and A&R calculation methods on the same data is performed, and the results are interpreted and related to the results obtained previously. Finally, a method of analysis is recommended to assess product and country substitution in an import market.

2. Conventional Bilateral Index Technique Applied to French Imports of Chairs

Applying the A&R method to our data set introduced in Section II results in the outcome given in Table 1. The various factors contributing to price changes – in accordance with the A&R method – in chair

Table 1 – *Sources of the Price Change in the French Chair Imports from 30 Trading Partners (A&R method)*

	1980 – 1981	1981 – 1982	1982 – 1983	1983 – 1984	1984 – 1985	1985 – 1986	1986 – 1987	1987 – 1988	1988 – 1989	1989 – 1990
@UV	3.803	4.033	4.167	4.359	4.565	5.134	5.238	5.523	5.252	5.406	5.608
∂*PI*		0.0587	0.0327	0.0451	0.0462	0.1175	0.0201	0.0529	*	0.0289	0.0366
∂*TQPI*		0.0534	0.0458	0.0573	0.0164	0.1006	0.0256	0.0111	*	0.0285	0.0449
∂*tq*		0.0053	−0.0131	−0.0122	0.0297	0.0169	−0.0055	0.0418	*	0.0003	−0.0083
TQPPIc		0.0600	0.0387	0.0467	0.0280	0.0909	−0.0009	0.0592	*	0.0180	0.0239
TQPPIp		0.0548	0.0479	0.0568	0.0286	0.1027	0.0301	0.0320	*	0.0290	0.0358
∂*CE*		−0.0013	−0.0060	−0.0016	0.0182	0.0266	0.0210	−0.0063	*	0.0109	0.0127
∂*PE*		0.0040	−0.0152	−0.0118	0.0176	0.0148	−0.0100	0.0209	*	−0.0001	0.0008
IAT		0.0026	0.0081	0.0011	−0.0061	−0.0245	−0.0166	0.0272	*	−0.0105	−0.0218

Note: *@UV* = aggregate unit value; ∂*PI* = change in price index; ∂*TQPI* = change in Törnqvist price index; ∂*tq* = change in total quality; *TQPPIc* = change in Törnqvist partial price index for country effect; *TQPPIp* = change in Törnqvist partial price index for product effect; ∂*CE* = change in country effect; ∂*PE* = change in product effect; *IAT* = interaction term. – * Due to the reclassification of NIMEXE statistics in 1988, the change from 1987 to 1988 cannot be calculated.

imports to the French market from 1980 to 1990 are shown. The aggregate UVs have steadily risen throughout the period. Following the interpretation of Table 1 in accordance with Aw and Roberts [1986], it seems that in general there has been a clear and continuous shift in the French import market for chairs towards products from countries charging higher prices and/or to more expensive product groups. A trend towards more "expensive" suppliers appears obvious since 1983, with practically no changes during the period 1980–1983. Furthermore a slight trend towards importing more expensive products is evident, but this is not as pronounced as the replacement of low-priced by high-priced supplying countries.

For a closer analysis, the results for the years 1989–1990 are considered. The A&R method reports a slight decrease in "total quality" (negative change in total quality, ∂tq). This contradicts the interpretation of the variable "change in country effect", which indicated a shift towards more expensive supplying countries, and the "change in product effect" (virtually no change). One also has to note that the "interaction term" (IAT), which is used by the method to correct for overestimation in the case when both the country and the product effects move in the same direction, is clearly bigger than either of the main effects. This raises questions about what is hidden behind the IAT, as suggested by Menzler-Hokkanen [1994]. Thus, the results from applying the A&R method in this case yield inconclusive results.

What changes and shifts did actually take place in the French import market for chairs from 1989 to 1990? Trade data indicate at least four types of movement, which should be considered:

First, countries with a UV well below the @UV, but which increased their trade share appreciably during the study period. These were Indonesia, China (P.R.), Spain, the Netherlands, Thailand, Poland and Austria, which increased their combined trade share by 2.44 percentage points (from 15.07 per cent of the import market to 17.51 per cent; Indonesia and China, however, approximately doubled their own trade share). Of these countries, the Netherlands and Indonesia also increased their UV, while the others decreased theirs (with no change for Austria). The products from these countries clearly indicate a shift towards lower-priced supplying countries.

