AN EX-ANTE MODEL FOR ESTIMATING THE IMPACT ON TRADE FLOWS
OF A COUNTRY'S ACCESION TO A CUSTOMS UNION

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Abstract

This paper presents a structural *ex-ante* model to study the trade creation and trade diversion effects associated with a country's accession to a Customs Union. The model extends previous studies by introducing explicitly product differentiation and exports in the determination of trade creation and trade diversion. Unlike the traditional Vinerian analysis where the role of exports is neglected, the model handles the effects of the elimination of the common external tariff facing home exports. The model is then applied to Portugal's accession to the EC and estimates of trade substitution elasticities are presented for 26 sectors. Finally these elasticities are used along with other parameter estimates to classify sectors according to whether they would give rise to trade creation or trade diversion.
I. Introduction

This paper is motivated by the imminent accession of Spain and Portugal to the European Community (EC) and the probable enlargement of the EC to other countries as well. It presents a structural model to analyze the resource and welfare implications of a country's accession to a Customs Union (CU). The model is then applied to Portugal's accession to the EC.

The traditional focus of the theory of customs unions has been to establish the effects of the formation of a union on trade flows by stressing the distinction between trade creation and trade diversion and to derive the resulting welfare implications. Recently, the literature has also addressed the implications of: simultaneous mutual tariff elimination with the establishment of a common external tariff (CET), terms-of-trade effects (TOT), and the presence of tariffs in the rest of the world (ROW). The bulk of empirical work has sought to measure the effects of economic integration on trade flows by measuring trade creation and trade diversion. Most of these estimates are ex-post rather than ex-ante, that is, they seek to isolate the Common Market effects from the changes that have actually taken place. The problem these studies face is to construct an anti-monde with which actual trade flows may be compared, the difference being the integration effect.

The challenge facing ex-ante models is to provide an analytical framework amenable to estimation and able to provide a relatively accurate description of the actual post-integration situation. Because of the difficulties inherent in prediction, ex-ante models are usually simple, concentrating solely on economic behavior in the country joining the customs union. This paper is in that tradition and extends earlier reduced-form
models by providing a structural model measuring trade creation and trade
diversion for a single country at a fairly disaggregate level. This is done
by distinguishing explicitly commodities by countries of origin. The origins
of the model are to be found in Armington (1969) and more recently in de Melo
and Robinson (1981) and Grossman (1982). The model determines sectoral
import levels by a series of allocative decisions under the assumption of
profit maximization and competition. The resulting model takes into account
characteristics of individual sectors (import-substituting, exporting, import-
dependent, etc.) in the hope of providing more accurate estimates.

The remainder of the paper is organized as follows. Section II
describes the model and briefly contrasts it with other models. Section III
applies the model to Portuguese data to estimate the likely extent and pattern
of trade creation or trade diversion that would result from accession to the
EC. Section IV classifies sectors according to whether accession to the EC is
likely to be trade creating or trade diverting. Section V summarizes the
paper's main results.

II. A Static Model to Estimate a Country's Access to a Customs Union

The motivation for the structure of the model described below is
two-fold. First it starts from the observation that, contrary to expectations,
the formation of the EC led to intra-industry specialization rather than to
inter-industry specialization as predicted by the factor endowments theory of
trade. Balassa (1966) and Grubel (1967) observed at a disaggregate level that
the formation of the EC led to the simultaneous increase of exports and
imports at the sector level suggesting the presence of product differentia-
tion. Our model suggests that this is exactly what will occur if there is a
lowering of tariff barriers. Thus, although the model does not explain all sources of two-way trade, it has the distinguishing characteristic of incorporating explicitly the presence of two-way or intra-industry trade as a result of directly modelling product differentiation in an empirically implementable framework. 6/

The second motivation for the model is also empirical and relates to the existing literature on estimating the static effects of a customs union on trade flows. Because the literature does not model directly the allocation of resources, the resulting models treat trade creation independently from trade diversion. Although the usual procedure recognizes that goods supplied from all three sources (partner, non-partner, and the home country) are imperfect substitutes in use, it neglects the treatment of exports partly because it assumes that domestic goods are in infinitely elastic supply so that one need not be concerned about potential adjustments in the domestic price when the tariff changes [Clague (1971), Kreinin (1973), Clague (1976), Kreinin (1976)]. The model presented below relaxes these assumptions by introducing a structural model where exports are treated symmetrically with imports and adjustments in domestic production are explicitly taken into account.

