MEASURING "THE EFFECTS OF EFTA"

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The lowering of tariffs for trade between the members of a group of countries will through its effects on relative prices, affect economic life in countries, as well inside as outside the group, in numerous ways. A number of the effects, perhaps some of the most important ones, will be of a nature, which makes it impossible to make any quantitative estimates of them on the basis of conventionally available statistics, whereas others may be more easily traced in economic indicators. It is not possible here to go into all possible effects and to assess their probable importance. But in any systematic analysis of the effects of a tariff union or a free trade area, such a survey should be attempted.

If we want to study effects of a set of economic changes, like the introduction of reduced tariffs under EFTA, we have to construct a reference model, an "anti-monde", which enables us to decide how the situation would have been without the change. Such a model will have to rest on a set of hypotheses, and the possible choice of hypotheses is so large that it is necessary to specify in detail the assumptions on which the development in the reference model rests, if the excersice shall be of any use.

In the discussion of the effects of customs unions and free trade areas, the division of these effects into "trade creation" and "trade diversion" has played an important role. Since we propose to measure effects through a comparison between actual figures and hypothetical figures, derived from a reference model, there are two ways of classifying the results:

1)   Results may be classified according to the types of variables which are
compared. By this principle, trade diversion might be defined as the differences
in market shares[1] in foreign trade between actual and hypothetical results, or
as the sum of trade lost by any country when actual figures are compared to
figures from the reference model. Correspondingly, trade creation might be defined
as the difference in import proportions between actual and hypothetical results, or
as the excesses of actual imports from all sources over hypothetical imports.
Calculations may be made in total or in a commodity breakdown.

2)   Alternatively, two different reference models may be studied: one of
these should be different from the actual world only in respect of structural
coefficients which are assumed to be influenced by trade diversion, and the other
only in respect of structural coefficients which are assumed to be influenced by
trade creation. If we, for instance, define trade diversion as a change in market
shares in foreign trade (on a total or on a commodity basis), we might study the
effects of the introduction of EFTA, first under the assumption that total import
proportions had changed as they really did, but with no effect on market shares,
and then under the assumption that market shares had changed as they actually
did, but with no effect on import proportions. (The effects calculated in this
way will not necessarily add up to the effects we would find if we worked with
both effects in only one reference model).

        We shall not here go further into the problem of classification of results,
but will turn to the problem of how a reference model could be created; that is
to assemble a set of hypotheses about how the economy might have looked in the
absence of EFTA.

        We shall employ the following symbols:
Flows:
X = total demand
D = demand for domestic uses
C = private consumption
G = government consumption
J = gross investment
V = input in production
A = inter-country deliveries (exports/imports).

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1) Market share is here defined as the share of exports from one particular country
   (or group of countries) in imports into a given country.

Shares:

i = import as a proportion of total demand

f = share in an import market

Subscripts:

One subscript, say i,: Index (flow or share) refers to country i.

Two subscripts, say ij: Index refers to a delivery from country i to country j.

Subscripts i, j refer to countries within the market or area.

Subscript x refers to countries outside the group.

Superscripts:

k, m, etc. refer to commodity k, m, etc.

Cap $\wedge$: The symbol refers to the hypothetical reference model, whereas indexes without this symbol refers to the year for which the effects are to be estimated.

Absence of a subscript or a superscript, or its replacement with a dot (.) indicates a total sum over that subscript or superscript ($A^k_{.j} = \Sigma_i \; A^k_{ij}$ etc.)

