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Central Bureau of Statistics, P.B. 8131 Dep, 0033 Oslo 1, Norway

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THE METHOD OF CONSTANT-MARKET-SHARES ANALYSIS REVISITED

BY

JAN FAGERBERG AND GUNNAR SOLLIE

CONTENTS

ABSTRACT

This paper reviews the development of the constant-market-shares (CMS) analysis of export growth. It is argued that the method can be considerably improved by taking the "index" or "base year" problem more seriously into account. An alternative formulation of the method is developed which in addition to the familiar CMS-effects also allows for the calculation of effects reflecting the ability of each country to adapt its export structure to the changes in the commodity and country composition of world imports.

1. INTRODUCTION[1]

In the fifties several studies appeared focusing on structural changes in world trade and production and the consequences of these changes for the export performance and growth of individual countries[2]. One of the earliest contributers, Tyszynski (1951), gave the following outline of the theoretical perspective underlying much of this work:

"Over the last hundred years, or so, the gradual industrialization of different areas of the world has led to significant changes in the nature of the demand for exports of manufactured commodities. It is a well established proposition that industrial equipment and modern means of transport considerably gained in relative importance at the expense of a number of consumer goods, notabably textiles. It is also well known that, in the course of time, the old manufacturing nations exhibited greatly varying degrees of adaptability to this process. It was the purpose of this investigation to give a clearer picture of these changes in world demand for exports and in the competitive position of the leading manufacturing nations of the world .."

To find out whether the changes in the market shares of different countries on the world market could be explained by the inital commodity composition of each country's exports, or whether other factors should be called for, he calculated what the aggregate market share of a country on the world market would have been if its market shares in individual commodity groups had remained constant. He refered to the difference between this hypothetical market share and the initial share as change in the market share caused by structural changes in world trade. The residual - the difference between the actual (final) and the hypothetical market share - was refered to as change caused by changes in competetiveness. This method is what later became known as "constant-market-shares analysis".

Calculations of the type carried out by Tyszynski soon became popular in applied international economics[3]. A detailed discussion of the method and its possible applications was given by Leamer and Stern (1970) in their influential book on quantitative international economics. They also proposed a new formulation of the method which has been used in a number of studies. Even if at a first glance it does not look so[4], they followed Tyszynski to a considerable extent by calculating Tyszynski's "structural" effect, which they labeled commodity composition effect, and a competetiveness effect which they, as Tyszynski, calculated as a residual. They did, however, add one "intermediate" effect, the effect of the market distribution of a country's exports[5]. The idea behind this is that since the imports of different countries grow at different rates, the geographical distribution of a country's exports may also affect the export growth of the country.

While it was found to be a useful tool by Leamer and Stern, a much more critical

evaluation of the method was given by Richardson (1971). He stressed[6] that the commodity composition and market distribution effects seemed to be interdependent[7], i.e. that the order in which they are calculated matters, and that the values and signs of the various effects may change if the final instead of the initial year of the period under consideration is used as base year. However, in spite of his criticism (which we find basically correct, though not exhaustive), he did not propose any new formulation of the method[8].

The purpose of this paper is to develop an alternative method which avoids some of the problems and weaknesses embodied in the methods outlined above. The next section is devoted to the "several commodities/one market" case studied by Tyszynski, moving in the third section to the "several commodities/several markets" case. In both cases our principal arguments are that the CMS-method can be considerably improved in theoretical consistency as well as in empirical applicability, if the "index" or "base year" problem is treated more seriously, and if the problematic practice of calculating some effects as residuals without showing explicitly how they are to be interpreted is abandoned. We have included two appendices; one which analyzes the formal relation between Leamer and Stern's and our alternative method, and one which compares the two different methods applied empirically.

2. THE "SEVERAL COMMODITIES/ONE MARKET" CASE

The main purpose of this section is to show that Tyszynski's residual effect, which he refered to as caused by changes in competitiveness, can be split in two separate effects, both with a clearcut economic interpretation.