Second, a group of four countries had a UV well below the @UV, and decreased their trade share appreciably: Romania, GDR (German Democratic Republic), Philippines, and Taiwan, which together accounted for a loss of 4.26 percentage points in TS. All these countries increased their UV, but the GDR negligibly. The products from these countries indicate a shift towards higher-priced supplying countries.

Third, countries with a UV well above the @UV, and which increased their trade share, were Belgium/Luxembourg, Italy, and the United Kingdom, with a rise in the TS by 1.94 percentage points. Belgium/Luxembourg decreased their UV, but Italy and the United Kingdom increased theirs.

Fourth, the group of countries with a UV well above the @UV, but with a declining trade share. These were the Fed. Rep. of Germany (FRG), Sweden, and Norway. They only lost 0.41 percentage points of the TS; while all were raising the UV (the FRG only slightly). A residual group, naturally, consists of countries and products which do not affect appreciably the @UV during the study period.

The product group effects reveal considerable shifts in the French import market for chairs: There is a divergence from the medium-priced product categories towards the most expensive (9401.61-00) as well as the least expensive product categories (9401.80-00). The former increased its TS by 1.5 percentage points, and the latter by 0.9 percentage points. All other categories decreased their TS. The UV of three product categories increased clearly (including 9401.61-00), whereas the others remained practically the same (two decreased very little, including 9401.80-00). These product effects clearly follow the pattern described in Menzler-Hokkanen [1993], simulation 1, where symmet-

rical shifts in quantity from medium-priced to higher- and lower-priced suppliers were simulated.

Considering that clear movements in several different directions were actually taking place in the French import market, the outcome of applying the A&R method appears meager. Clearly, slight unidirectional changes, as indicated by the method, are unsatisfactory and do not reflect the many, often counteracting changes in the market. Therefore, we must conclude that the conventional use of the bilateral index technique, as proposed by Aw and Roberts [1986], is misleading and unsatisfactory.

3. Comparison of Refined Analytical Methods

For a detailed assessment of what is behind the overall changes in the @UV, it appears logical that intermediate steps in the A&R analysis could be used before summing up the effects of different contributing countries and/or product groups. Analogous to the comparison based on simulated data in Menzler-Hokkanen [1993], analytical data concerning the French import market for chairs are detailed in Tables 2 and 3, for the years 1980–1990, using both the extended A&R method and the M-H method.

Note that the A&R impact figures in these tables represent only the "pure price effect"; additionally the "quality effect" has to be taken into account. Unfortunately, the "quality" component of A&R [see Aw and Roberts, 1986] can only be obtained for the aggregate figure, and not by country or product breakdown. Therefore, it cannot be incorporated into the A&R impact column. Instead, the aggregate "quality" component is shown at the end of Tables 2 and 3, and should be considered together with the individual impact figures of A&R, for the total impact.

In general, the results yielded by the two methods are rather close: they obviously measure similar phenomena. Considering that the A&R column only represents the "pure price effect", it can be estimated that for most comparisons the price effect alone accounts for about 50–90 per cent of the country impact.

The agreement between the M-H and A&R methods appears to be best for the countries or product categories whose UV is close to the @UV, because then changes in trade shares have only a slight effect on the @UV. For groups whose UV deviates most from the @UV, the differences in results are most distinct. Thus, for example, in 1981–82 imports from Romania contributed to lowering the @UV by −34.6