We have now

(1) $\quad X^k_i = V^k_i + C^k_i + G^k_i + J^k_i + A^k_{ix} + \Sigma_j A^k_{ij} = D^k_i + A^k_{i.}$

(2) $\quad A^k_{ij} = f^k_{ij} \; i^k_j \; X^k_j \;$, $\; A^k_{xj} = f^k_{xj} \; i^k_j \; X^k_j \;$, $\; (A^k_{ix} = f^k_{ix} \; i^k_x \; X^k_x)$

Our first assumption concerns import shares:

I.   We assume that in the absence of EFTA the import share i^k_i for any given EFTA-country and for any given commodity in our adopted commodity classification would have had an alternative value, which as a first approximation is set at $\hat{i}^k_i$. These hypothetical import shares, $\hat{i}^k_i$, might be calculated in a number of ways:

a) They might be put equal to the shares before EFTA came into effect.

b) They might be determined through the extrapolation of trends from some period before EFTA came into effect.

c) They might be determined on the basis of import elasticities immediately before EFTA came into effect.

We will simply assume that acceptable estimates can be made.

II.   We assume that in the absence of EFTA, any given country's share in the imports of a given commodity to a given EFTA country would have had an alternative

value, $\hat{f}_{ji}^{k}$, which can be estimated by similar methods, as the first approximation import shares.

III.   We assume that exports from any EFTA-country to non-EFTA-countries in the absence of EFTA would have been the same as they actually were. (Alternatively we might introduce a scale factor, depending on the import of EFTA-countries from non-member countries, and reflecting the balance of payments situation of non-member countries. This scale factor, say Γ , might be the same for all commodities and all EFTA countries and might be put equal to the ratio $\dfrac{\hat{A}_{x\cdot}}{A_{x\cdot}}$, i.e. the ratio of hypothetical EFTA import from non-member countries to actual EFTA-import from these countries. In order to simplify we will not introduce such a scale factor here.)

IV.   We assume that gross national product (GNP) in each EFTA-country in the absence of EFTA would have been a given proportion of what it actually was. Actually, the effects on GNP are among the principal reasons for the establishment of EFTA, and to measure these effects might be considered to be one of the primary objects of a study like the one we are discussing. However, since these effects relate to the relationships between available resources and the outputs of production, it would be necessary in order to investigate them, to have models specifying these relationships and the changes occuring to them. It is the assumption here, that we are not able to establish models in which these problems can be studied, and we must find other ways to deal with the effects on production. The establishment of a free trade area could conceivably affect the total gross national product of a country in some of the following ways:

a)   The GNP may be increased through a fuller utilisation of productive resources. Since a policy of full employment is a generally accepted government obligation in Western countries, we will assume that available resources would have been fully employed, even in the absence of EFTA. We will exclude here also the possibility that GNP might be increased even under full employment through a stronger inflationary pressure.

b)   GNP may be increased through higher investments. If GNP is increased for other reasons, it is very possible that more of it will be available for investment, and thus will contribute to a further increase as a secondary effect. Also the share of investment in GNP may be affected, since both the income distribution and the market prospects are likely to be changed. It would be possible in the following analysis to take account of changes in investment, but in order to avoid the problems of estimating these changes, and for the sake of simplicity, we will assume that there are no effects on GNP from the total volume of investments.

c)   GNP may be increased through productivity changes. There are at least
three ways in which this may occur: Resources may be shifted from less to more
productive uses. This is the traditional division of labour effect. To this may
be added that the changes in scales of production may also contribute to changes
in productivity. Finally, increased competition may bring forth productivity
changes through increased efforts in branches, which through these efforts are
able to stay in the market. We may also refer to the possible "inflation effect"
mentioned under a). Since small changes in productivity may be the results of
sizeable reallocations of resources, and large disturbances in income distributions,
and in the patterns of international trade   it may be argued that these
other effects need not have been materially different whether the resulting (and
motivating) change in productivity had been at one percentage in stead of another.
By postulating a few alternatives for the total change in productivity it may be
possible to assess the common characteristics of other changes in the economy.
On the basis of an evaluation of these changes it may then be possible through
circumstancial information, as for example industry studies of various types, to
arrive at conclusions about the reasonableness of particular guesses with respect
to productivity changes. We will consequently assume that an initial guess about
the productivity effect is made outside the model, and that the plausibility of
this guess is evaluated outside the model, but in the light of model results.