The following symbols will be used:

- n - number of commodities,
- $0,t$ - subscripts which refer to the initial year and to the final year of the comparison, respectively,
- X_i^{kl} - country k's exports of commodity i to country l,
- B_i^l - country l's imports of commodity i,
- M^{kl} - market share of country k (macro share of country k) in country l's imports; $M^{kl} = \sum_i X_i^{kl} / \sum_i B_i^l$,

a^{kl} - market shares, by commodity, of country k (micro shares of country k) in country l's imports; row vector of dimension n; $a^{kl} = (a_1^{kl},\ldots,a_n^{kl})$, where $a_i^{kl} = X_i^{kl}/B_i^l$.

b^l - commodity shares of country l's imports; column vector of dimension n; $b^l = (b_1^l,\ldots,b_n^l)'$, where $b_i^l = B_i^l/\Sigma B_i^l$ and ' denotes transposition.

The macro share of country k (M^{kl}) may be written as the inner product of the vector of its micro shares (a^{kl}) and the vector of commodity shares of country l's imports (b^l):

$$(1) \qquad M^{kl} = a^{kl}b^l.$$

The change in M^{kl} between time 0 and time t is

$$(2) \qquad \Delta M^{kl} = M_t^{kl} - M_0^{kl}.$$

Tyszynski calculated the effect of changes in the commodity shares of the market ($b_t^l - b_0^l$), using the micro shares of the initial year (a_0^{kl}) as weights, and a competitiveness residual. Regarding the last term, he explicitly assumed that it represented a measure of changes in the micro shares. However, as pointed out by Baldwin (1958) and Spiegelglas (1959), this is the case only as long as some kind of mix of initial and final year weights (Laspeyres and Paasche indices), are used in the calculations. In other words, if the first effect is calculated by using initial year weights, then the second effect must necessarily be calculated by using final year weights, if the sum of the two effects is going to be equal to the change in the macro share. If either Laspeyres or Paasche indices are used throughout the calculations, a third (residual) term necessarily appears[9], as shown below (Laspeyres indices or initial year weights are used)

$$(3) \qquad \Delta M^{kl} = \Delta M_a^{kl} + \Delta M_b^{kl} + \Delta M_{ab}^{kl}.$$

The first of these terms (ΔM_a^{kl}) is the effect of changes in the micro shares (market share effect), while the second (ΔM_b^{kl}) is the familiar commodity composition effect calculated by Tyszynski. The third (residual) term (ΔM_{ab}^{kl}) is the inner product of a vector of changes in micro shares and a vector of changes in commodity shares.

$$(4) \qquad \Delta M_a^{kl} = (a_t^{kl} - a_0^{kl})b_0^l,$$

(5) $$\Delta M_b^{kl} = a_0^{kl}(b_t^l - b_0^l),$$

(6) $$\Delta M_{ab}^{kl} = (a_t^{kl} - a_0^{kl})\,(b_t^l - b_0^l).$$

Does the residual have any economic meaning? In our opinion it does, because its sign and value depends on the correlation between the changes in the micro shares of the country and the changes in the commodity composition of the market. A formal proof of this statement is given below. For the sake of simplicity, the superscripts are omitted in the proof:

(7) $$\Delta M_{ab} = (a_t - a_0)\,(b_t - b_0).$$

The correlation coeffecient between the changes in micro shares and the changes in commodity shares, r_{ab}, is defined by

(8) $$r_{ab} = \frac{(a_t - a_0 - \bar{a}_t + \bar{a}_0)\,(b_t - b_0 - \bar{b}_t + \bar{b}_0)}{\|a_t - a_0 - \bar{a}_t + \bar{a}_0\|\,\|b_t - b_0 - \bar{b}_t + \bar{b}_0\|}.$$

The symbol $\|\|$ denotes the norm (length) of the vector, while $\bar{a}_t$, $\bar{a}_0$, $\bar{b}_t$ and $\bar{b}_0$ are vectors of means, defined by

(9) $$\bar{a}_t = \frac{1}{n} a_t ee',$$

(10) $$\bar{a}_0 = \frac{1}{n} a_0 ee',$$

(11) $$\bar{b}_t = \frac{1}{n} e,$$

(12) $$\bar{b}_0 = \frac{1}{n} e,$$

where e is a column vector of ones and ' denotes transposition. It follows from (8)-(12) that

(13) $$\|a_t - a_0 - \bar{a}_t + \bar{a}_0\|\,\|b_t - b_0\|\,r_{ab} = (a_t - a_0 - \frac{1}{n} a_t ee' + \frac{1}{n} a_0 ee')\,(b_t - b_0).$$