Table 2 – *Country Impact on the Change in @UV*

Exporting country	1980–81		1981–82		1982–83		1983–84	
	M-H	A&R[a]	M-H	A&R	M-H	A&R	M-H	A&R
EC								
B/L	4.2	7.4	−19.6	−16.7	16.6	13.5	16.1	26.6
DEN	−0.6	−0.8	2.4	1.9	2.5	2.7	0.1	−0.1
ESP	11.8	11.3	17.2	2.6	−2.0	−4.9	4.4	8.6
FRG	6.3	5.3	28.7	19.4	9.0	12.1	−0.3	−15.0
ITA	64.8	65.3	71.7	58.1	67.6	64.2	38.8	57.1
NLD	9.0	3.5	2.3	2.6	8.0	5.4	0.8	1.3
UKD	−1.7	−3.3	0.5	5.2	2.0	1.2	−0.8	1.4
EFTA								
AUT	0.3	0.3	−0.3	−0.4	−0.1	−0.2	−0.8	−0.7
FIN	0.1	−0.0	0.1	0.5	−0.1	0.0	1.2	4.2
NOR	0.7	1.2	−1.5	−0.6	0.5	1.8	1.4	0.8
SWE	0.2	0.5	2.8	2.7	−5.0	−5.5	3.5	5.8
SWI	4.9	2.9	−4.8	3.9	1.7	1.0	−1.2	−4.4
Eastern Europe								
BUL	0.7	0.3	3.6	0.3	−0.3	−0.1	0.3	0.1
CSL	−0.5	0.0	6.5	0.1	−3.5	−0.0	2.4	0.9
GDR	1.1	0.1	−8.3	2.4	−9.5	1.8	12.3	7.3
HUN	−0.2	−0.3	4.0	1.4	−0.8	0.3	−0.1	0.1
POL	0.3	0.4	2.7	1.2	0.1	−0.0	0.3	0.8
ROM	−6.6	1.2	−34.6	1.8	2.5	−1.2	13.1	1.1
SOV	0.3	0.1	−0.4	−0.0	0.5	0.0	0.2	0.0
YUG	−1.4	−0.5	−2.3	−0.6	2.3	1.9	6.9	−0.8
Asia								
IND	0.0	0.1	0.2	0.1	0.1	−0.1	0.1	0.1
JAP	−0.0	0.0	−0.0	0.0	0.0	0.0	0.0	0.1
MAL	−0.1	−0.2	0.4	0.0	0.0	0.0	0.0	0.0
PHI	2.6	2.0	2.0	1.3	2.8	2.6	0.3	0.9
PRC	5.8	0.1	14.1	3.0	4.7	1.4	1.2	0.5
ROC	0.7	0.5	4.6	3.7	−2.1	−2.0	−2.7	−0.6
SGP	0.0	0.0	−0.1	−0.1	0.1	0.0	−0.1	0.0
THL	−0.4	1.7	2.0	1.0	1.7	2.5	3.2	3.3
USA	−0.2	0.7	5.9	5.2	0.7	1.3	−0.8	0.6
"Total quality change" (A&R)		9.0		−40.1		−27.1		64.3

[a] This column only gives the breakdown of the "price effect" of the A&R method. For the total impact, one also has to consider the "quality effect", given in the last row of this table (no breakdown possible, see text for explanation).

for French Imports of Chairs, 1980–1990 (per cent)

