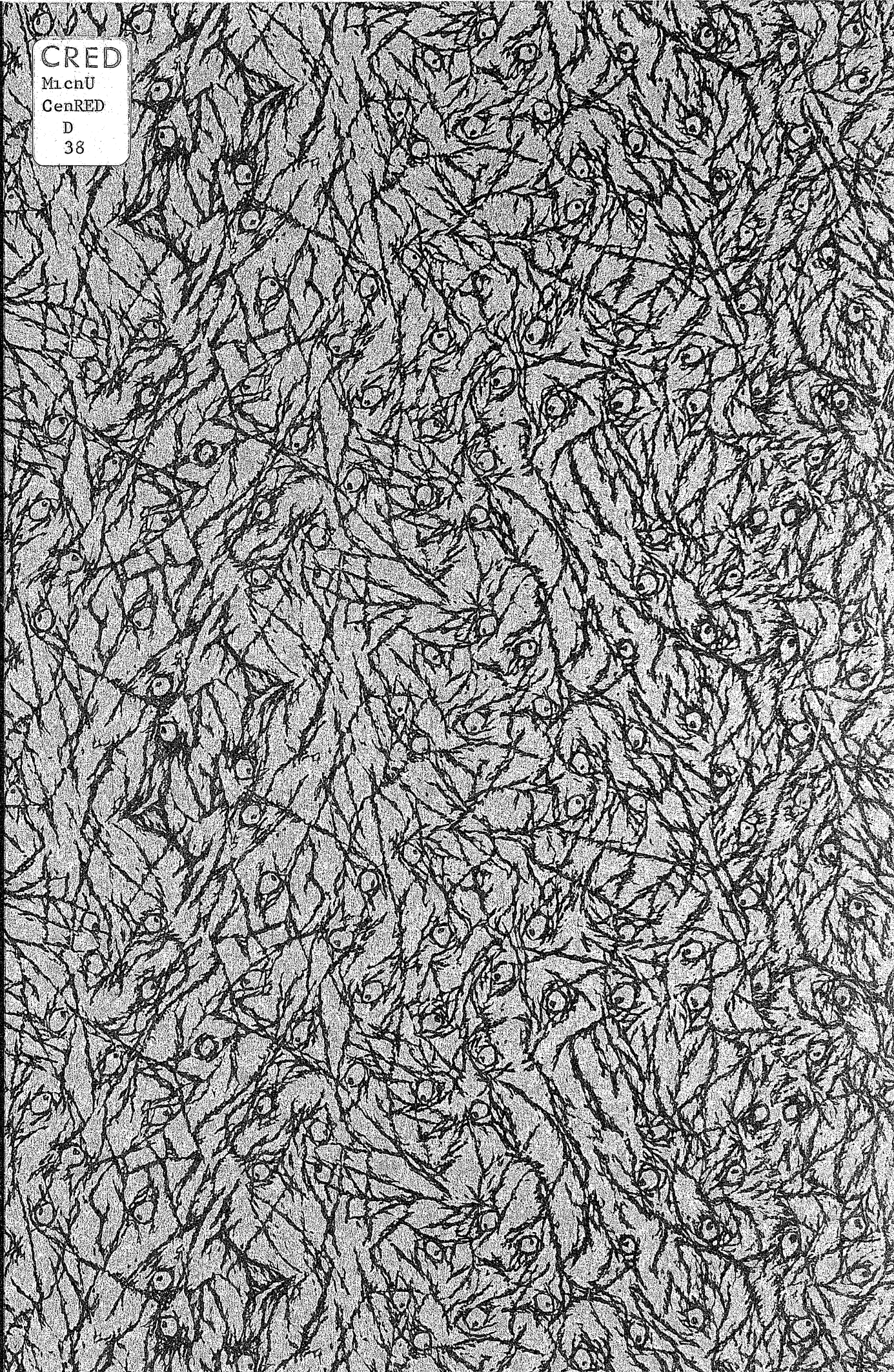

Measuring the Cost of Granting Tariff Preferences

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ABSTRACT

This paper is aimed at measuring the welfare cost incurred when partial tariff preferences are granted by one country (or group of countries) to another.

Three sources of such welfare cost are considered:

1) Once preferences are granted, the relative prices paid by importers, inclusive of duties, diverge from the relative social costs of importing.

2) The exporters in the country that receives privileged entry to another country's markets may decide to realize part of this advantage through a price rise.

3) The introduction of preferences may lead to distortions of import patterns from the socially optimal.

The techniques developed in the paper are then applied to the preferences accorded in 1971 by the East African Community to certain of its imports from the European Economic Community. This empirical effort suggests that only the first of the three kinds of welfare cost is discernible in the two-year period after the introduction of this very limited EAC-EEC preferential arrangement and that even this first kind of welfare cost was probably extremely small.

Measuring the Cost of Granting Tariff Preferences

Richard C. Porter*

Much analytical attention has been focused on the formation of customs unions, in which all tariff barriers are removed between partner states. Also occurring over the past twenty years, but much less noticed, has been the reciprocal granting of less-than-complete preferences between countries or regions, whereby some but not all tariffs between partners are reduced somewhat but not necessarily to zero. This paper is aimed at measuring the welfare cost incurred when such partial tariff preferences are granted by one country (or group of countries) to another.

Three sources of such welfare cost are considered:

1) Once preferences are granted, the relative prices paid by importers, inclusive of duties, diverge from the relative social costs of importing (i.e. CIF). Importers will buy too much of the preferenced goods relative to the unpreferenced; the importing country could have been just as well off, with respect to its overall imports, with a smaller expenditure of foreign exchange if its import composition had not been distorted.

2) The exporters in the country that receives privileged entry to another country's markets may decide to realize part of this advantage through a price rise. Then the CIF prices of the preferenced goods rise as a direct result of the preferences. Here too, the importing country could have been just as well off with a smaller expenditure of foreign exchange had the induced price rise not occurred.

3) The introduction of preferences is seldom unaccompanied by other changes, especially in less developed countries, where extensive direct controls are exercised over foreign-trade activities. The introduction of preferences may lead to new or further distortions of import patterns from the socially optimal. The welfare cost again reflects the fact that the country could have been just as well off, by pre-preference standards, with a smaller expenditure of foreign exchange.

The techniques developed in this paper are then applied, product by product, to the preferences accorded in 1971 by the East African Community

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*I am indebted to Alan Deardorff, Peter Heller, and Charles Staelin for many helpful comments.

(EAC) to certain of its imports from the European Economic Community (EEC). This empirical effort suggests that only the first of the three kinds of welfare cost is discernible in the two-year period after the introduction of this very limited EAC-EEC preferential arrangement and that even this first kind of welfare cost was probably extremely small. Of course, no overall assessment of the value of the Association to the EAC is warranted without an estimate of the benefits to the EAC of the EEC's reciprocal concessions, since these benefits may also have been extremely small.

The organization of the paper is as follows. In the next section, it is argued that the preferenced and non-preferenced "varieties" of a particular product should be viewed as imperfect substitutes. Within a framework of heterogeneity, a method of measuring the welfare cost of preferences is then derived for each of the three kinds of distortion. The final section applies the method to the EAC-EEC agreement.

The Trouble With Assuming Homogeneous Products

The usual method of measuring the welfare effects of tariffs begins with the assumption that the properly disaggregated SITC group provides data about a single, homogeneous product. There are obvious advantages to the assumption. Micro-economic theory is more precise as concerns homogeneous products; and the SITC data are the only empirical information readily available about trade flows.

But there are disadvantages. The most obvious is that the most highly disaggregated SITC class usually contains more than one "product" by any plausible definition. Examples abound.[1] The clearest are the "n.e.s." classes,[2] such as "electro-mechanical domestic appliances, other, n.e.s." (SITC 725.039). But no more recognizable as a single product is "electric fans, domestic type (e.g. bracket, ceiling, portable, pedestal, etc.)" (SITC 725.031)--where, incidentally, quantity is measured by "number". Even

[1]The examples of this section are from East Africa. The published trade data there are fairly disaggregated by the standards of the less developed countries, being recorded to at least three SITC digits and at most six.

[2]I.e., "not elsewhere specified."

where there is proximity to homogeneity, real or perceived quality differences surely intrude; for example, "manhole covers" (SITC 698.913; unit of quantity, weight) or "towels" (SITC 656.912; unit of quantity, area).

There is, however, more than the feeling that such "products" are rarely very homogeneous. Most imports, defined by SITC groups, arrive from a number of different sources and are bought at vastly different "prices" (i.e. unit values, calculated by dividing the CIF value of the import by whatever quantity unit is used). "Towels" entered Kenya in 1972 from ten different (non-government) sources, at "prices" ranging from 5.8 shillings[3] per square meter for those from Czechoslovakia, through Shs. 13.2 for those from West Germany, to Shs. 35.6 for those from the United States. Even "manhole covers" came from both India and the United Kingdom, at a "price" from the former of Shs. 108 per quintal[4] and from the latter of Shs. 207 per quintal.

Beyond the assault on common sense, the assumption of homogeneity implies some awkward theory. First, by definition, homogeneity within a given SITC class means an infinite elasticity of substitution in consumption between the "varieties" imported from different countries. Thus, a "manhole cover" from India is assumed to be a perfect substitute for a "manhole cover" from the United Kingdom. But why then doesn't Kenya import all of its manhole covers from India, where the price is barely half that of the United Kingdom? The only answer is that it must take 1.92 kilograms (i.e. 207/108) of Indian manhole covers to substitute perfectly for each kilogram of British manhole covers.

But even this heroic assumption merely makes possible the simultaneous import of a "product" from different sources; it leaves indeterminate the national shares in the Kenyan market. This would not be too serious except that, for tariff-preference analysis, one of the things we most want to know is the effect of the introduction of the preferences on import shares, and hence on import costs and welfare. By this approach, the tiniest tariff preference extended to a nation becomes responsible for that nation's entire sale, regardless of whether it achieves 1% or 99% of the market--and regardless of what its share had been before the preference was given.

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[3]Hereinafter written as Shs. 5.8. The Kenyan, Tanzanian, and Ugandan shillings were officially worth U.S. $0.14 during 1970-72.

[4]I.e., 100 kilograms.