By rearranging:

$$(14)\quad \|a_t - \bar{a}_0 - \bar{a}_t + a_0\| \, \|b_t - b_0\| \, r_{ab} = (a_t - a_0)(b_t - b_0) - \frac{1}{n}(a_t - a_0)\, ee'(b_t - b_0).$$

Since the sum of the commodity shares is always equal to one, it follows that

$$(15)\quad e'(b_t - b_0) = 0.$$

Substituting (15) into (14) gives

$$(16)\quad \|a_t - a_0 - \bar{a}_t + \bar{a}_0\| \, \|b_t - b_0\| \, r_{ab} = (a_t - a_0)(b_t - b_0).$$

By substituting (7) into (16) the residual can be expressed as the product of the correlation coeffecient between the changes in micro shares and the changes in commodity shares, and two terms which are necessarily non-negative. The first of these terms is a measure of the spread of the changes in micro shares, while the second is a measure of the changes in commodity shares (superscripts are reintroduced):

$$(17)\quad \Delta M^{kl}_{ab} = \|a^{kl}_t - a^{kl}_0 - \bar{a}^{kl}_t + \bar{a}^{kl}_0\| \, \|b^{l}_t - b^{l}_0\| \, r^{kl}_{ab}.$$

Thus, this third effect indicates to what degree a country has succeeded in adapting the commodity composition of its exports to the changes in the commodity composition of the market. We have therefore chosen to label it the commodity adaptation effect[10].

3. THE "SEVERAL COMMODITIES/SEVERAL MARKETS" CASE

The interpretation of the third (residual) term in the "several commodities/one market" case is quite simple and may to some extent be understood intuitively[11]. In this section we try to extend the kind of reasoning developed in the previous section to the more complicated "several commodities/several markets" case. As in the previous case we use Laspeyres indices throughout the calculations.

The following symbols will be used:

s - number of countries,

M^k - market share of country k in world imports; $M^k = \sum\sum_{li} x_i^{kl} / \sum\sum_{li} B_i^l$,

m^k - macro shares of country k in world imports; row vector of dimension s; $M^k = (M^{k1}, \ldots\ldots, M^{ks})$,

c - country shares of world imports; column vector of dimension s; $c = (c^1, \ldots\ldots, c^s)'$, where $c^l = \sum_i B_i^l / \sum\sum_{li} B_i^l$ and ' denotes transposition.

The market share of country k in world imports (M^k) may be written as the inner product of the vector of its macro shares (m^k) and the vector of country shares of world imports (c):

$$(18) \qquad M^k = m^k c.$$

The change in M^k between time 0 and time t is

$$(19) \qquad \Delta M^k = M_t^k - M_0^k.$$

The change in the market share (ΔM^k) may be split into three effects

$$(20) \qquad \Delta M^k = \Delta M_m^k + \Delta M_c^k + \Delta M_{mc}^k,$$

where

$$(21) \qquad \Delta M_m^k = (m_t^k - m_0^k) c_0,$$

$$(22) \qquad \Delta M_c^k = m_0^k (c_t - c_0),$$

$$(23) \qquad \Delta M_{mc}^k = (m_t^k - m_0^k)(c_t - c_0).$$

The first effect (ΔM_m^k) represents the changes in the macro shares weighted by initial year country shares, while the second is the changes in the country shares weighted by initial year macro shares (market composition effect). The third term can be interpreted as the degree of success of the country in adapting the market composition of its exports to the changes in the country composition of world imports (market adaptation effect). Since the proof and the subsequent interpretation is analogous to the argument of the previous section, we

just state the result of the proof here. Let r^k_{mc} be the correlation coefficient between the changes in macro shares and the changes in country shares, and let $\bar{m}^k_0$ and $\bar{m}^k_t$ be vectors of means, then

$$(24) \qquad \Delta M^k_{mc} = \| m^k_t - m^k_0 - \bar{m}^k_t + \bar{m}^k_0 \| \, \| c_t - c_0 \| \, r^k_{mc}.$$