1984–85		1985–86		1986–87		1988–89		1989–90	
M-H	A&R	M-H	A&R	M-H	A&R	M-H	A&R	M-H	A&R
15.4	14.2	42.6	71.7	0.2	−1.2	20.9	40.3	7.0	−9.0
0.7	1.1	−1.8	−3.3	2.7	2.8	−0.5	−2.0	−0.5	−1.3
5.9	5.3	54.4	20.6	0.6	0.3	4.1	−0.8	−20.2	−22.7
11.0	9.2	51.4	47.6	17.5	20.4	−18.7	−23.1	−0.5	0.4
39.7	54.9	−64.9	−97.6	108.3	100.1	57.3	70.8	62.5	94.8
3.0	4.7	24.2	29.3	−20.6	−13.1	−23.2	−20.2	−2.2	5.3
0.4	−0.7	−37.8	−51.2	14.4	11.8	1.6	−1.3	4.7	5.2
−1.0	0.1	−0.4	1.6	0.6	0.2	1.6	−0.2	−1.1	0.4
−0.3	−0.9	−0.2	−0.1	0.6	0.2	−0.0	0.1	0.3	0.5
0.2	0.4	1.7	1.5	0.6	−0.2	−5.0	−14.4	3.1	8.6
1.3	2.7	−2.3	−9.1	−0.5	−1.2	1.8	2.7	1.5	4.4
2.4	1.9	−2.7	−4.4	−0.5	−6.3	10.8	19.0	−0.5	0.5
−0.3	−0.2	−1.7	−0.1	2.0	0.4	0.3	0.4	0.4	0.2
−0.7	−0.0	4.5	0.6	−0.7	0.2	−2.2	0.1	−0.4	0.1
12.5	7.5	21.9	6.7	−4.6	−5.6	1.3	1.6	21.9	1.2
−0.3	0.1	5.3	1.3	−3.2	−1.1	0.6	0.7	−0.4	0.1
0.0	−0.0	−0.5	−1.0	−0.8	−0.4	−3.2	−2.1	−3.1	−0.6
11.0	1.4	38.2	3.0	1.2	−1.3	36.2	2.9	47.8	4.9
−0.6	0.0	1.8	0.3	−0.7	−0.1	−5.7	−0.9	−2.5	−1.2
2.0	0.7	−0.6	−2.7	2.6	−0.8	7.0	3.7	−5.5	−4.0
0.0	0.0	−0.5	−0.5	−0.4	0.1	−2.6	0.2	−5.1	2.7
−0.0	−0.0	−0.1	0.0	0.7	0.0	0.0	0.0	0.0	0.0
−0.0	0.0	−0.0	0.0	−0.1	0.1	0.0	0.1	−1.0	−0.4
0.0	0.0	−3.9	−5.5	−1.7	−0.3	0.9	1.9	14.7	26.6
0.1	0.2	−5.4	−4.1	−2.1	−0.2	2.1	5.5	−11.7	−2.3
0.4	0.0	−10.7	−4.0	−2.5	0.1	−2.8	1.9	5.2	2.6
0.0	0.0	−0.0	0.0	0.2	0.0	2.7	5.3	−2.4	−4.8
−3.0	−2.6	−16.5	−11.4	−13.1	−2.7	8.8	−0.8	−9.6	−7.9
0.5	0.1	4.0	4.3	−0.7	−2.1	5.9	8.6	−2.6	−4.2
	14.4		−27.4		79.0		1.0		−22.7

Table 3 – *Product Effect (in per cent) on the Change in @UV for French Imports of Chairs, 1980–1990*

Year	NIMEXE							Total quality change (A&R)
	9401.31	9401.39	9401.41	9401.45	9401.49	9401.60	9401.70	
1980–81								
M-H	22.9	25.6	−31.2	7.3	55.7	4.4	15.4	
A&R[a]	3.4	20.6	8.0	0.5	29.3	5.5	32.7	9.0
1981–82								
M-H	9.5	−5.2	2.0	5.9	112.0	9.2	−33.5	
A&R	5.3	4.5	11.2	4.3	91.1	4.5	−20.9	−40.1
1982–83								
M-H	−2.9	1.7	9.2	−3.4	75.6	7.0	12.9	
A&R	4.3	5.2	7.5	0.4	62.8	5.4	14.4	−27.1
1983–84								
M-H	−13.8	24.1	29.6	5.9	45.0	7.0	2.2	
A&R	2.9	31.4	8.1	9.2	37.7	10.3	0.4	64.3
1984–85								
M-H	4.7	19.7	6.8	3.5	74.7	−1.8	−7.6	
A&R	6.1	20.3	0.2	1.4	81.8	−1.5	−8.3	14.4
1985–86								
M-H	−59.0	59.6	−29.3	−9.8	247.1	−28.5	−80.0	
A&R	−30.7	36.9	−36.2	−1.8	191.9	−14.2	−45.8	−27.4
1986–87								
M-H	31.5	64.1	57.1	−7.7	33.0	−14.3	−63.7	
A&R	35.8	127.2	27.9	−7.2	−29.7	−7.9	−46.2	79.0