An arithmetical example may make clear how drastic this procedure is. The quantity (say, kilograms), the value (CIF, before tariff) and the tariff rate for widget imports from countries A and B are given in Table 1, rows 1 through 3. The "price" (i.e. unit value) can be calculated, and is shown before tariff in row 4 and after tariff in row 5. Since the price to consumers is five times as high for B's widget, B's variety must be five times as "good." In A-equivalent units, therefore, the quantities imported are quite different from those shown in row 1; the "correct" volumes are those shown in row 6. Then recalculate the CIF prices per A-equivalent unit; these are shown in row 7. The "cost" of the preference accorded to imports from A is then seen to be Shs. 2 per unit of A imports or, since two units were imported, Shs. 4 in total. Since the total volume of imports (i.e., twelve A-equivalent units) could have been bought in B at Shs. 2--i.e. at a total cost of Shs. 24--the excess cost due to preferences amounts to 17% (i.e. 4/24) of the minimum possible cost.[5]

Table 1

Illustrative Calculation of the Cost of a Preference for Homogeneous Goods

		Country	
		A	B
1.	Quantity imported	2 kgs.	2 kgs.
2.	Value (CIF)	Sh. 8	Sh. 20
3.	Tariff rate	0%	100%
4.	Price, before tariff	Sh. 4 per kg.	Sh. 10 per kg.
5.	Price, after tariff	Sh. 4 per kg.	Sh. 20 per kg.
6.	Quantity, in A-equivalent kilograms	2 kgs.	10 "kgs."
7.	Price, before tariff, per A-equivalent kilogram	Sh. 4 per kg.	Sh. 2 per "kg."

Homogeneity forces upon us much of the unreality of the above calculation; but one aspect can be removed. The assumption that the after-tariff prices per A-equivalent unit of A's and B's widgets are coincidentally identical is not necessary. Just one upward-sloped supply curve suffices to bring about the determination of A's and B's import shares at that point on the supply

[5]Formulas are developed later, but for the curious, this excess cost ratio (ECR) equals rs/(1+r-rs), where r is the preference rate (here 1.00) and s is the actual share of the total import value held by the recipient of the preference (here 0.29, i.e. 8/28).

curve where the prices of A-equivalent units are equated. But this assumption of one or more upward-sloped supply curves for the various national suppliers of the homogeneous product raises new problems. Most obvious is the fact that East Africa's tiny, by world standards, imports of such things as fans, towels, and manhole covers are extremely unlikely to drive the German, British or even Indian suppliers perceptibly along their supply curves. The "small-country" assumption, with foreign prices given is surely more appropriate. But upward-sloped supply curves also raise the spectre of terms-of-trade tariff preferences. One may end up with the "cost" of a tariff preference being negative (if a preference is extended to the nation with the more elastic supply curve). Perhaps somewhere, sometime, tariff preferences were granted for this reason, but it is quite clear that the East African Community (EAC) did not extend preferences on certain products to the members of the European Economic Community (EEC) in order to exploit more effectively their monopsony power over the rest of the world.[6]

Aside from the methodological problems with homogeneity, the resulting estimates of the costs of tariff preferences tend to be extreme. Where an infinite elasticity of substitution in consumption between different nations' "varieties" of a product is assumed, and national shares between zero and one hundred percent are observed, it follows that removal of a tariff preference would cost the formerly favored nation its entire market. Thus the excess cost to the importing country of granting a preference equals the full rate of preference on the total value imported from the favored country.[7] Because this is so clearly an extreme estimate, most economists who approach trade diversion in this way view the result not as an expected but as a "maximum loss estimate."[8]

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[6] See Appendix A for a brief review of the agreement and its negotiation. In any case, if only the EEC supply curve were upward-sloped, the formula for the excess cost ratio would not be changed from that given in footnote number 5 (although one would have the satisfaction of determinate import shares). If the rest-of-world supply curve were also upward-sloped, the excess cost formula becomes quite complicated.

[7] More precisely, the excess cost is $rV_F/(1+r)$, where r is the rate of preference and V_F is the (CIF) value of the preferenced imports--i.e. the excess cost is rP_NQ_F, where P_N is the (CIF) price of non-favored, and hence least-cost, imports and Q_F the quantity of favored, and $P_F=(1+r)P_N$. See Appendix D for the derivation of all formulas involving constant elasticities of substitution.

[8] The phrase is from Johnson (1958).

Once so much loss is attributed to the preference itself, there is little scope for any other kind of loss--for example, the second kind of loss we shall consider, due to monopoly price reactions, is automatically zero when homogeneity is assumed. While the practical difficulty of measuring this second kind of loss will soon be seen, I hope the reader will become convinced that the existence of such loss should be conceivable.

In short, for any given "product", as defined by its SITC group, there usually are differences between the "varieties" supplied by different geographical sources. And this means that the different national varieties of a product are imperfect substitutes for each other. To treat them as homogeneous is wrong and may, in the name of simplification, introduce serious error into the analysis. It is difficult to know exactly what the elasticity of substitution in consumption is between different "varieties" of a product, but when we believe that it is generally less than infinity, we should consider values less than infinity in our empirical work. The methods and measurements of the succeeding sections are premised on the assumption that different national varieties may be heterogeneous and that the excess costs of preferences should be calculated using finite as well as infinite values for the elasticity of substitution.

Cost I--The Preference Itself

At the beginning of 1971, the East African Community (EAC) extended preferential tariff rates on the import of certain products from the European Economic Community (EEC).[9] On the assumption that all goods are gross substitutes, such tariff preferences increased the EAC imports of the favored EEC products at the expense of 1) domestic production, 2) imports of goods to which no preferences applied, from both EEC and rest-of-world (ROW) sources, and 3) the ROW varieties of those goods for which the EEC varieties received preference. The first kind of expenditure switching, the trade creation of the customs union literature, is certainly small since the EAC negotiators were most careful to prevent impact on the EAC's nascent industrial plant. The second kind of switching undoubtedly occurred, although I shall ignore it in what follows, principally on the intuitive belief that such trade diversion is probably small relative to the third kind of switching--i.e. from ROW to EEC varieties of these products receiving preferences. This neglect can be defended on the grounds that inter-product substitutability is usually lower than intra-product substitutability and that the EAC import-licensing bureaucracies permit importers' intra-product preferences to emerge to a much greater degree than their inter-product preferences.[10]

In what follows, therefore, I will consider only one aspect of the trade diversion that may result from the granting of the tariff preferences--namely, the diversion to EEC from ROW varieties of the preferenced products. Such intra-product switching means losses to the EAC since the relative <u>private</u> cost of importing the two varieties diverges from the relative <u>social</u> cost. The relative social cost is simply the ratio of the CIF price of the EEC variety, P_E, to the CIF price of the ROW variety, P_R; but the relative private cost is $P_E/P_R(1+r)$, where r is the margin of preference accorded to the EEC variety of the product.[11]

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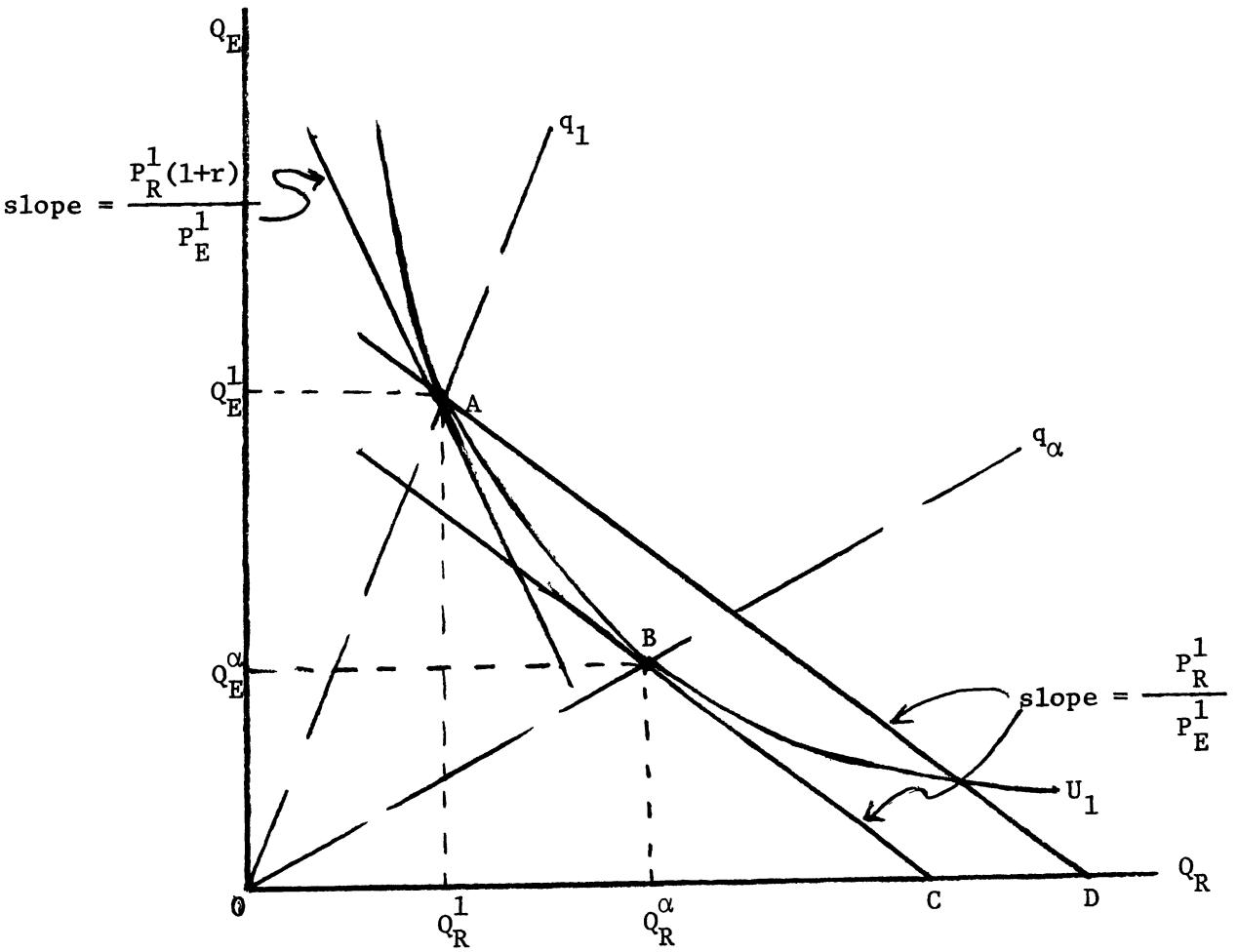
[9]For a description of this Association, see Appendix A, and for a list of the products involved, see Appendix B.

[10]One must also consider the practical difficulty of defining the "average" price of the product, to which inter-product substitution responds, once the concept of homogeneity is discarded. See, for example, Verdoorn (1963).

[11]To be precise, the relative private cost should be written $P_E(1+t-r)/P_R(1+r)$, where t is the full tariff rate and r the rate of preference. For the small values of r involved in the EEC-EAC association--see Appendix B--the error involved in the simpler formulation is negligible.