By substituting (1) into (21), and by taking into account (2)-(6) and the definition of m^k, ΔM^k_m may be written as the sum of three effects:

$$(25) \qquad \Delta M^k_m = \Delta M^k_a + \Delta M^k_b + \Delta M^k_{ab},$$

$$(26) \qquad \Delta M^k_a = \sum_l (a^{kl}_t - a^{kl}_0) b^l_0 c^l_0 ,$$

$$(27) \qquad \Delta M^k_b = \sum_l a^{kl}_0 (b^l_t - b^l_0) c^l_0 ,$$

$$(28) \qquad \Delta M^k_{ab} = \sum_l (a^{kl}_t - a^{kl}_0)\,(b^l_t - b^l_0) c^l_0 .$$

The first effect (ΔM^k_a) is the effect of changes in the micro shares of country k in each market weighted by the commodity composition of each market and the country composition of world imports in the initial year (market share effect). Similarily, the second effect (ΔM^k_b) may be labeled commodity composition effect and the third (ΔM^k_{ab}) commodity adaptation effect. Since the proof and the subsequent interpretation in this latter case is quite analogous to the previous cases, we just state the result of the proof here:

$$(29) \qquad \Delta M^k_{ab} = \sum_l \| a^{kl}_t - a^{kl}_0 - \bar{a}^{kl}_t + \bar{a}^{kl}_0 \| \, \| b^l_t - b^l_0 \| \, r^{kl}_{ab} \, c^l_0 .$$

To sum up, the change in a country's market share in world imports may be split into five effects:

ΔM^k_a - the market share effect,

ΔM^k_b - the commodity composition effect,

ΔM^k_c - the market composition effect,

ΔM^k_{ab} - the commodity adaptation effect,

ΔM^k_{mc} - the market adaptation effect,

such that

$$(30)\quad \Delta M^k = \Delta M^k_a + \Delta M^k_b + \Delta M^k_c + \Delta M^k_{ab} + \Delta M^k_{mc}.$$

It may be of some interest to see how our formulation of the method relates to the more familiar Leamer and Stern formulation. Since this is analyzed in more detail in Appendix 1, we will just summarize the conclusions very briefly here. As shown in Appendix 1, the change in a country's market share in world imports may in the Leamer and Stern formulation of the method be written as the sum of three effects, where the first effect is Leamer and Stern's commodity composition effect, the second their market distribution effect, and the third their competitiveness residual. The main differences between Leamer and Stern's and our formulation of the method are :

In the Leamer and Stern formulation of the method the commodity composition effect and the market distribution effect are interdependent because the former, following Tyszynski (1951), is calculated in the "several commodities/one market" case, while the latter is calculated residually as the difference between a "combined commodity and market distribution" effect, calculated in the "several commodities/several markets" case, and their commodity composition effect[12]. In our formulation of the method, both effects are calculated in the "several commodities/several markets" case with initial year weights to ensure that they are independent of each other.

The third (residual) effect has in Leamer and Stern's formulation of the method been given an important economic interpretation; as a measure of "competitiveness". The argument behind this is the one given by Tyszynski; that the effect reflects the development of the market shares in individual commodity groups. This is, however, misleading, since the effect, as shown by us, can be split into a market share effect, a commodity adaptation effect, and a market adaptation effect[13].

4. CONCLUDING REMARKS

The method of constant-market-shares analysis was developed by Tyszynski (1951) and others, and later extended by Leamer and Stern (1970), in order to study the relation between structural changes in world trade and the export and growth performance of individual countries. Both Tyszynski's and Leamer and Stern's formulations of the method, however, suffer from serious weaknesses; an inconsistent use of indices or base years, and an insufficient discussion of how the residual in the calculations should be interpreted. As a consequence, doubts have been expressed - starting with Richardson (1971) - regarding the inter-

pretation of the various effects and the usefulness of the method in general.

In this article we have tried to develop an alternative formulation of the CMS-method which avoids some of these weaknesses. Contrary to both Tyszynski and Leamer and Stern, we have chosen to use Laspeyres indices throughout the calculations. Furthermore, we have avoided to calculate some of the effects residually without showing how they should be interpreted, as done by both Tyszynski and Leamer and Stern. As a consequence, in the general "several commodities/several markets case" studied by Leamer and Stern, we get five effects instead of Leamer and Stern's three. In our opinion, these additional effects have a clearcut economic interpretation: They reflect a country's ability to adapt its export structure to changes in the commodity and market composition of world imports, respectively. Interestingly enough, this formulation of the method seems to provide a solution to the problem originally posed but only partly solved by Tyszynski; to develop a method which gives a clear picture of the adaptability of different countries to changes in the patterns of world trade.