	NIMEXE						Total quality change (A&R)
	9401.50-00	9401.61-00	9401.69-00	9401.71-00	9401.79-00	9401.80-00	
1988–89							
M-H	25.1	92.0	42.2	22.8	−5.7	−76.5	
A&R	15.1	82.2	13.4	19.4	4.6	−34.7	1.0
1989–90							
M-H	18.3	89.3	68.1	−4.5	12.8	−83.8	
A&R	12.3	74.7	22.3	−4.3	2.1	−7.0	−22.7

[a] See footnote in Table 2.

per cent (share of the actual change) according to the M-H method, but the A&R method suggests a negligible impact (+1.8 per cent, Table 2). Similarly, for 1989–90, the A&R method indicates that imports from Belgium and Luxembourg contributed to lowering the @UV (−9.0 per cent), whereas the M-H method indicates a positive effect (+7.0 per cent). Some of the largest discrepancies occur for product effects: for example, the M-H method shows in 1986–87 a positive impact of 33.0 per cent for NIMEXE 9401.49, but the A&R method suggests a decrease of −29.7 per cent.

Assessing in depth the differences for 1989–1990, which were detailed above, it is evident that the methods give a different direction of impact (increasing or decreasing) for seven countries, and that in some cases the magnitude of change is quite different. These discrepancies arise precisely as shown in Menzler-Hokkanen [1993] with the simulations based on hypothetical data. For example, the indication with the A&R method that the @UV is lowered by Belgium/Luxembourg (−9.0) is due to only taking into account the small UV decrease from 7.20 ECU/kg in 1989 to 7.10 ECU/kg in 1990, and ignoring the fact that the TS increased at the same time from 10.9 per cent to 12.6 per cent, which far more than compensated for the UV decrease in terms of affecting the @UV.

Note that it is difficult – indeed, impossible – to utilize the information concerning the "change in total quality" of the A&R method, which is designed to correct for the effect of changing trade shares. As it cannot be broken down into the categories concerned, the indications given by the A&R method remain inconclusive.

Thus, it is clear that even the extended version of the A&R calculation method (intermediate steps in the calculation), are for some elements misleading, and therefore cannot be used for a more detailed analysis of the changes in the market. On the other hand, the method of Menzler-Hokkanen [1994] and Menzler-Hokkanen [1993] provides a reliable basis for further analysis.

Further examples of the advantages associated with the M-H method of calculation are given in Table 4, in which the contribution of imports from individual countries in specific sub-items to changes in @UV are presented. In each year, a few elements actually determine the behaviour or movements within the whole import sector. For example, 73 per cent of the @UV change in the French import market for chairs from 1989 to 1990 was due to one single source: chairs from Italy in commodity group 9401.61-00. Similarly, 14 per cent of the @UV increase was due to imports from Belgium/Luxembourg in

Table 4 – *The Contribution of each Product Group from Selected Exporting Countries to the Change in the Aggregate Unit Value of Chairs Imported by France in 1989–90*

Country	Product category (NIMEXE)						Impact	
	50-00	61-00	69-00	71-00	79-00	80-00	in ECU/kg[a]	in %[b]
B/L	0.452	13.825	−2.410	1.610	−1.064	−5.461	0.014	7.019
DEN	−0.005	0.254	−0.463	0.459	−0.278	−0.468	−0.001	−0.512
ESP	−1.573	1.946	6.238	1.071	1.991	−29.578	−0.041	−20.207
FIN	0.000	0.115	0.066	0.138	0.000	0.000	0.001	0.325
FRG	0.540	−0.032	−0.238	−4.404	5.670	−1.965	−0.001	−0.470
ITA	−1.003	72.727	20.774	6.460	−1.690	−35.771	0.126	62.525
NLD	0.672	−0.065	−3.616	3.405	7.155	−9.748	−0.005	−2.191
NOR	0.000	3.322	0.073	−0.317	0.000	−0.041	0.006	3.096
SWE	0.000	0.984	0.079	−0.000	−0.104	0.556	0.003	1.540
UKD	0.000	3.233	0.570	0.844	0.156	−0.178	0.010	4.709
All countries	17.73	88.19	67.00	−2.88	12.42	−82.46	0.205	100.0