Figure 1


Q_E
q_1
slope = $\frac{P_R^1(1+r)}{P_E^1}$
Q_E^1
A
q_α
B
Q_E^α
slope = $\frac{P_R^1}{P_E^1}$
U_1
Q_R
0
Q_R^1
Q_R^α
C
D

In order to measure the excess cost, we must estimate how much less foreign exchange would have been required if EAC importers were made just as well off but with an undistorted selection between EEC and ROW varieties. I assume that, in 1971, EAC importers chose the relative quantities of EEC and ROW varieties, within each relevant SITC group, as if they were maximizing their "utility" with respect to the given relative prices of the varieties--that is, the relevant private prices, inclusive of tariffs and preferences. East African importers actually consumed in 1971--see point A in Figure 1--a certain volume of EEC imports, Q_E^1, and of ROW imports, Q_R^1, in each product class.[12] The relative quantity, $Q_E^1/Q_R^1 = q_1$, is shown as a ray from the origin through point A. And the relevant importer indifference curve, U_1, is shown tangent to a line with absolute slope equal to the private price ratio, $(1+r)P_R^1/P_E^1$, at that point A.

If the EEC preference had not existed, however, the slope of the relative price line would have been flatter (i.e. of absolute slope, P_R^1/P_E^1) and the ratio between Q_E and Q_R would have also been lower (i.e. ray q_α in Figure 1). To achieve indifference with the quantities, Q_E^1 and Q_R^1, importers would have required imports of Q_E^α and Q_R^α (point B in Figure 1). The quantities, Q_E^α and Q_R^α, also represent the socially cheapest way of achieving the actual 1971 level of utility (U_1) since the relative-price line there (with slope, P_R^1/P_E^1) reflects the relative social cost to the EAC of the two varieties.

The minimum social cost of achieving U_1 is given by point B, or in the units of Q_R, by the point C on the Q_R-axis. The social cost of the actually imported variety-bundle, i.e. Q_E^1 and Q_R^1 at point A, is shown by point D on the Q_R-axis. The ratio of the excess cost to the minimum social cost is, measured along the Q_R- axis, CD/OC. In the empirical work, this excess cost ratio due to the preference itself, called ECR-I, is calculated by means of the formula,

$$\text{ECR-I} = \frac{P_E^1 (Q_E^1 - Q_E^\alpha) + P_R^1 (Q_R^1 - Q_R^\alpha)}{P_E^1 Q_E^\alpha + P_R^1 Q_R^\alpha},$$

[12]The subscript E for EEC and R for ROW; and the superscript 1 for 1971 and (later) 0 for 1970.

where the absolute excess cost, called AEC-I, is the numerator and the minimum social cost the denominator. Analysis of the formulas of Appendix D shows that the values of both ECR-I and AEC-I rise at a decreasing rate as higher values of a constant elasticity of substitution along U_1 are considered.[13] Thus, the cost of the preference is, for any finite elasticity of substitution, less-- and perhaps much less--than the cost calculated on the assumption of honogeneous varieties.

The actual calculation of either ECR-I or AEC-I requires, of course, precise specification of the shape of the indifference curve through the actual purchase-point (i.e. through Q_E^1 and Q_R^1 at point A in Figure 1). The entire utility map is not needed, since only the indifference curve through point A is considered, so no issues of cardinality or homotheticity intrude. On the other hand, because the slope of U_1, when it passes through point A, must equal the appropriate relative price ratio, $(1+r)P_R^1/P_E^1$, one of the parameters of any function is thereby determined. Thus, as the formulas of Appendix D indicate, for a constant-elasticity-of-substitution (CES) formulation of the utility function, only the elasticity itself is free to be varied arbitrarily.[14]

Cost II--EEC Monopolistic Price Rises

In the previous section, it was assumed that the CIF prices of imports, both EEC and ROW varieties, were not affected by the introduction of the tariff preferences. If, however, there are monopoly forces in the pricing process, either in the EEC or the ROW, one might expect that the EEC price to East Africa (P_E^1) would rise or the ROW price to East Africa (P_R^1) would fall in response to the EEC's receipt of preferences. While the possibility that ROW prices are formed monopolistically seems remote, it is plausible that P_E^1 may have been raised once the after-tariff prices in East Africa of the EEC varieties were cut by a percentage, r, below competing varieties.

A formal model may make clear the possibility of such pricing behavior. Assume that ROW prices do not change in response to the EEC preferences.

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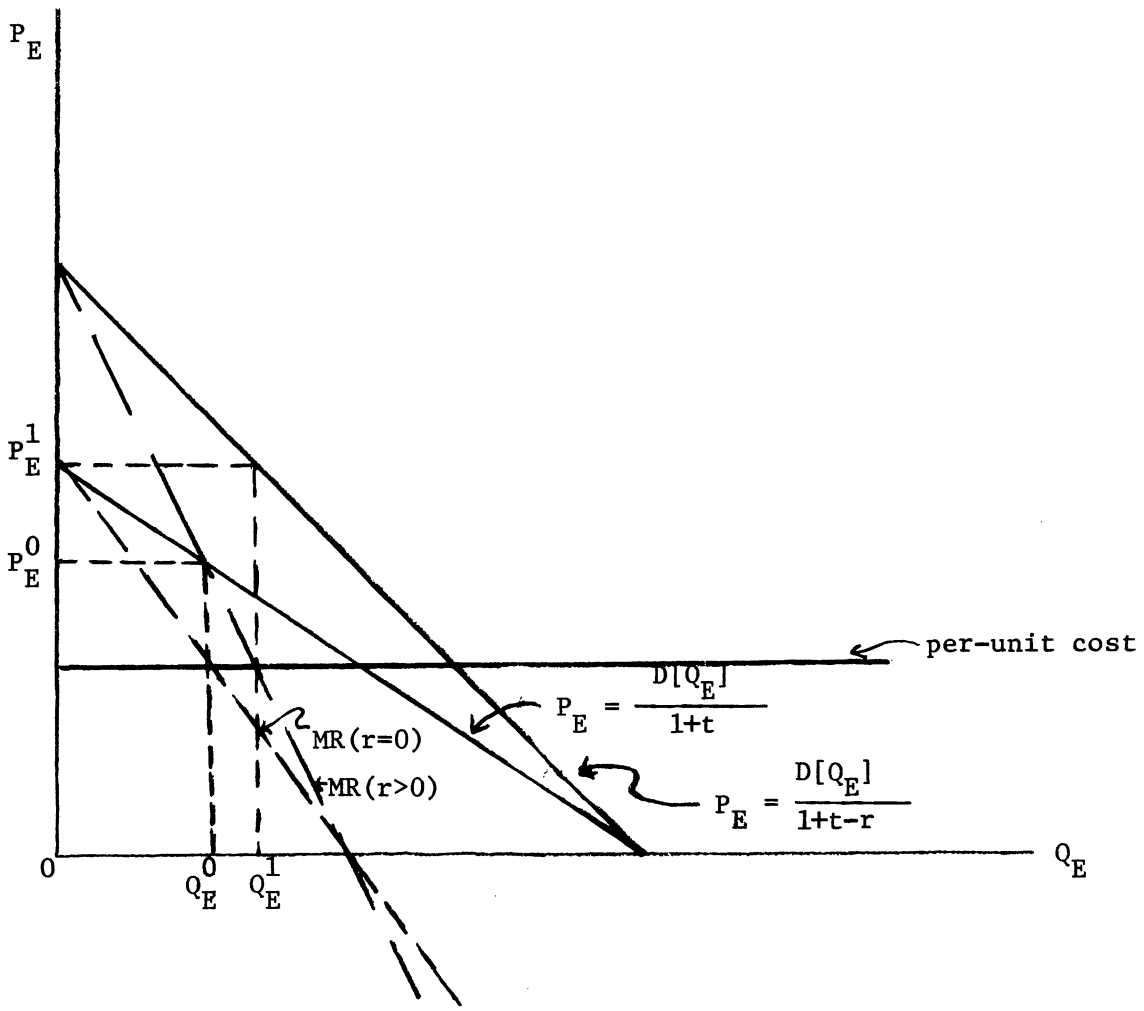
[13] Ceteris paribus, given P_E^1, P_R^1, Q_E^1, Q_R^1, and r.

[14] It is, of course, arbitrary which of the CES parameters is left free to vary.

Figure 2


P_E
P_E^1
P_E^0
per-unit cost
$P_E = \frac{D[Q_E]}{1+t}$
MR(r=0)
MR(r>0)
$P_E = \frac{D[Q_E]}{1+t-r}$
0
Q_E^0
Q_E^1
Q_E

Then, whether homogeneity is assumed or not, the EEC sellers of any product face some EAC demand curve,

$$D[Q_E] = (1+t-r)P_E,$$

where P_E is the (CIF) price of the EEC variety, Q_E the quantity, $D[Q_E]$ the after-tariff price that EAC importers pay, t the full rate of duty, and r the EEC preference. A linear version of this demand function is shown in Figure 2, for "1970" when there were no preferences (i.e. r=0) and for "1971" when preferences began (i.e. 0<r<t). If the EAC market absorbs a small fraction of the EEC output, the per-unit cost can be taken as constant.

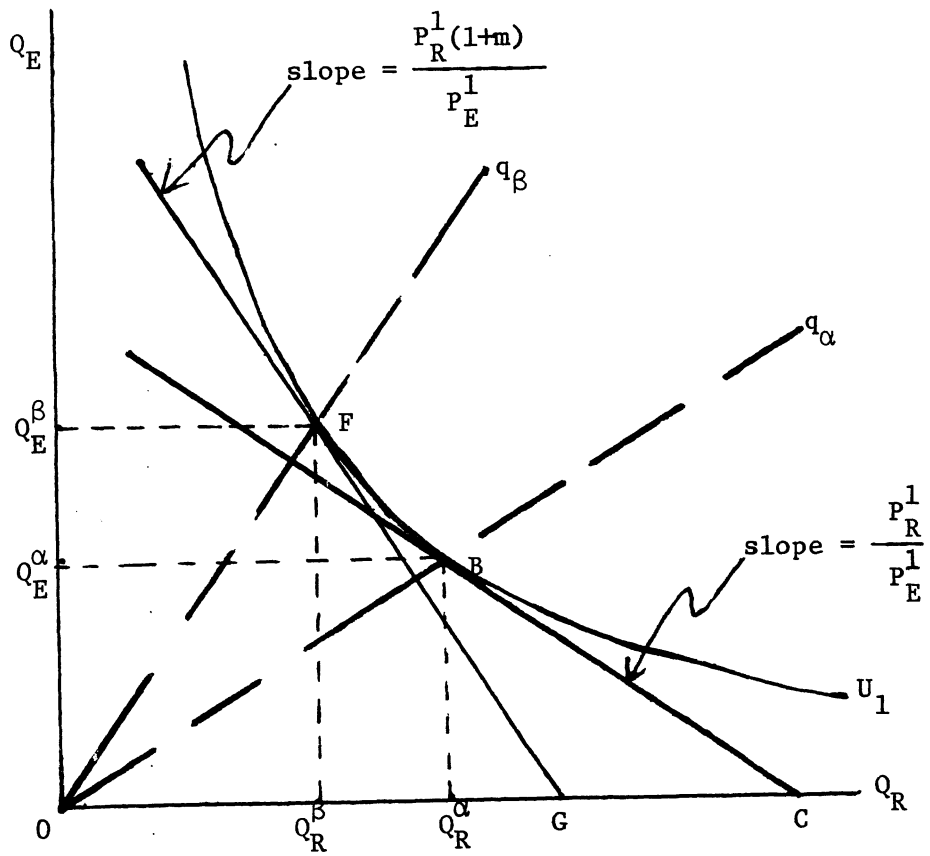
From inspection of Figure 2 (or a little geometry), it is clear that the introduction of the preference induces the EEC producers to sell a larger volume to the EAC and to set a higher (CIF) price.[15] Thus, there is some theoretical basis for fearing that preferences may induce price rises, if the producers in the favored region are few or are organized.