V.   It follows from IV that we assume total gross investment to be unaffected
by the establishment of EFTA. Could we also assume the commodity composition of
investment to be unaffected? This would probably not be too realistic, but it
might not be too damaging for the results of our analysis. If we have estimates
of what changes there might have been in the commodity composition of gross invest-
ment in the absence of EFTA, these may be introduced, if not we will assume
$\widehat{J}_i^k = J_i^k$ for all i and k.

VI.   We assume that there is as a first approximation, a fixed relationship
between GNP and private and government consumption. In the absence of a more
refined model, we might assume simply that all items of private and government
consumption in the absence of EFTA would have been reduced proportionately by
amounts which added up to the total reduction in GNP, postulated under IV:

$$\widehat{C}_i^k = C_i^k \left(1 + \frac{R_i - \widehat{R}_i}{C_i + G_i}\right) \ , \quad \widehat{\widehat{G}}_i^k = G_i^k \left(1 + \frac{R_i - \widehat{R}_i}{C_i + G_i}\right) \ , \text{ where } \widehat{\widehat{C}}_i^k \text{ and } \widehat{\widehat{G}}_i^k \text{ are the}$$

first approximations to $\widehat{C}_i^k$ and $\widehat{\widehat{G}}_i^k$.

VII. There remains to adopt assumptions for the demands for input in production. For countries, where input-output tables are available, it would seem reasonable to use these and pre-EFTA import proportions to calculate the indirect demand in gross investments, private consumption, government consumption and exports. This would give:

$$\hat{V}_i^k = b_{iC}^k \hat{C}_i + b_{iG}^k \hat{G}_i + b_{iJ}^k \hat{J}_i + b_{iA}^k (\sum_m (\hat{A}_{ix}^m + \sum_j \hat{A}_{ij}^m)),$$

where b_{iC}^k, b_{iG}^k, etc. are the indirect demand coefficients derived from the input-output table. The indirect demand coefficients are here represented as calculated for each of the four final demand categories: private and government consumption, gross investments and exports. But each of these categories might be further disaggregated. Where input-output tables are not available, a simpler procedure must be resorted to. I would suggest the following: For all commodities where deliveries for use in production are small, or where deliveries go to production sectors which are unlikely to be affected by the changes due to EFTA, no change in demand for use in production is assumed: $\hat{V}_i^k = V_i^k$. For other input deliveries: Direct coefficients for the main users are estimated ad hoc, e.g. on the basis of statistics from other countries, and the changes due to EFTA are estimated as first round effects by the following formula:

$$\hat{V}_i^k = a_i^{km} (1-\hat{i}_i^m)\hat{X}_i^m + a_i^{kn}(1-\hat{i}_i^n)\hat{X}_i^n + \hat{V}_i^{k'}$$

We assume here that commodity k is mainly used as an input in the production of commodities m and n, and

$$\hat{V}_i^{k'} = V_i^k - a_i^{km}(1-i_i^m)X_i^m - a_i^{kn}(1-i_i^n)X_i^n$$

a_i^{km} and a_i^{kn} are the estimated direct input coefficients for the use of commodity k in the production of commodities m and n respectively.

VIII. The assumptions made so far are more than sufficient to determine preliminarily all magnitudes specified. The system is overdetermined in so far as the implied uses of resources will not add up to the assumed levels of the gross national products. In order to obtain a consistent model we must therefore be willing to adjust some of our preliminary assumptions. I will suggest the following adjustments:

a) If the preliminary assumptions discussed under I to VII above imply that total aggregated demand for a country's products $(\hat{C}_i + \hat{G}_i + \hat{J}_i + \hat{A}_{ix} + \sum_j \hat{A}_{ij})$ exceeds total supply $(\hat{R}_i + \hat{A}_{xi} + \sum_j \hat{A}_{ji})$ all import items are increased proportionately so as to achieve a balance.

b)   If the preliminary assumptions imply that total aggregate demand for a country's products is less than total supply, all items in government consumption (or in government consumption plus private consumption) are increased proportionately so as to achieve balance. (The effects of a full employment policy.)