[a] Overall impact of each country in absolute terms (ECU/kg). – [b] Overall impact of each country in relative terms (in per cent).

commodity group 9401.61-00. In other years, some other elements may explain most of the changes. When single sources are so dominant in explaining the behaviour of the overall @UV, it appears misleading to generalize them into broad, ambiguous concepts such as "country effect", or "product effect" as the A&R method does.

In contrast to Table 1 and its interpretation, the information given in Tables 2–4 dismisses such overall "trends" as meaningless. For example, from 1985 to 1986 there is a "trend towards lower-priced countries and/or products", according to the A&R interpretation (negative charge in total quality). In reality, however, this was caused mainly by a slight decrease in the price of products from Italy as the leading supplier, and not by major shifts between the supplying countries and/or products. In the same year, there were many other shifts between countries in trade shares, or changes in unit values, but the interpretation of a general trend towards "less expensive" countries and/or products is not substantiated by actual data.

4. Analyzing Country and Product Substitution

Detailed information on the impact of each element on the change in @UV can be obtained with the M-H method. A table such as Table 4 can be used in many ways to further analyze and to draw conclusions about the market and the changes which are taking place. One can simply rank the impact figures from the highest to the lowest for each element, over all country and product categories, to find out the elements which caused most of the changes during the study period. As an example, the five elements with the largest decreasing and increasing impacts for the period 1989–90 in the French import market for chairs are given:

Five biggest (+) and (−) impact figures in 1989–1990

Country	*Product*	*Impact %*	*Country*	*Product*	*Impact %*
ITA	9401.80-00	−35.8	ITA	9401.61-00	72.7
ESP	9401.80-00	−29.6	ROM	9401.69-00	36.9
THL	9401.71-00	−15.3	ITA	9401.69-00	20.8
YUG	9401.61-00	−12.4	PHI	9401.50-00	14.7
NLD	9401.80-00	−9.7	B/L	9401.61-00	13.8

These five elements account for 102.8 per cent of the total change in the negative direction (to lower the @UV) and for 158.9 per cent of the change in the positive (increasing) direction of the @UV. Clearly, most of the total of the 174 elements are close to zero, having no impact on the @UV in this particular comparison. The M-H method, however, easily picks out the elements which are important for the change in the study period. Note also that the two biggest effects *in opposing directions* are two different chair groups from Italy. In such a variable market situation it is misleading to condense all the movements into a vague "country effect".

The information from the M-H analysis provides a reliable basis for examining changes in the market. The countries responding similarly to market forces can be grouped together using discriminant analysis [e.g. Johnson and Wichern, 1988]. Such an analysis of Table 4 provides seven groups. The largest block consists of those 14 French trading partners whose commodity groups do not affect the @UV in the study period (1989–1990). On the other hand, each of the other six groups behaves individually. Italy and Belgium/Luxembourg account for practically all the changes involving product group 9401.61-00, some of 9401.69-00, and most of 9401.80-00; similarly

Thailand and the Philippines explain virtually all the changes in 9401.50-00, and some of 9401.71-00, but have no effect on the other groups. Such analyses are necessary to yield a correct picture of the actual changes in the market, instead of the ambiguous results that are obtained from the simple application of the bilateral index technique as in Aw and Roberts [1986].