To the extent that EEC prices in East Africa were increased in order to take fuller advantage of the new preferences, then a second source of excess cost emerges. In Figure 3, as in Figure 1, point B represents the quantity of EEC and ROW varieties of a particular good that would have been purchased by EAC importers in the absence of preferences--that is, if the relative prices had reflected no preferences (P_R^1/P_E^1), importers would have bought at the variety-ratio, q_α, and achieved a welfare level of U_1 at quantities, Q_E^α and Q_R^α. But if the EEC price, P_E^1, would have been lower in the absence of preferences, the preference has imposed another cost.[16] Assume that the 1971 EEC price would have been $P_E^1/(1+m)$, where m>0. Then the

[15] While the volume is larger and the after-tariff price to the EAC customers is lower for any downward-sloped demand curve, the CIF price will be higher provided the (absolute value of the) price elasticity is declining with increased output in the relevant region of the demand curve. While not a necessary property, most commonly used demand curves display it--it is called "the normal case" by Allen (1938), p. 258. The only obvious exception to this "normal" relationship is the constant-elasticity demand curve, which yields the same profit-maximizing price after the preference as before.

[16] I.e. the actual CIF price, P_E^1, is a fraction, m, higher than it would have been in the absence of preferences.

Figure 3


Q_E
slope = $\frac{P_R^1(1+m)}{P_E^1}$
q_β
q_α
Q_E^β
F
Q_E^α
B
slope = $\frac{P_R^1}{P_E^1}$
U_1
Q_R
0
Q_R^β
Q_R^α
G
C

relative price ratio rises to $P_R^1(1+m)/P_E^1$ and the same level of welfare, U_1, could have been achieved at point F in Figure 3 with quantities, Q_E^β and Q_R^β, being imported.

At the lower EEC price, associated with point F, the welfare level, U_1, is more cheaply attained than at the higher price of point B. The excess cost can be measured in terms of units of Q_R (i.e. along the Q_R-axis of Figure 3) since its price, P_R^1, is unchanged between the two situations. The cost at point B is given by point C (in Figure 3 as in Figure 1) and the cost of point F by point G, so the excess cost ratio due to the EEC price increase is measured along the horizontal axis by CG/OG. The formula for this excess cost ratio is

$$\text{ECR-II} = \frac{P_E^1 \left(Q_E^\alpha - \frac{1}{1+m} Q_E^\beta\right) + P_R^1 \left(Q_R^\alpha - Q_R^\beta\right)}{\frac{1}{1+m} P_E^1 Q_E^\beta + P_R^1 Q_R^\beta},$$

and the concomitant absolute excess cost (AEC-II) is the numerator of the above expression. Note that, for $0<m<r$, such a monopoly price reaction partly offsets the first distortion in terms of the relative quantities of Q_E and Q_R (i.e. q_β in Figure 3 is between q_α and q_1 in Figure 1). Because the first distortion involves a change in only the private price and the second a change in the social price as well, the excess cost is, however, <u>not</u> offset. This can be seen in the figures: point G (in Figure 3) is to the left of point C just as point C (in Figure 1) was to the left of point D.

Of course, the tough question for the empirical work is to determine whether there <u>was</u> in fact such a monopolistic price reaction--that is, whether m was greater than zero. The simple model of the earlier part of this section concluded that the <u>after-tariff</u> EEC price would in any case be lowered, so that m is probably lower than r, and might conceivably be negative, for monopolists. If the EEC suppliers act as competitors, on the other hand, m would be zero. Thus, the relevant empirical range of m is only somewhat circumscribed by a priori notions.

Cost III--Induced Changes in Importers' Preferences

There is a third way in which an EEC preference can impose excess cost upon the EAC. So far we have assumed that the utility function (U_1) is unaffected by the granting of the preference--that is, only prices and hence the position on U_1 could have been altered. In fact, however, the location of the utility function itself may change in the very act of introducing the preferences. The most obvious way in which this could occur is for importers to interpret the new tariff-differential as an assurance of government favor to importers from the EEC. Then, for any given relative price relationship between EEC and ROW varieties, this would raise the relative volume of purchases of the EEC variety. Such a shift due to expected favor is a distortion of the "true" utility function, and accordingly the altered purchase pattern involves excess cost. On the other hand, the introduction of preferences may be accompanied--to salve the ROW commercial attachés--by official rumor that the government will attempt to offset the EEC tariff advantage through stricter licensing and customs formalities. This might shift the utility function away from EEC varieties--but this too involves distortion and excess cost.

The measurement of this excess cost is straightforward, once one knows what the relative volumes of imports would have been (in 1971) in the absence of preferences and the extent to which the preferences altered these volumes. This is a tall empirical order--to be considered later--but the measurement that follows is not difficult. Here, we assume that the 1970 utility function is the "true" one (i.e. undistorted by expectation of partiality or penalty) and that any shift in the observed[17] 1971 function is assumed to be caused entirely by socially costly reactions to preferences.

Two caveats are appropriate before proceeding further. First, this procedure provides neither a maximum, a minimum,nor an expected estimate of the distortion. Since any measured shift of the utility schedule may be

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[17]Observed in the sense that one point on it and its slope at that point are yielded by the import volumes and prices of 1971. We still need an elasticity-of-substitution assumption to be able to write out the complete 1971 preference function.

composed partly of an exogenous shift in "tastes" and partly of an induced shift due to preferences, the overall shift may yield an overstatement or an understatement of the distortion involved. Furthermore, since the preferenced products are far from randomly selected, one cannot reasonably hope that the shifts due to taste are likely to cancel out on the average. Second, and even more serious, if shifts in the utility function occur as a result of preferences, it calls into question the appropriateness of the technique for measuring the first two kinds of excess cost. Those excess cost ratios were estimated on the assumption that the utility function for 1971 was socially meaningful. Nevertheless, we proceed with the measurement of this third kind of distortion, partly for the sake of theoretical completeness and partly so that we will know, in the empirical work, to what extent this second caveat is relevant.

In the previous section, we found the variety-ratio (i.e. ray q_β in Figure 3) which EAC importers would have sought if no preferences or concomitant price rises had occurred, and the point on that ray (F in Figure 3) which would have made them just as well off as did their actual variety-bundle. These quantities, Q_E^β and Q_R^β, are again shown as point F in Figure 4. But we now recognize that U_1 may be a distortion of the true utility function; we must therefore estimate the true function, U_0, which can be done from the 1970 price and quantity data.[18] That member of the U_0 family of utility functions which passes through point F in Figure 4 is drawn. Had the true utility function, U_0, been operative, then at prices, $P_E^1/(1+m)$ and P_R^1, the EAC importers could have been just as well off as at point F with a purchase of Q_E^γ and Q_R^γ along ray q^γ. The cost of such a variety-bundle, in terms of Q_R (i.e. along the Q_R-axis), would have been OH, whereas the bundle represented by point F cost OG. The excess cost ratio due to the distortion of the utility function is therefore GH/OG.

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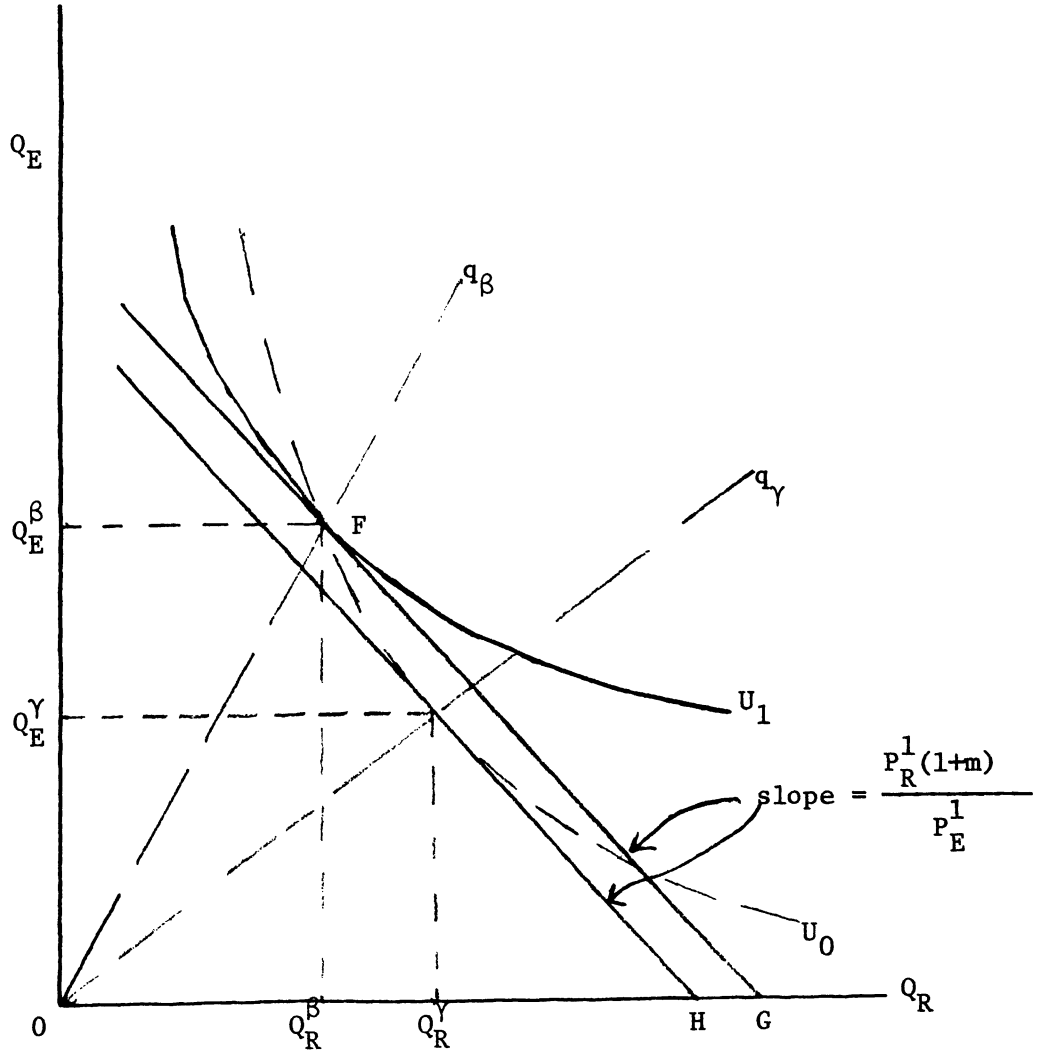
[18] As with U_1, such data indicate a point and its slope. This, plus an assumption of homotheticity, is sufficient to determine completely a two-parameter preference function (such as one with constant elasticity of substitution (CES) of zero, one, or infinity). The general CES function is not completely determined until a value for its elasticity of substitution is assumed.