APPENDIX 1. THE LEAMER AND STERN FORMULATION OF THE METHOD

Leamer and Stern's formulation of the CMS- method differs from both earlier and our alternative formulation in focusing on exports instead of the market share of exports. This difference, however, is not at all essential, and the Leamer and Stern formulation of the method may easily be converted into a "market share" form. To avoid misinterpretations, we have in this appendix chosen to use a notation close to the one used by Leamer and Stern.

The following symbols are needed:

X = value of country k's exports,

X_i = value of country k's exports of commodity i,

X_{ij} = value of country k's exports of commodity i to market j,

r = growth rate of world imports,

r_i = growth rate of world imports of commodity i,

r_{ij} = growth rate of market j's imports of commodity i.

The Leamer and Stern formulation of the method may be written as follows, where superscript(') and no superscript refer to period 2 and period 1, respectively:

$$(A1)\quad X'-X = rX - \underset{i}{\Sigma}(r_i-r)X_i + \underset{ij}{\Sigma\Sigma}(r_{ij}-r_i)X_{ij} + \underset{ij}{\Sigma\Sigma}(X'_{ij}-X_{ij}-r_{ij}X_{ij}).$$

$$\qquad\qquad (I) \qquad (II) \qquad\quad (III) \qquad\qquad (IV)$$

The first term on the right hand side is the effect of the general growth in world imports, the second is the commodity composition effect, the third is the market distribution effect, and the fourth is the competitiveness residual. To convert this equation into a market share form, some additional symbols are needed:

a = country k's market share in world imports,

a_i = country k's market share in world imports, commodity i,

a_{ij} = country k's market share, commodity i, market j,

b_i = commodity i's share of world imports,

b_{ij} = commodity i's share of country j's imports,

c_j = country j's share of world imports,

M = world imports,

M_i = world imports, commodity i,

M_j = country j's imports,

M_{ij} = country j's imports, commodity i.

The difference between the value of a variable in period 2 and period 1 is denoted by Δ.

The following is true by definition:

$$a = X/M \quad , \quad a_i = X_i/M_i \quad , \quad a_{ij} = X_{ij}/M_{ij} \quad , \quad b_i = M_i/M \quad , \quad b_{ij} = M_{ij}/M_j \quad , \quad c_j = M_j/M \; .$$

We may now rewrite equation (A1) by taking into account the symbols and definitions stated above:

Left side:

$$X' - X = a'M' - aM = (a+\Delta a)(M+\Delta M) - aM = \Delta aM(1+r) + aMr \; .$$

Right side(I):

$$rX = aMr \; .$$
$$(I^*)$$

Right side(II):

$$\sum_i (r_i - r)X_i = \sum_i a_i(M_i' - M_i) - aMr = \sum_i a_i[(b_i+\Delta b_i)(M+\Delta M) - b_i M],$$

$$\sum_i (r_i - r)X_i = \sum_i M(a_i b_i r + a_i \Delta b_i M + a_i \Delta b_i r) - aMr = \sum_i a_i \Delta b_i M(1+r).$$
$$(II^*)$$

Right side(III):

$$\sum_{ij}\sum (r_{ij} - r_i)X_{ij} = \sum_{ij}\sum r_{ij}X_{ij}' - \sum_i r_i X_i = \sum_{ij}\sum a_{ij}(M_{ij}' - M_{ij}) - (II^* + aMr),$$

$$\sum_{ij}\sum (r_{ij} - r_i)X_{ij} = \sum_{ij}\sum a_{ij}(b_{ij}'c_j'(M+\Delta M) - b_{ij}c_j) - (II^* + aMr),$$

$$\sum_{ij}\sum(r_{ij} - r_i)X_{ij} = \sum_{ij}\sum a_{ij}M[(\Delta b_{ij}c_j + b_{ij}\Delta c_j + \Delta b_{ij}\Delta c_{ij})(1+r) + b_{ij}c_j r]$$

$$- (II^* + aMr),$$

$$\sum_{ij}\sum(r_{ij} - r_i)X_{ij} = \sum_{ij}\sum(a_{ij}\Delta b_{ij}c_j + a_{ij}b_{ij}\Delta c_j + \underset{(III^*)}{a_{ij}\Delta b_{ij}\Delta c_j} - a_i\Delta b_i)M(1+r).$$