In the above discussion we have implicitly assumed that for each country in the group to be studied, the full account of supply and demand for each commodity is available. For some countries we must be prepared to find that no breakdown by uses of internal demand is available. If a relatively fine commodity breakdown/(e.g. into 54 commodity classes, as in the study under preparation by the EFTA-secretariat) this is not too serious. It is probably not essential for the outcome of an analysis to maintain the distinction between government and private consumption. Our problem is then to distribute domestic demand for each commodity between gross investment, consumption and input in production. A number of commodity classes may then be put down as going largely to only one of these uses, whereas the rest, for the purpose of this analysis may be roughly apportioned between two or three uses on the basis of diverse types of information.

We must now find out how our reference model looks, if it can be solved and if it is manageable.

Let us introduce the coefficients α_i and β_i respectively for the adjustments discussed under VIII a) and b) above.

For each commodity, k, we will have the following set of equations:
Introducing the items from the reference model into (1) above:

(1') $\hat{X}_i^k = \hat{V}_i^k + \hat{C}_i^k + \hat{G}_i^k + \hat{J}_i^k + \hat{A}_{ix}^k + \sum_j \hat{A}_{ij}^k$ (i=1,2 ————)
(k=1,2 ....)

By V we have

(2') $\hat{J}_i^k = J_i^k$ or given in some other way $(\sum_k \hat{J}_i^k = \sum_k J_i^k)$

By VI and VIII we have

(3' a) $\hat{C}_i^k = \alpha_i \hat{\hat{C}}_i^k = \alpha_i C_i^k (1 + \frac{R_i - \hat{R}_i}{C_i + G_i})$

(3' b) $\hat{G}_i^k = \alpha_i \hat{\hat{G}}_i^k = \alpha_i G_i^k (1 + \frac{R_i - \hat{R}_i}{C_i + G_i})$

By IV

(4) $\hat{R}_i =$ given (fraction of R_i)

By III

(5') $\hat{A}_{ix}^k = A_{ix}^k$

By VII

(6') $\hat{V}_i^k = b_{iC}^k \hat{C}_i + b_{iG}^k \hat{G}_i + b_{iJ}^k \hat{J}_i + b_{iA}^k (\hat{A}_{ix} + \sum_j \hat{A}_{ij})$

or

(6") $\hat{V}_i^k = V_i^k + a_i^{km} \left[(1 - \hat{\hat{i}}_i^m) \hat{X}_i^m - (1 - i_i^m) X_i^m \right]$

$+ a_i^{kn} \left[(1 - \hat{\hat{i}}_i^n) \hat{X}_i^n - (1 - i_i^n) X_i^n \right]$

By I and II

(7') $\hat{A}_{ij}^k = \beta_j \hat{f}_{ij}^k \hat{\hat{i}}_j^k \hat{X}_j^k$

(8') $\hat{A}_{xj}^k = \beta_j \hat{f}_{xj}^k \hat{\hat{i}}_j^k \hat{X}_j^k$

For each country we will in addition to these get the global balance equations:

(9') $\alpha_i (\hat{\hat{C}}_i + \hat{\hat{G}}_i) + \hat{J}_i + \hat{A}_{ix} + \sum_j \beta_j \sum_k \hat{f}_{ij}^k \hat{\hat{i}}_j^k \hat{X}_j^k - \beta_i \sum_k \hat{\hat{i}}_i^k \hat{X}_i^k = \hat{R}_i$