Figure 4


Q_E
q_β
q_γ
Q_E^β
F
Q_E^γ
U_1
slope = $\frac{P_R^1(1+m)}{P_E^1}$
U_0
Q_R
0
Q_R^β
Q_R^γ
H
G

The formula for this excess cost ratio is

$$\text{ECR-III} = \frac{\frac{P_E^1}{1+m}(Q_E^\beta - Q_E^\gamma) + P_R^1(Q_R^\beta - Q_R^\gamma)}{\frac{P_E^1}{1+m} Q_E^\gamma + P_R^1 Q_R^\gamma}$$

and the absolute excess cost (AEC-III) is the numerator of the above expression.

It should be noted, as can be seen in Figures 1, 3, and 4, that the three excess costs are cumulative and may be added. In terms of units of Q_R, i.e. on the Q_R-axis, the actual foreign-exchange expenditure in 1971 is OD in Figure 1. The absolute excess costs are, for AEC-I, the distance CD in Figure 1, for AEC-II, the distance GC in Figure 3, and for AEC-III, the distance HG in Figure 4, similarly, the three excess cost ratios can be combined into an overall excess cost ratio (ECR-Σ) as follows:

$$\text{ECR-}\Sigma = (\text{ECR-I} + 1)(\text{ECR-II} + 1)(\text{ECR-III} + 1) - 1$$

Once more, however, the reader is reminded that, if ECR-III is large, the meaningfulness of the estimates of ECR-I and ECR-II must be questioned, so the cumulative property of these excess cost measures is more of theoretical than practical interest.

An Application to the EAC-EEC Preferences

The agreement establishing the Association between the East African Community (EAC) and the European Economic Community (EEC) became effective in 1971. The EAC benefits in that its exports to the EEC were accorded (in principle, though subject to important exceptions--see Appendix A) duty-free status; the EAC incurs costs in that certain of its imports from the EEC were granted preferential treatment. It is to the measurement of the costs that this section is directed.

The Basic Sample. In the agreement itself, the EEC was given a partial preference--never duty-free status--on 62 different "products", as defined by their position in the East African Tariff Classification (EATC). Unfortunately, not all of these "products" can be examined by the techniques outlined in the previous sections for three reasons:

1. The EAC import data are recorded by the Standard International Trade Classification (SITC), not by EATC. Although each EATC can be uniquely mapped into an SITC group, the reverse is not always true. Where the import data cannot be precisely related to a rate of preference, the observation is discarded.

2. Although all import data are kept in value terms, for many of the more heterogeneous SITC "products," no quantity data are recorded. This in itself suggests that analysis of such a "product" would be suspect; but such analysis is in any case impossible since unit values cannot be calculated.

3. Occasionally, for one of the years involved (i.e. 1970, 1971, or 1972), there were no imports into the EAC from either EEC or ROW sources. As the ratio of quantities (i.e. Q_E/Q_R) approaches zero or infinity, one suspects a product homogeneity that makes inappropriate the approach outlined in the previous sections; but such analysis is in any case impossible since unit values cannot be calculated.

Once these problems are considered, the basic EAC sample of products with EEC preferences drops from 62 to 26.[19] It is on this basic sample of 26 that the empirical estimates of this section rest. There is no easy way of knowing whether these 26 represent an unbiased sample from the population. No obvious reason suggests itself why the products which are uniquely mappable between SITC and EATC should be systematically different from those not so mappable; but the other criteria, the absence of quantity data or of diversified imports (as between EEC and ROW varieties), may well have introduced bias.

ECR-I. The excess costs due to tariff preferences are largest, ceteris paribus, when the varieties of the product are assumed to be perfect substitutes in consumption. At that assumed infinite elasticity of substitution, the distribution of the values of the ECR-I for the 26 products is given in Table 2.[20] Most of the estimated values of ECR-I are quite small, and the median is only 1.50%.[21] Moreover, the absolute excess cost (AEC-I) totals less than Shs. 3 million for these 26 products in 1971. This AEC-I is essentially equal to the tariff revenue lost owing to the preferences on the actual 1971 value of EEC imports (see Appendix D for the formula); since the basic sample covers almost one fourth of the total preferenced EEC imports, this suggests that the absolute excess cost of the preferences to the EAC in 1971

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[19] See Appendix B for description of the sample.

[20] Most of the statistics reported in this section are presented in fuller detail in Appendix C.

[21] Similar small values of ECR-I emerge for the three countries (Kenya, Tanzania, and Uganda) individually and for 1972. See Table C-1 of Appendix C.

Table 2

Distribution of ECR-I for the Basic EAC Sample, 1971

Range of ECR-I	Number of Products
Less than .01	7
.01 to .02	11
.02 to .03	3
.03 to .04	4
.04 to .05	1
Greater than .05	0
Total	26

was around Shs. 10 million if an infinite elasticity of substitution between varieties is assumed.[22]

Even this small cost represents, it must be remembered, the maximum cost. For lower assumed values of the elasticity of substitution, the excess cost is much smaller; at a CES of unity, for example, the median ECR-I is less than one per cent and the AEC-I totals only Shs. 55 thousand for the 26 products.[23]

The Control Sample. In order to say anything about the second and third kinds of excess cost, it is necessary to judge whether EEC prices (to EAC importers) were raised or whether the EAC importers' utility functions shifted for preferenced products. Such changes may have been i) coincidental, ii) true also of products that did not receive preference, or iii) the reason why preferences were sought--by either the EEC or the EAC negotiators--for these products. I am willing to reject (i) out of hand and (iii) on the grounds that the negotiations were conducted too long before 1971 to have been so shrewdly motivated. But (ii) needs to be checked.

The check I offer is a "control" sample of products which are similar to the basic sample but which did not receive preferences.[24] Unfortunately, for only 17 of the 26 products in the basic sample is a reasonably similar and otherwise usable control product available. In the remainder of this section, therefore, comparisons of the basic and the control samples are

[22]This is more than double Ghai's estimate of this cost, based on 1968 trade data; see Ghai (1972), p. 25.

[23]For the EAC in 1971. Recall that this excess cost is zero if an elasticity of substitution of zero is assumed (see Appendix D).

[24]See Appendix B for a detailed description and listing of this sample.

made on the basis of only 17 of the preferenced products. Accordingly, the conclusions from here on should be received with greater caution.

ECR-II. Before assessing the costs of monopoly price increases by the EEC exporters in response to their EAC preferences, we must first be sure that such increases in fact occurred. One way to discover this is to compare the 1971 (or 1972) prices of EEC varieties of preferenced products with their counterparts in the control sample. This is here done by forming the dependent variable, π_i, where

$$\pi_i = \left[\frac{P_E^1/P_E^0}{P_R^1/P_R^0}\right]_{\text{Pref.}} \Big/ \left[\frac{P_E^1/P_E^0}{P_R^1/P_R^0}\right]_{\text{Cont.}}$$

for the i=1,..., 17 products which are in both the preferenced and control samples; then the regression is fitted,

$$\pi_i = e_0 + e_1 r_i,$$

where r_i is the EEC preference rate on the i^{th} product. If P_E^1 is indeed raised for preferenced products, then such regression should exhibit estimates of e_0 greater than one and/or estimates of e_1 that are positive.

These regressions were estimated for 1971 and 1972 (with each in turn being the year 1 of the regression, and with 1970 being the year 0), and for the EAC as a whole as well as for Kenya, Tanzania, and Uganda separately. The resulting eight regressions show uniformly low coefficients of correlation and in no case is there significant evidence that $e_0 > 1$ or $e_1 > 0$. Six of the eight estimates of e_0 are, however, greater than one,[25] and six of the eight estimates of e_1 are greater than zero.[26] This is mildly suggestive, since the probability is low that the signs of the monopoly hypothesis will so frequently appear by chance.[27]

Obviously, many things determine π_i besides preferences; without a much more carefully specified model, significant results could not have

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[25] For all regressions except those for Kenya in 1971 and in 1972.

[26] For all regressions except those for Tanzania in 1971 and Uganda in 1972.

[27] Other definitions of the dependent variable do not yield more significant results. Two alternatives were examined, the ratio of P_E^1/P_E^0 of preferenced to P_E^1/P_E^0 of control products, and the ratio of P_E^1/P_R^1 of preferenced to P_E^1/P_R^1 of control products.

been expected. But even the evidence of the signs cannot be taken at face value. At least one explanation for $e_0 > 1$ and $e_1 > 0$, other than EEC monopoly price rises, is possible. Once the EAC price for EEC varieties fell as a result of preferences, the EAC importers may have shifted their import composition toward the higher-priced sub-varieties within the EEC variety; if so, the EEC unit value could have risen despite the absence of change in any EEC (CIF) price.

In short, there is very little evidence of monopolistic price reactions by the EEC producers to their receipt of EAC preferences. It is nevertheless worth noting that the maximum possible value of ECR-II is always smaller than the maximum possible value of ECR-I if the monopoly price rise (m) is smaller than the rate of preference (r).[28] Thus, unless the monopoly price rise absorbs a large part of the preference rate, the preference itself probably causes a much larger excess cost than any monopoly price reaction. Since maximum values of ECR-I have already been seen to be small, the maximum possible values of ECR-II are probably very small.

ECR-III. The importers' utility function (U) implied by the observed relative quantities and prices of EEC and ROW varieties of any product will seldom have remained unchanged between any two years; and shifts between 1970 and 1971 (or 1972) should not be too quickly attributed to the granting of preferences or to any reactions caused by preferences. Here as with ECR-II, a comparison is made between the products of the basic preferenced sample and their non-preferenced counterparts, the control sample.

There are many ways of measuring the implied shift of the U function between two years, but one suggests itself from the derivation of the ECR-III concept: a comparison of the variety-ratios (i.e. the ratio of Q_E to Q_R) that would have been imported, at given relative prices, according to the implied U functions of two different years. Such a comparison is shown in Figure 4. The variety-ratio, q_β, would have been purchased in year one (i.e. 1971 or 1972) at actual year-one prices,[29] and the variety-

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[28] The maximum ECR-I occurs at CES = ∞ and equals $rP_E^1Q_E^1/[P_E^1Q_E^1 + (1+r)P_R^1Q_R^1]$; the maximum ECR-II occurs at CES = 0 and equals $mP_E^1Q_E^1/[P_E^1Q_E^1 + (1+m)P_R^1Q_R^1]$. (See Appendix D.) For small values of r and m, the ratio of the maximum ECR-II to the maximum ECR-I is approximately m/r.