V. Conclusions

Viewed against the analysis of actual market prices, unit values are second-best proxies for the price or quality component in international trade. Yet, they are still the only major source available. Given the fact that such data are usually expressed in an aggregate form, it is imperative that the aggregates do not reflect non-price elements such as changes in trade shares. For some reasons, such changes are far from being negligible. To mention two of them, former Socialist countries have increasingly captured trade shares in recent years after prohibitive trade barriers of Western countries were relaxed. However, given the instability in the macroeconomic framework of these countries, there was much volatility in export patterns so that gains in trade shares could often not be sustained. Admittedly, changes in trade shares were also accentuated by aggressive pricing policies giving rise to anti-dumping procedures, but in many cases trade shares changed without shifts in import price ratios. Furthermore, up-grading activities have emerged in rapidly growing exporters of manufactures as a response to protectionist policies in Western markets. Such activities were rewarded by gains in trade shares without being reflected in price changes. In sum, country-specific effects have become much more important. To disregard them through aggregation, is the major shortcoming of the Aw and Roberts [1986] method. This is even more important, as the authors themselves and other researchers [Hufbauer and O'Neill, 1972; Rodrik, 1988; Faini and Heimler, 1991a, 1991b; de Melo and Winters, 1993] apply the approach to identify the impact of quality changes and non-tariff barriers (NTB) on the direction and pattern of trade flows. It is well known that such issues are product-specific and vary substantially between items. Non-tariff barriers, for instance, are very selectively applied and differ even within four-digit NIMEXE product groups. Therefore, any aggregation tends to bias estimates of NTB coverage upwards and to distort the results (for the choice of appropriate aggregation levels, see for instance Balassa and Balassa [1984]; Nogues et al. [1985, p. 31]; Laird

and Yeats [1990, p. 304]). Similar arguments hold true for measuring the quality impact.

A case study analyzing imports of chairs into the French market illustrates the technique developed in Menzler-Hokkanen [1994] and Menzler-Hokkanen [1993] based on actual data. In addition to the precision in assessing country and product substitution in imports under all market conditions, the M-H method allows for an accurate breakdown of changes in the market performance by individual item, which then can be used to study market dynamics in import markets.

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 misleading. In our paper, for example, a single group of chairs exported from Italy to the French market could be considered to be responsible for all the changes in the aggregated UV. Most other groups of chairs 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 label them as "country effect" or "product effect".

Appendix

NIMEXE Groups Analyzed in the Study

1984–1987:

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 backers 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:

9401.50-00	Seats of cane, osier, bamboo or similar materials
9401.61-00	Upholstered seats, with wooden frames (other than those of heading N 94.02), (Excl. 9401.10-10 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)

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	FRG	West Germany

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Abstract: Product and Country Substitution in Imports: An Empirical Comparison of Theoretical Concepts. – The paper focuses on the shortcomings of current unit-values based measures for estimating product and country substitution in imports. The results of the bilateral index number technique in measuring changes in the country composition or product mix of imports were found to be inadequate, which was shown in an analysis of data on the French import market for chairs. An improved technique is briefly summarized, and its applicability compared with the bilateral index number technique. The new method performed accurately and provided a reliable basis for a refined analysis of changes within import markets. JEL No. C43, F11

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Zusammenfassung: Substitution von Produkten und Herkunftsländern bei Importen. Ein empirischer Vergleich theoretischer Konzepte. – Die Verfasser konzentrieren sich auf die Mängel der auf Importeinheitswerten basierenden Maße, mit denen die Substitution von Produkten und Herkunftsländern im Falle von Importen ermittelt werden soll. Die Ergebnisse der Technik, bilaterale Indexwerte bei der Messung von Veränderungen in der Zusammensetzung der Herkunftsländer oder Importgüter zu benutzen, erwiesen sich als unzulänglich, wie sich bei der Analyse von Daten über die französischen Importe von Stühlen zeigte. In dem Aufsatz wird eine verbesserte Technik kurz skizziert und deren Anwendbarkeit mit der Technik bilateraler Indexwerte verglichen. Das neue Verfahren bewährte sich und lieferte eine verläßliche Grundlage für eine verfeinerte Analyse von Veränderungen auf den Importmärkten.