The fourth term on the right hand side(the competitiveness residual) is simply the difference between the left hand side and the three other terms on the right hand side. By subtracting aMr and dividing with M(1+r) on both sides we obtain:

$$(A2)\quad \Delta a = \underset{(I^{**})}{\sum_i a_i\Delta b_i} + \sum_{ij}\sum(a_{ij}\Delta b_{ij}c_j + \underset{(II^{**})}{a_{ij}b_{ij}\Delta c_j} + a_{ij}\Delta b_{ij}\Delta c_j - a_i\Delta b_i)$$

$$+ \sum_{ij}\sum(\Delta a - a_{ij}\Delta b_{ij}c_j - a_{ij}b_{ij}\Delta c_j - a_{ij}\Delta b_{ij}\Delta c_j).$$
$$(III^{**})$$

On the left hand side we now have the change in country k's market share in world imports, while we on the right hand side have three effects; the commodity composition effect (I**), the market distribution effect (II**) and the competitiveness residual (III**). What this residual contains may be seen more clearly by expanding the following equation:

$$\Delta a = \sum_{ij}\sum(a'_{ij}b'_{ij}c'_j - a_{ij}b_{ij}c_j) = \sum_{ij}\sum[(a_{ij}+\Delta a_{ij})(b_{ij}+\Delta b_{ij})(c_j+\Delta c_j)$$

$$- a_{ij}b_{ij}c_j],$$

$$(A3)\quad \Delta a = \sum_{ij}\sum[\underset{(I^{**} + II^{**})}{(a_{ij}\Delta b_{ij}c_j + a_{ij}b_{ij}\Delta c_j + a_{ij}\Delta b_{ij}\Delta c_j)}$$

$$+(\Delta a_{ij}b_{ij}c_j + \underset{(III^{**})}{\Delta a_{ij}b_{ij}\Delta c_j} + \Delta a_{ij}\Delta b_{ij}c_j + \Delta a_{ij}\Delta b_{ij}\Delta c_j)].$$

The first bracket is the sum of Leamer and Stern's commodity and market distribution effects. This sum equals the sum of our commodity and market composition effects and a third term which depends on the correlation between the changes in the commodity composition of the imports of each country and the country composition of world imports. This third term is in our formulation included in the market adaptation effect. Thus, there is no exact correspondence between the sum of Leamer and Stern's two first effects and the corresponding effects in our formulation of the method, and even less so when the effects are viewed seperately. This may bee seen more clearly by expanding Leamer and Stern's commodity composition effect, taking into account the definitions stated above:

$$I^{**} \quad \sum_i a_i \Delta b_i = \sum_{ij} \frac{a_i}{a_{ij}} (a_{ij} \Delta b_{ij} c_j + a_{ij} b_{ij} \Delta c_j + a_{ij} \Delta b_{ij} \Delta c_j).$$

Their market distribution effect may then be written:

$$II^{**} \quad \sum_{ij} \frac{a_{ij} - a_i}{a_{ij}} (a_{ij} \Delta b_{ij} c_j + a_{ij} b_{ij} \Delta c_j + a_{ij} \Delta b_{ij} \Delta c_j).$$

It is thus clear that both effects can be regarded as functions of the term in brackets, and therefore as interdependent. Furthermore it may be noted that the market distribution effect in Leamer and Stern's formulation of the method differs from our market composition effect in that it is primarily dependent of the distribution of the market shares on the different markets in the initial year and not, as in our formulation, of the change in the country composition of world imports. It follows that both size and sign of Leamer and Stern's market distribution effect and our market composition effect may differ. To make a simple (but extreme) example: If the market shares of a country in the different markets are identical for each commodity group ($a_i = a_{ij}$) in the initial year, and the composition of world imports changes dramatically, the market distribution effect as calculated by Leamer and Stern will be zero, while in our formulation this will normally not be the case.

The second bracket in equation (A3) is their competitiveness residual. Since this third effect contains not only our market share effect, but also our commodity adaptation effect and a part of our market adaptation effect, it follows that an economic interpretation of it is very difficult.