[29] The budget-line slope, according to Figure 4, involves m, but the ratio of q_β to q_γ does not require knowledge of m. This can be seen by examining equations D-13 and D-18 of Appendix D.

ratio, q_γ, would have been purchased in year zero (i.e. 1970) at those same year-one prices. The ratio, q_β/q_γ, is one way of measuring the extent to which the implied U function shifted.

This ratio, q_β/q_γ, was computed for all preferenced and control products, for 1971 and 1972, for the EAC as a whole and each country separately--all, quite arbitrarily, at an assumed elasticity of substitution (CES) of unity. The ratio of the q_β/q_γ for each preferenced product to the q_β/q_γ of its counterpart was then calculated. There was, as might be expected, great variance, this final ratio ranging (to three decimals) from 0.000 to 37.742. But there is no evidence at all that the ratio, on the average, is different from one.[30] Moreover, for neither the preferenced nor the control products separately is there any evidence that, on the average, q_β/q_γ is different from one.[31]

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[30] For example, the medians of the ratio of the (q_β/q_γ) of preferenced to the (q_β/q_γ) of control products for the various samples (at CES=1):

Region	Year	Median
EAC	1971	1.206
	1972	1.025
Kenya	1971	1.014
	1972	.912
Tanzania	1971	.930
	1972	.968
Uganda	1971	1.721
	1972	.972

[31] For example, the medians of (q_β/q_γ) for the various samples (at CES=1):

Region	Year	Median	
		Preferenced Sample	Control Sample
EAC	1971	.932	.882
	1972	.990	.870
Kenya	1971	1.005	1.009
	1972	.716	.582
Tanzania	1971	1.008	.861
	1972	1.946	2.677
Uganda	1971	1.221	.654
	1972	1.498	1.188

Note: The preferenced sample here includes only these 17 products for which there are control-sample counterparts.

In short, there is abundant evidence that the implied U functions shift around a good deal between any two years, but none that the appearance of preferences shifted the functions of the preferenced products in any consistent manner. This is reassuring in one sense since significant shifts would have made suspect the empirical evidence with respect to ECR-I and ECR-II.

Despite this evidence that the U shifts were due to forces other than preferences, I calculated the values of ECR-III for the preferenced products (arbitrarily, at a value of CES=1).[32] For the EAC taken as a whole in 1971, the value of ECR-III was less than one per cent for exactly half of the 26 products and for only four was it greater than four per cent. The results for Kenya and Uganda were similar. For Tanzania, on the other hand, many large estimates of ECR-III appeared; this is not surprising given the suppression of market forces and politically inspired trade patterns that were emerging there in these years.[33] Even for Tanzania, however, the implied absolute excess costs, when all shifts in functions are attributed to the introduction of preferences, are under Shs. 4 million (total for all sample products) in each of 1971 and 1972; and for Kenya and Uganda, they are much less.

In summary, there is no evidence that importers' utility functions were shifted as a result of the EEC preferences in 1971. In fact, the costs of shifts in the implied U functions, from whatever causes, are generally small--except in Tanzania, where there are clearly other explanations than EEC preferences.

Summary. In a sentence, little evidence of excess cost of preferences has been uncovered. The median rate of preference granted the EEC on the 26 products of the basic sample is only four per cent,[34] and the median

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[32] See Table C-2 of Appendix C.

[33] An extreme case illustrates the pattern. Tanzania imported 277 thousand liters of wine in 1970, over 80 percent of it from the EEC. In 1971, though CIF prices changed little, such socially valueless imports fell to 47 thousand liters and less than 30 per cent of that from the EEC. The measured ECR-III (at CES=1) is 85.96% and the AEC-III is Shs. 184 thousand (on a total 1971 import value of Shs. 306 thousand).

[34] For the entire 62 preferenced products, the median rate of preference is slightly higher--five per cent. See Appendix B, Table B-1.

excess cost due to these preferences (i.e. ECR-I) is less than two per cent for each of the EAC countries (and for the three taken together) and for each of the after-preference years, 1971 and 1972. There is no clear evidence that as a result of the preferences, EEC prices were raised (i.e. ECR-II) or that EAC importing choices were distorted (i.e. ECR-III). And, in any case, the maximum costs on these latter counts could not have been high.

But, it must be remembered, there are sources of excess cost due to preferences that the techniques employed here cannot consider. First, it must be remembered that all the costs measured above refer to distortion between EEC and ROW varieties of a "product." There are also, presumably, some distortions between products--for example, the EEC preference of 3% on "sheets and plates, of iron or steel, hot-rolled or cold-rolled, flat, uncoated, of a thickness of 0.355 centimeters or less" could well have distorted EAC imports not only away from thin ROW sheets but also away from thicker sheets of either EEC or ROW varieties. Although no attempt has been made to assess this distortion intuition suggests that, if the intra-product distortion is small, the inter-product distortion will be even smaller.

And second, large excess cost may emerge in the long run as various small costs recur, cumulate, interact, and generally create advantages for EEC exporters in the EAC. Only time can provide the micro-data needed to examine the long-run impact of these preferences on the structure of EAC imports. Certainly, the aggregates so far give no hint of increased EEC penetration in EAC markets.[35]

Finally, it must also be recalled that the EAC costs due to import distortion are incurred in order to achieve gains from privileged entry reciprocally accorded to EAC exports by the EEC. For a complete appraisal of the EAC-EEC association, these gains must also be measured--a job that remains to be done.

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[35]The EEC share of EAC imports fell slightly in 1971 and rose slightly in 1972.

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Appendix A: The EAC-EEC Association[36]

Discussion between the East African Community (EAC) and the European Economic Community (EEC) began at the time of the Independence of Kenya, Tanzania and Uganda in 1963, and a formal "agreement establishing an association" between the two communities was finally signed in 1969. Known as the Arusha Agreement, it went into operation--conveniently from a data-using viewpoint--on January 1, 1971. This agreement is to last for roughly four years, through January 31, 1975.

The Arusha Agreement is much narrower in scope than its more famous predecessor association between the EEC and many African nations, the Yaounde Convention. The EAC-EEC Association is strictly a commercial agreement, offering reciprocal preferences on certain imports.

In principle, all exports from the EAC to the EEC members enter duty-free, provided they do not fall into one of two categories:

1) Products subject to the specific rules of the EEC's Common Agritural Policy (CAP); these consist largely of the agricultural produce of the EEC countries, i.e. grains, meats, dairy products, vegetables, vegetable oils, tobacco and wool.[37]

2) Unroasted coffee, cloves, and tinned pineapple, which are granted duty-free entry only up to a quota, a device intended to provide protection to the exports of the competing French West African exports of these products to the EEC.[38]

These exceptions eliminate much of the potential short-run benefit to the EAC from its association with the EEC. But the actual list of products on which the EEC offers the EAC privileged entry is even smaller, since several important EAC exports--e.g. tea and sisal--already enter duty-free from any country. What is left? A handful of existing EAC exports--such as pyrethrum, leather, fresh pineapples, and passion-fruit juice--and a long array of manufactures which the countries of the EAC now hardly produce, much less export.

In return, the EAC was required to offer preferential import treatment on some EEC products. The list (of 62 products; see Appendix B) contains a

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[36] The discussion of this Appendix draws heavily from Ghai (1972).

[37] Products listed under Annex II of the Treaty of Rome are "also" excluded from duty-free entry, but these were almost identically the very products later covered by the CAP.

[38] For a critique of such preference-within-quota systems, see Cooper (1972).

variety of products, tied only loosely by two threads:

1) Products which are, or are likely soon to be, produced in the EAC are absent. This criterion for selection insures that there is no need to worry about the effects of preferences on domestic (i.e. EAC) production, but only on the composition of imports by source.[39]

2) Important imports from the United Kingdom are excluded in order that the association should disrupt as little as possible the traditional trade links between the EAC and Great Britain.

It is not possible (for reasons detailed in Appendix B) to know how much trade these 62 "products" involve, but it has been estimated that the EAC imports from the EEC of these 62 products amounted in 1963 to Shs. 160 million (Ghai, 1972, p. 24). The 26-product sample on which the empirical estimates of this paper are based covers about one fourth of the total.

[39]Where domestic production is involved, the analysis is more complex; see, for example, Clague (1972).

Appendix B: The Samples

The official list of products on which the EAC granted tariff preference to EEC imports is given in Protocol No. 3 of the Text of the Agreement.[40] There are 62 different East African Tariff Classifications (EATC) mentioned; they are listed in Table B-1. As discussed in the text, all but 26 of these "products" proved unusable for one (or more) of three reasons:

1) The SITC group under which their trade data is gathered also includes non-preferenced or differently preferenced products. Twenty-four products were lost on this count.

2) The trade data are given in value terms only; without some kind of quantity data, neither the quantity (Q) nor the unit-value (P) variables can be calculated. Ten more products went.

3) Where the EAC imports of a product were not diversified, as between EEC and ROW varieties, in the base year, 1970, it is probably unwise to consider the product heterogeneous, as the methods of this paper do. Two more products were thereby ejected.[41]

A "control" sample was also generated for use in the analysis of ECR-II and ECR-III. A "control" product was sought for each of the 26 products in the "basic" (preferenced) sample in the following manner. Within the same three-digit SITC group, the product with the greatest physical similarity was selected, subject to two provisions:

1) There must have been at least Shs. 100,000 of EAC imports in 1970.

2) At least two of the EAC countries must have imported some of the product from each of the EEC and ROW in 1970.

Unfortunately, even with so little constraint--plus a quite generous interpretation of product similarity--it was not possible to find a satisfactory control product for nine of the "basic" products. When the control sample and the basic sample are used together, therefore, there are only 17 matched products. The list of control-sample products is given in Table B-2.

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[40] East African Community, Legal Notice No. 43 of 10 October 1969.

[41] And several others go when the sample is applied to the three partner countries separately.