(10') $(\alpha_i - 1)(\beta_i - 1) = 0$

(11') $\alpha_i + \beta_i \overset{>}{-} 2$

For each commodity, k, the set of equations (1') to (7') can be reduced to one equation between the total demand: $\hat{X}_1^k$, $\hat{X}_2^k$, $\hat{X}_3^k$ .... in each country for commodity k, the coefficients $\alpha_1, \alpha_2, \alpha_3, \ldots\ldots$ and $\beta_1, \beta_2, \beta_3, \ldots\ldots$ and items which are assumed to be given. If equation (6") has to be used in stead of (6') there will also be the demands $\hat{X}_i^m$ and $\hat{X}_i^n$ for commodities m and n. These could in many cases be calculated in advance, namely if they are not themselves typically producers' inputs. If this is not so, we might work through iterations, or look at a complex of commodities, k, m and n simultaneously.

If we knew the α_i and β_i - coefficients we could therefore normally calculate the demand levels for any one commodity by solving a system of as many linear equations as there are countries in our group.

A reasonable procedure consequently appears to be to start from a preliminary assumption that $\alpha_i = \beta_i = 1$ for all i, and to solve all the commodity equations. The resulting estimates might be inserted into (9'). Taking into consideration (10') and (11'), the set of one equation (9') for each country can then be solved as a set of linear equations in the set of α_i's and β_i's which are not one. A new solution of equations (1') to (7') may then be found, with the use of the estimated values for α_i and β_i. On this basis a new solution for the α_i's and

β_i's may be found and so on. Probably one or two iterations will suffice to give sufficiently consistent estimates. On the basis of the computed total demands for each commodity in each country, import and export figures will be given by (7') and (8').

A short discussion of the reference model

The crucial assumption in our model is perhaps that import proportions and market shares as they would have been in the absence of EFTA can be estimated. Still, such an assumption is probably less controversial for a detailed model than for a more aggregated one.

Also the assumptions about the development and composition of private and government consumption and gross investment in the absence of EFTA are rather rigid and probably unrealistic. Still, even this moderate specification of magnitudes in the internal economies of participating countries represents a considerable refinement as compared to other models which have been proposed[1]. It seems reasonable, and fairly generally accepted that a country's imports are linked up with the developments in its internal economy.

It should be noted that this model provides for consistency in the estimates in respects which are neglected by most other models which have been proposed: a) Imports of one country from another are equalized to exports from the second country to the first and b) the total balance of supply and demand is maintained for each country (gross national product plus imports equals consumption plus gross investment plus exports).

The way in which consistency is achieved may be discussed: It is assumed that in the case of insufficient demand, this would have been amended through expansion of consumption only. Conceivably both expansions in investments and in exports as well as a reduction in imports might have been tried. The model may be adjusted to account for these effects as well, but this would imply some mathematical complications in regard to exports and imports, and would have raised the question of the effects on the gross national product of alternative investment figures. Without complication some items of government investment might be adjusted in the same way as consumption, if the effects on the gross national product are neglected.

1) See for instance Bela Belassa "Trade Creation and Trade Diversion in the Common Market", The Economic Journal, March 1967, or P.J. Verdoorn and F.J.M. Meyer zu Schlochtern: "Trade Creation and Trade Diversion in the Common Market". In Integration Européenne et Réalité Economique.

In the case of excessive demand, it is assumed that imports are expanded to cover the supply deficiency. It might equally well have been assumed that consumption, investment and exports would be reduced. In particular a certain reduction in exports might be a realistic assumption. Such an assumption must in case be formulated under the observation that exports of one country are imports of others, and that changes in export determinants in one country must affect the market shares of all countries. The adjustments would consequently be somewhat restricted and a certain mathematical complication of the model would be implied. At least until an estimate of the magnitudes of the necessary adjustments is available, it may be as well to proceed as suggested earlier in this note.

The model is highly computable. For a study of a group of 8 countries with a specification of 54 commodities it implies that 110 or 165 systems of each 8 linear equations in 8 unknowns are solved, and this may be done even on desk calculators.