APPENDIX 2. A NUMERICAL EXAMPLE

The Norwegian market share in total imports of Denmark , Finland and Sweden (Nordic imports) increased from 4.56 per cent in 1970 to 4.73 per cent in 1981 (based on value figures). The method proposed in this article has, together with Leamer and Stern's formulation of the method, been applied to decompose this change. The analysis was based on value figures for each of the Nordic countries for total imports and imports from Norway of 36 commodities. The decomposition gave the following result:

	Method	
	Our	Leamer and Stern
Actual change	0.17	0.17
Commodity composition effect	- 0.40	-0.55
Market composition/distribution effect	- 0.11	0.06
Commodity adaptation effect	0.13	na
Market adaptation effect	- 0.01	na
Market share effect	0.56	na
Competetiveness residual	na	0.66

The market share and commodity adaptation effects are both positively affected by the increase in the Norwegian market share in Nordic crude oil imports. The latter effect is also positively affected by the increase in the relative importance of crude oil in Nordic imports. In fact, the commodity adaptation effect would have been negative if crude oil had been excluded from the analysis.

Regarding the relation between our and Leamer and Stern's formulation of the method, it is interesting to notice that not only is the numerical value of the commodity composition effect larger when Leamer and Stern's formulation of the method is applied, but also that the sign of their market distribution effect differs from the sign of our market composition effect. The value of their competetiveness residual is also larger than our market share effect, as should be expected since both the market share effect and the commodity adaptation effect are positive while the market adaptation effect is close to zero.

NOTES

1) We are indebted to Aadne Cappelen, Petter Frenger, and Anders Rygh Svendsen, all Central Bureau of Statistics, for valuable comments and suggestions, retaining, however, sole responsibility for the present version. Further comments are highly welcomed.

2) Among the more important contributions may be mentioned Tyszynski (1951), Svennilson (1954), Baldwin (1958), Spiegelglas (1959) and Maizels (1963).

3) The second to apply the method was Svennilson (1954). His formulation of the method was quite close to the one applied by Tyszynski. Among the early contributers to the development of the method and its application were also Baldwin (1958) and Spiegelglas (1959) who independent of each other pointed out the inconsistent use of base years or indices in Tyszynski's and Svennilson's work, and the existence of a third "interaction effect". They did not, however, extend their analyses to the general "several commodities/several markets case".

4) The reason why it does not look so is that Leamer and Stern calculated effects influencing the growth of exports, not the growth of the market share, as Tyszynski did. This difference, however, is not essential, and the formulation proposed by Leamer and Stern may easily be converted into a "market share" formulation as shown in Appendix 1. The only difference between an "export growth" and a "market share" version of the Leamer and Stern formulation of the method is that the effect of the general rise in world demand disappears when changes in export growth are normalized to changes in market shares. For convenience, the "market share" version of the Leamer and Stern formulation of the method will be used throughout this paper.

5) The market distribution effect was in Tyszynski's formulation of the method included in the residual.

6) He also stressed that the common practice of calculating CMS-effects on the basis of values instead of quantities has damaging implications for the interpretation of the CMS-effects. This, however, is a question of data, not of method.

7) This was pointed out already by Leamer and Stern.

8) What he did propose was (1) to calculate the effects with two sets of base years (the initial and the final year) to see how sensitive the structural effects were to a shift in base year, (2) to be careful in selecting different "worlds" for different countries, and (3) to use quantity data instead of value data.

9) This is, in essence, nothing but the well known result from the theory of indices that neither the Laspeyres nor the Paasche index passes the "factor reversal test", cfr. Allen (1975)

10) A zero adaptation effect, however, does not mean that no adaptation takes place, but that the country transforms its export structure - or adapts - at exactly the same rate as the average of all countries exporting to the market in question. A more correct name of the effect would therefore be "relative adaptation effect", but for convenience the term "relative" is dropped.

11) Both Baldwin and Spiegelglas to some extent discussed this third effect, which they labeled "interaction" effect, but without attributing much economic meaning to it. Richardson to some extent saw the importance of the "interaction" effect, which he called "a second measure of competitiveness", but did not, curiously enough, construct a new formulation of the method for the general "several commodities/ several markets" case which explicitly took this into account.

12) For a discussion of this interdependence and its empirical implications, see Appendix 1 and 2, respectively. The "combined" effect is not identical to the sum of our two corresponding effects.

13) However, a part of our market adaptation effect is included in the sum of Leamer and Stern's commodity composition effect and their market distribution effect, as can be seen by comparing our effects as stated earlier with A3 in Appendix 1.

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