Table B-1

Basic Sample

Product	EATC	SITC	Full Tariff Rate	Rate of EEC Preference	Uniquely Mappable?	Quantity Data?	Diversified Imports?	1970 EAC Imports (Shs. 1,000s) EEC	ROW
1. Malt, roasted or not	11.07	048.2	.50	.13	yes	yes	yes	1,196	10,469
2. Hops	12.06	054.84	.15	.05	yes	yes	yes	2,332	888
3. Olive oil	15.07.C	421.5	.50	.02	yes	yes	yes	254	120
4. Prepared or preserved fish including caviar & caviar substitutes	16.04	--	.50	.025	no				
5. Sugar confectionary, not containing cocoa	17.04	--	.50	.03	no				
6. Chocolate and other preparations containing cocoa	18.06	073.	.50	.08	yes	yes	yes	205	4,582
7. Bakers' and household yeast	21.06.A	099.061	.30	.04	yes	yes	yes	1,744	2,548
8. Wine, bottled	22.05.Aii	112.122	--	--	yes	yes	yes	3,640	860
9. Champagne	22.05.Bi	112.123	--	--	yes	yes	no		
10. Sparkling wines, other than champagne	22.05.Bii	112.124	--	--	yes	yes	yes	42	35
11. Vermouth, and other wines of fresh grapes flavored with aromatic extracts, bottled	22.06.B	112.132	--	--	yes	yes	yes	105	9
12. Brandy	22.09.B	112.401	--	--	yes	yes	yes	4,292	7
13. Vegetable coloring	32.04	--	.375	.07	no				

Table B-1 (cont.)

Product	EATC	SITC	Full Tariff Rate	Rate of EEC Preference	Uniquely Mappable?	Quantity Data?	Diversified Imports?	1970 EAC Imports (Shs. 1,000s) EEC	ROW
14. Putty	32.12	533.35	.30	.09	yes	yes	yes	211	2,209
15. Oils for use in manufacture of perfume, cosmetics, or toilet preparations	33.01.A	--	.75	.07	no				
16. Other oils	33.01.B	--	.30	.07	no				
17. Gelatin	35.03.A	--	.30	.08	no				
18. Film in rolls, sensitized, unexposed	37.02	884.42	.30	.03	yes	no			
19. Other cinematograph film, of a width exceeding 16 mm	37.07.C	--	--	--	no				
20. Cigarette paper in bulk	48.01.A1	641.4	.45	.02	yes	yes	yes	763	2,179
21. Cigarette paper, cut to size	48.10	642.91	.45	.05	yes	yes	yes	21	57
22. Carpets	58.02	657.6	.30	.05	yes	yes	yes	1,044	3,229
23. Safety glass	70.08	664.7	.30	.05	yes	yes	yes	1,038	1,420
24. Sheet or plate glass, with metal	70.09	664.8	.30	.03	yes	yes	yes	449	817
25. Glassware for table	70.13	665.2	.333	.033	yes	yes	yes	3,734	3,192
26. Sheets & plates of iron & steel, flat, uncoated, less than 0.355 cm thick	73.13.C1	674.421	.15	.03	yes	yes	no		

Table B-1 (cont.)

Product	EATC	SITC	Full Tariff Rate	Rate of EEC Preference	Uniquely Mappable?	Quantity Data?	Diversified Imports?	1970 EAC Imports (Shs. 1,000s) EEC	ROW
27. Wire grill	73.27.A	--	.30	.05	no				
28. Stoves, ranges, cookers, grates, etc.,not electrically operated for domestic use-- of iron & steel	73.36.B	697.109	.30	.05	yes	no			
29. Cooking & heating apparatus for domestic use-- of copper	74.17.B	697.109	.30	.05	yes	no			
30. Domestic water heaters, non-electric	84.17.A	719.43	.15	.03	yes	yes	yes	450	108
31. Weighing machinery, counting & checking machines, weighing machine weights	84.20.B	--	.30	.05	no				
32. Typewriters, check-writing machines	84.51	714.1	.30	.04	yes	yes	yes	4,637	1,898
33. Calculating machines, and all other machines incorporating a calculating device	84.52	{714.21 714.22}	.30	.02	yes	yes	yes	6,339	10,238
34. Other office machines	84.54	714.91	.30	.07	yes	yes	yes	216	1,356
35. Parts and accessories for typewriters, calculating machines & other office machines	84.55	714.92	.30	.09	yes	no			
36. Electric fans	85.06.A	725.031	.30	.05	yes	yes	yes	46	1,810

Table B-1 (cont.)

Product	EATC	SITC	Full Tariff Rate	Rate of EEC Preference	Uniquely Mappable?	Quantity Data?	Diversified Imports?	1970 EAC Imports (Shs. 1,000s) EEC	ROW
37. Radio & television receiving sets and radiograms	85.15.A	724.1	.50	.03	yes	yes	yes	715	2,253
38. Parts and accessories for motor vehicles	87.06.C	--	.333	.05	no				
39. Lenses, prisms, mirrors, & other optical elements-- unmounted	90.01.A	--	.30	.07	no				
40. Lenses, prisms, mirrors & other optical elements-- mounted	90.02.A	--	.30	.07	no				
41. Refracting telescopes	90.05	--	.30	.07	no				
42. Photographic cameras and flashlight apparatus	90.07.B	--	.30	.05	no				
43. Movie cameras, projectors, and sound reproducers	90.08	861.5	.30	.05	yes	no			
44. Image projectors, photographic enlargers & reducers	90.09	--	.30	.05	no				
45. Measuring rods, tape measures, spring rules	90.16.A	--	.30	.07	no				
46. Pocket-watches, wrist watches & other watches	91.01	864.11	.30	.025	yes	yes	yes	50	4,324
47. Clocks with watch movements	91.02	864.12	.30	.05	yes	yes	yes	115	353

Table B-1 (cont.)

Product	EATC	SITC	Full Tariff Rate	Rate of EEC Preference	Uniquely Mappable?	Quantity Data?	Diversified Imports?	1970 EAC Imports (Shs. 1,000s) EEC	ROW
48. Other clocks	91.04.B	--	.30	.05	no				
49. Pianos, harpsichords, harps	92.01	891.41	.30	.05	yes	no			
50. Other stringed musical instruments	92.02	891.42	.30	.05	yes	no			
51. Pipes & reed organs, and the like	92.03	--	.30	.05	no				
52. Accordions, concertinas, mouth organs	92.04	--	.30	.05	no				
53. Other wind musical instruments	92.05	--	.30	.05	no				
54. Percussion musical instruments	92.06	--	.30	.05	no				
55. Electronic musical instruments	92.07	--	.30	.05	no				
56. Other musical instruments	92.08	--	.30	.05	no				
57. Musical instrument strings	92.09	891.43	.30	.05	yes	no			
58. Parts and accessories of musical instruments (other than strings)	92.10	891.9	.30	.05	yes	no			
59. Gramophones & dictating machines, record players, tape decks	92.11	891.111	.375	.075	yes	yes	yes	6,237	9,586

Table B-1 (cont.)

Product	EATC	SITC	Full Tariff Rate	Rate of EEC Preference	Uniquely Mappable?	Quantity Data?	Diversified Imports?	1970 EAC Imports (Shs. 1,000s) EEC	ROW
60. Gramophone records	92.12.C	891.201	.375	.05	yes	yes	yes	303	1,091
61. Recordings, other than gramophone	92.12.D	--	.30	.05	no				
62. Parts & accessories for gramophone, dictating machines, record players, tape decks	92.13	891.12	.375	.025	yes	no			

Notes: 1. 1970 EAC imports given only for products in the basic EAC sample.

2. -- indicates a specific rate of tariff or preference.

3. SITC given where uniquely mappable.

4. Products 28 and 29 were not uniquely mappable separately but were if considered together.

5. Product 33 was uniquely mappable into two SITC groupings.

Table B-2

Control Sample

Product	SITC	SITC of Paired Basic Sample Product	1970 EAC Imports (Shs. 1,000s) EEC	ROW
1. Preparations of flour, starch, or malt extract	048.82	048.2	1,497	2,268
2. Beans, peas, lentils, etc.	054.2	054.84	538	1,420
3. Milk food for infants	099.092	099.061	3,750	2,404
4. Wine, not in bottles	112.121	112.122	2,369	982
5. Beer	112.300	112.124	578	1,965
6. Potable spirits, other than gin, brandy, whiskey, rum	112.405	112.132	333	798
7. Liqueurs	112.406	112.401	614	556
8. Prepared pigments, enamels, glazes	533.31	533.35	161	1,698
9. Parchment, etc.	641.91	641.4	358	2,115
10. Paper bags	642.11	642.91	598	1,669
11. Linoleum	657.4	657.6	626	927
12. Drawn glass, unworked	664.3	664.7	689	4,260
13. Cart glass, unworked	664.5	664.8	169	336
14. Bottles, jars, flasks	665.1	665.2	949	1,889
15. Refrigerator, non-domestic	719.15	719.43	462	3,547
16. Radio receivers	724.2	724.1	2,904	16,502
17. Washing machines, domestic	725.02	725.031	285	932

Appendix C: Statistical Detail

Table C-1

Distribution of ECR-I and Total AEC-I

When, for all Products, CES = ∞

Sample	Distribution of ECR-I							Median ECR-I	Total AEC-I (Shs. 1,000s)
	No. of products	Less than .01	.01-.02	.02-.03	.03-.04	.04-.05	Greater than .05		
1971									
EAC	26	7	11	3	4	1	0	.0150	2,616
Kenya	26	7	12	3	3	0	1	.0135	1,306
Tanzania	24	10	5	5	1	2	1	.0129	577
Uganda	26	13	3	2	3	5	0	.0125	742
1972									
EAC	26	7	11	4	3	1	0	.0155	2,283
Kenya	26	10	9	4	2	0	1	.0135	952
Tanzania	21	8	5	2	5	0	1	.0155	732
Uganda	24	12	2	5	1	0	4	.0110	597

Notes: 1. The number of products will be less than 26 for the individual country samples whenever its imports were not diversified (i.e. between EEC and ROW) in the relevant year.

2. AEC-I total for the EAC differs from the sum for the three partner countries due to rounding.

Table C-2

Distribution of ECR-III and Total AEC-III,
When, for all Products, CES = 1

Sample	Distribution of ECR-III								Median ECR-III	Total AEC-III (Shs. 1,000s)
	No. of Products	Less than .01	.01-.02	.02-.03	.03-.04	.04-.05	.05-.10	Greater than .10		
1971										
EAC	26	13	5	3	1	0	1	3	.0097	5,081
Kenya	23	11	2	0	2	1	5	2	.0139	1,796
Tanzania	21	6	0	3	1	1	1	9	.0412	3,103
Uganda	22	8	3	2	1	2	3	3	.0189	833
1972										
EAC	26	12	3	0	0	1	2	8	.0140	7,617
Kenya	22	6	3	0	2	1	3	7	.0395	2,714
Tanzania	19	3	2	0	1	0	3	10	.1398	3,507
Uganda	17	6	3	1	0	1	1	5	.0195	665

Notes: 1. The number of products will be less than 26 for the individual country samples whenever its imports were not diversified (i.e. between EEC and ROW) in the relevant year and 1970.

2. AEC-III total for the EAC is not conceptually related to the sum of the totals of the three partner countries.

Appendix D: Derivation of the Formulas

Symbols

U_0, U_1. EAC importers' utility functions for 1970 and 1971, respectively.

Q_E^1, Q_E^α, etc. Quantities imported of the EEC variety of a product.

Q_R^1, Q_R^α, etc. Quantities imported of the ROW variety of a product.

q_1, q_α, etc. Ratios of the EEC to ROW varieties purchased of a product, (e.g. $q_\alpha = Q_E^\alpha/Q_R^\alpha$); throughout called the variety-ratio.

P_E^1, P_R^1. Prices (i.e. unit value) of the EEC and ROW varieties, respectively, in 1971.

r. rate of tariff preference granted the EEC variety.

m. the rate of increase in the price of the EEC variety as a result of its receipt of preference, where, plausibly but not necessarily, $0 \leq m \leq r$.

p_1, p_0 the ratios of the EEC price to the ROW price in 1971 and 1970, respectively (e.g. $p_1 = P_E^1/P_R^1$); throughout called the relative price.

ECR-I, ECR-II, ECR-III. the excess cost ratio of the first, second, and third kinds (discussed in the text).

AEC. the absolute excess cost.

Background

The general constant-elasticity-of-substitution (CES) utility function can be written as

$$U = [a(Q_E)^{-b} + (1-a)(Q_R)^{-b}]^{-1/b} \qquad \text{(D-1)}$$

where the two parameters are a and b, where the constant elasticity of substitution equals $1/(1+b)$, and where the scaling coefficient (in front of the brackets) is omitted since it is arbitrary and unnecessary. It should be noted that this function is homothetic, although only once in the procedure outlined below is that property utilized.

Different points on an indifference curve can be related to each other. For any two points, (Q_E^x, Q_R^x) and (Q_E^y, Q_R^y),

$$[a(Q_E^x)^{-b} + (1-a)(Q_R^x)^{-b}]^{-1/b} = [a(Q_E^y)^{-b} + (1-a)(Q_R^y)^{-b}]^{-1/b}, \qquad \text{(D-2)}$$

or, after substitution of the variety-ratios, q_x and q_y,

$$Q_R^x = \left(\frac{\frac{a}{1-a} q_x^{-b} + 1}{\frac{a}{1-a} q_y^{-b} + 1} \right)^{1/b} Q_R^y \quad . \tag{D-3}$$

Since utility maximization is assumed on the part of the importers (as a group), the slope of an indifference curve at any point will be equal to the appropriate relative price (since the CES function is homothetic). The slope of an indifference curve is

$$\left. \frac{dQ_E}{dQ_R} \right|_{dW=0} = - \frac{1 - a}{a} \left(\frac{Q_E}{Q_R} \right)^{1+b} , \tag{D-4}$$

which can also be written

$$\left. \frac{dQ_E}{dQ_R} \right|_{dW=0} = - \frac{1 - a}{a} q^{1+b} . \tag{D-5}$$

We will have frequent occasion to use equations (D-3) and (D-5). Finally, a subscript (i.e. U_0 or U_1) to the U function indicates the year to which it applies (i.e. 197<u>0</u> or 197<u>1</u>). Since the value of the elasticity of substitution (and hence of b) will be assumed and will be assumed not to change between 1970 and 1971, no subscript need be attached to b; but the value of a will vary and hence a subscript is appended to indicate to which U it refers. In what follows, only the excess cost ratio (ECR) formulas are developed, but the absolute excess cost (AEC) formulas can be readily derived.

<u>ECR-I</u>

Q_E^1 and Q_R^1 are the quantities of the EEC and ROW varieties actually purchased by EAC importers in 1971. The relative price pertinent to these importers was, in 1971, equal to $P_R^1(1+r)/P_E^1$, or $(1+r)/p_1$. The observed relative price and variety-ratio, together with the assumption of utility maximization, yield an estimate of a_1:

$$\frac{1-a_1}{a_1} q_1^{1+b} = \frac{1+r}{p_1} ; \tag{D-6}$$

and therefore

$$a_1 = \frac{p_1 q_1^{1+b}}{p_1 q_1^{1+b} + (1+r)} \quad . \tag{D-7}$$

Similarly, we can find the variety-ratio that would have been purchased had there been no preference (q_α on Figure 1 of the text),

$$\frac{1-a_1}{a_1} q_\alpha^{1+b} = \frac{1}{p_1} \quad , \tag{D-8}$$

and hence

$$q_\alpha = (1+r)^{-\frac{1}{1+b}} q_1 . \tag{D-9}$$

Finally,

$$Q_R^\alpha = \left(\frac{\frac{a_1}{1-a_1} q_\alpha^{-b} + 1}{\frac{a_1}{1-a_1} q_1^{-b} + 1} \right)^{1/b} Q_R^1 \quad . \tag{D-10}$$

The first excess cost ratio (ECR-I) can then be derived:

$$\text{ECR-I} = \frac{P_E^1 Q_E^1 + P_R^1 Q_R^1}{P_E^1 Q_E^\alpha + P_R^1 Q_R^\alpha} - 1 \quad , \tag{D-11}$$

which reduces, after substitutions from (D-6) through (D-10) to:

$$\text{ECR-I} = \frac{[p_1 q_1 + 1][p_1 q_1 (1+r)^{-1} + 1]^{1/b}}{\left[p_1 q_1 (1+r)^{-1/(1+b)} + 1 \right]^{(1+b)/b}} - 1 \quad . \tag{D-12}$$

ECR-II

The variety-ratio that would have been purchased if the EEC price had been $P_E^1/(1+m)$ instead of P_E (q_β in Figure 3 of the text) is found through

$$\frac{1-a_1}{a_1} q_\beta^{1+b} = \frac{1+m}{p_1} \quad , \tag{D-13}$$

where a_1 has already been estimated in (D-7). Also,

$$Q_R^\beta = \left(\frac{\frac{a_1}{1-a_1} q_\beta^{-b} + 1}{\frac{a_1}{1-a_1} q_\alpha^{-b} + 1} \right)^{1/b} Q_R^\alpha , \tag{D-14}$$

since both are on the indifference curve, U_1, and the variety-ratios, q_α and q_β, have already been estimated, in (D-9) and (D-13) respectively.

The second excess cost ratio (ECR-II) is

$$\text{ECR-II} = \frac{P_E^1 Q_E^\alpha + P_R^1 Q_R^\alpha}{\frac{P_E^1}{1+m} Q_E^\beta + P_R^1 Q_R^\beta} - 1 , \qquad \text{(D-15)}$$

or, after substitutions from (D-9), (D-13), and (D-14),

$$\text{ECR-II} = \left[\frac{p_1 q_1 (1+r)^{-1/(1+b)} + 1}{p_1 q_1 (1+m)^{-b/(1+b)} (1+r)^{-1/(1+b)} + 1} \right]^{(1+b)/b} - 1 , \qquad \text{(D-16)}$$

ECR-III

The tangency of the 1970 utility function, U_0, and the 1970 relative price, p_0, means that

$$\frac{1-a_0}{a_0} q_0^{1+b} = \frac{1}{p_0} , \qquad \text{(D-17)}$$

where $q_0 = Q_E^0/Q_R^0$, the variety-ratio actually observed in 1970. The variety-ratio that would have appeared in 1970 if the relative price had then been $P_R^1(1+m)/P_E^1$--i.e. q_γ in Figure 4 of the text--is given by

$$\frac{1-a_0}{a_0} q_\gamma^{1+b} = \frac{1+m}{p_1} . \qquad \text{(D-18)}$$

(D-17) and (D-18) together imply

$$q_\gamma = q_0 \left[\frac{(1+m)p_0}{p_1} \right]^{1/(1+b)} . \qquad \text{(D-19)}$$

Finally,

$$Q_R^\gamma = \left(\frac{\frac{a_0}{1-a_0} q_\gamma^{-b} + 1}{\frac{a_0}{1-a_0} q_\beta^{-b} + 1} \right)^{1/b} Q_R^\beta . \qquad \text{(D-20)}$$

The third excess cost ratio (ECR-III), is

$$\text{ECR-III} = \frac{\frac{P_E^1}{1+m} Q_E^{\beta} + P_R^1 Q_R^{\beta}}{\frac{P_E^1}{1+m} Q_E^{\gamma} + P_R^1 Q_R^{\gamma}} - 1 , \qquad \text{(D-21)}$$

which, after substitutions from (D-13), (D-19), and (D-20), becomes

$$\text{ECR-III} = \frac{\left[p_1 q_1 (1+m)^{-b/(1+b)} (1+r)^{-1/(1+b)} + 1\right] \left[p_0 q_0^{1+b} q_1^{-b} (1+m)^{-b/(1+b)} (1+r)^{-b/(1+b)} + 1\right]^{\frac{1}{b}}}{\left[p_1^{b/(1+b)} p_0^{1/(1+b)} q_0 (1+m)^{-b/(1+b)} + 1\right]^{(1+b)/b}} - 1 \qquad \text{(D-22)}$$

CES=0 (i.e. b = ∞)

$$\text{ECR-I} = 0 \qquad \text{(D-23)}$$

$$\text{ECR-II} = \frac{m p_1 q_1}{p_1 q_1 + (1+m)} . \qquad \text{(D-24)}$$

$$\text{ECR-III} = \begin{cases} \dfrac{p_1 (q_1 - q_0)}{p_1 q_0 + (1+m)} & \text{if } q_1 > q_0 . \\ \dfrac{q_0 - q_1}{q_1 [p_1 q_0 + (1+m)]} & \text{if } q_1 < q_0 . \end{cases} \qquad \text{(D-25)}$$

CES = 1 ("Cobb-Douglas", i.e. b = 0)

In the Cobb-Douglas function, the parameter, a_1, appears as an exponent in the utility function, i.e.,

$$U_1 = (Q_E^1)^{a_1} (Q_R^1)^{1-a_1} ,$$

but it is still estimated in the same way as for the general CES function, i.e., by (D-7) with b set equal to zero.

$$\text{ECR-I} = \frac{(p_1 q_1 + 1)(1 + r)^{1-a_1}}{p_1 q_1 + (1+r)} - 1. \tag{D-26}$$

$$\text{ECR-II} = (1+m)^{a_1} - 1. \tag{D-27}$$

$$\text{ECR-III} = \left(\frac{a_0}{a_1} \right)^{a_0} \left(\frac{1-a_0}{1-a_1} \right)^{1-a_0} - 1. \tag{D-28}$$

CES = ∞ (i.e. b = -1)

$$\text{ECR-1} = \frac{r p_1 q_1}{p_1 q_1 + (1+r)} . \tag{D-29}$$

$$\text{ECR-II} = 0 \tag{D-30}$$

$$\text{ECR-III} = \begin{cases} 0 & \text{if } \dfrac{p_1}{1+m} > p_0 . \\ \dfrac{p_0 (1+m)}{p_1} - 1 & \text{if } \dfrac{p_1}{1+m} < p_0 . \end{cases} \tag{D-31}$$

When applied to the empirical work, the variables in the subscript, 0, always refer to 197<u>0</u> and the variables in the subscript, 1, refer to either 197<u>1</u> or 1972. The context makes the choice clear.


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