Let there be \( n \) goods in the economy which can either be produced domestically, imported from a partner in a CU or imported from a non-partner country. Following Arzington's (1969) terminology, commodities distinguished by kind are called goods and commodities distinguished by kind and place of production are called products. For an economy with \( n \) goods there are \( 3nxn \) products, corresponding to domestic production, partner imports, and non-partner imports. Denote the \( i \)th good (\( i = 1, \ldots, n \)), by \( Q_i \) the domestic product for domestic use by \( D_i \) imports from the partner by \( ME_i \) and imports
from the non-partner by $MR_4$. Assume a two-level separable utility index, $U = (Q_1, Q_2, \ldots, Q_n)$ where the quantity index

$$Q_i = Q_i [D_i, \lambda_i (ME_i, MR_i)]$$

is linear homogeneous. It is as if buyers allocate their expenditures in two separate steps: (i) by maximizing their utility function subject to their budget constraint they decide how much will be purchased of each good, and; (ii) given the expenditure on the $i$th good, they decide how much to purchase of the domestic product and of the imported product from both sources. Two-stage allocation implies that the utility function generating that behaviour is weakly separable over sub-groups. In view of the empirical estimation to follow, we assume that the elasticities of substitution between domestic production and imports on the one hand ($s_1$) and between the two sources of imports ($s_2$) are constant, but not necessarily the same. This allows us to use the nested CES function proposed by Sato (1967) introducing strong separability in (1).

While convenient, two-stage budgeting and strong product separability have implications for intra-group allocation and inter-group budgeting between the partner and the non-partner and between domestic sales and imports. With respect to intra-group allocation, weak separability implies that expenditure shares by supplier are independent of group expenditures, while homotheticity implies that the “income” elasticities of all products within a group are equal. Therefore, partner and non-partner shares in total imports expenditures are only affected through relative price changes. With respect to inter-group budgeting (the effects of domestic price changes on imports
from one of the sources) cross-group price effects are proportional to the relevant "income" effect. It follows that a low "income" response for imports will be reflected in a low import source response to domestic prices.

Using the linear homogeneity assumption and Euler's theorem, expenditures on the \( i \)th good are given by:

\[
P_i Q_i = P_{D_i} D_i + P_{M_i} M_i
\]

where

\[
P_{M_i} M_i = P_{ME_i} E_i + P_{MR_i} R_i
\]

In these expressions \( P_{M_i} \), \( P_{ME_i} \), \( P_{MR_i} \) are the domestic currency prices of imports and \( P_i \) the price of the composite good \( Q_i \) and \( P_{D_i} \) is the price of the domestically produced good. The assumption of cost minimization leads to dual CES unit cost functions for \( P_i \) and \( P_{M_i} \). On the import side, the small country assumption is maintained, a reasonable assumption for most goods in a country such as Portugal, joining an existing CU.

Exports are determined by foreign demand and export price. As with imports, product differentiation is assumed on the export side. Exports in the eyes of foreigners are differentiated from products of other suppliers. Therefore we assume less than infinitely elastic foreign demand curves for exports. Note, however, that no distinction is made between production for local sales and production for exports. However, because accession to a customs union implies that the partner will drop his tariffs on exports from the new partner, a distinction must be made between export demand from the partner and export demand from the non-partner. To simplify the algebra
and the interpretation of results, it is assumed that in a given market (i.e. partner or non-partner) the elasticities of substitution between imports from any two countries and between imports and domestic production are constant and identical. Furthermore, we also assume that the elasticities of substitution, $s_e$, are identical in the partner's and in the non-partner's market. Thus, as with imports, two-stage budgeting and strong product separability are assumed in foreign markets. Therefore, partners' and non-partners' export shares only change through price changes.

With these simplifying assumptions and functional forms we proceed to derive comparative static expressions for changes in trade policy associated with accession to a customs union. These expressions in turn allow us to establish the presence of trade creation and trade diversion at the sector level. Dropping sectoral subscripts, holding wages constant the equilibrium condition for each sector is:

$$ X_s (PD) = D (PD, PM (PME, PNR)) + E_P (PME) + E_R (PWR) \tag{4} $$

where $X_s$ is the domestic supply, $PME$ and $PWR$ are the foreign currency prices, and $E_P$ and $E_R$ are exports to the partner and non-partner country. Totally differentiating (4) under the functional forms specified above and letting a hat over a variable denote a percentage change (i.e. $\hat{X} \equiv \frac{dX}{X}$) we have:

$$ \hat{X} X_s \equiv \hat{D} + \hat{E} \tag{5} $$

where $E$ are total exports. Further define the following: the elasticity of supply ($e_s \equiv \frac{X_s}{PD}$); the elasticity of substitution between imports and
domic goods \( (s_1) \), and between imports from the partner and imports from the non-partner \( (s_2) \); the elasticity of composite demand \( (e^d) \); the expenditure shares for domestic production \( (q_1) \), for imports from the partner \( (q_2) \), for domestic exports in total partner's expenditures \( (h_e) \); the price elasticity of demand for the good in the partner country \( (n_e) \); and the elasticity of substitution between the new entrant and non-partner exports, \( (s_e) \). Upon substitution, we obtain:

\[
\begin{align*}
\hat{D} &= s_1 (\hat{P} - \hat{P}_d) - e^d \hat{P} \\
\hat{M} &= s_1 (\hat{P} - \hat{P}_m) - e^d \hat{P} \\
\hat{ME} &= s_2 (\hat{P}_m - \hat{P}_{ME}) + \hat{M} \\
\hat{MR} &= s_2 (\hat{P}_m - \hat{P}_{MR}) + \hat{M} \\
\hat{P} &= q_1 \hat{P}_d + q_2 \hat{P}_{ME} + (1 - q_1 - q_2) \hat{P}_{MR} \\
\hat{PM} &= \frac{q_2}{1 - q_1} \hat{P}_{ME} + \frac{1 - q_1 - q_2}{1 - q_1} \hat{P}_{MR} \\
\hat{E}_E &= [ - (1 - h_e) s_e + h_e n_e ] \hat{P}_{ME}
\end{align*}
\]

To determine simultaneously how exports and imports from the partner and the non-partner are affected by a country's accession to a customs union, one must also take into account the domestic supply response. This in turn requires that the domestic price, \( P_d \), be determined so as to clear the
domestic market. To simplify further, we assume for each sector that the share of domestic exports in the partner country's total expenditures is small \( h_e = 0 \) so that (12) reduces to \( \hat{E}_e = -s_e P WE \). Likewise,

\[
\hat{E}_e = -s_e P WE
\]  

(13)

and the percentage change of total exports reduces to

\[
\hat{E} = -s_e \hat{P} D - s_e \lambda_e \frac{E_e}{E}
\]  

(14)

where \( \lambda_e = \frac{dte}{1 + te} \) and \( dte \) is the change in the CET. Substitution of (6-11) and (14) into (5) provides us with two expressions indicating changes in domestic prices following a change in tariffs. First assuming no change in the CET facing the country's exports we have:

\[
P D = \frac{\left( s_1 - e^d \right) (1 - q_1) \hat{P} M}{\left( e^s + s_e \right) \frac{E}{D} + e^s + \left( s_1 - e^d \right) (1 - q_1) + e^d}
\]  

(15)

In the case where the CET facing home exports to the CU is eliminated we obtain:

\[
P D = \frac{(1 - q_1) \left( s_1 - e^d \right) \hat{P} M - s_e \lambda_e \frac{E_e}{E}}{\left( e^s + s_e \right) \frac{E}{D} + e^s + (1 - q_1) \left( s_1 - e^d \right) + e^d}
\]  

(16)

Several propositions follow from these expressions. Start with the case of no change in the CET. First the change in the domestic price is inversely related to the domestic elasticity of supply. Second, unless domestically produced goods and imports are complements, (i.e. unless
(s_1 - e^d) q_1 < 0) a fall in the import price via a tariff cut will lead to a fall in the domestic price which in turn will lead to a decline in domestic production for domestic consumption from (6), an increase in imports from (7) and an increase in exports from (14). Third, if the three products differentiated by source are pairwise substitutes, then a fall in the partner import price will lead to a decline in domestic production and imports from the non-partner from (6) and (9). If import sources are complements, i.e. if \( s_{ME,MR} < e^d \) where \( s_{ME,MR} \) is the Allen elasticity of substitution between import sources then imports from both origins may increase. In turn, when it is also recognized that accession to a CU involves elimination of the CET facing home exports, the effect on domestic price and hence on domestic production is determined by the sign of the numerator in expression (10). Other things equal, if the domestic product is a close substitute in foreign markets (a high value for \( s_0 \)), the domestic price is likely to rise. 16/

Trade creation and trade diversion in the model are the result of two effects: The Vinerian effect whereby there is a substitution between sources of production holding consumption (PQ) constant; and the effect associated with changes in consumption due to variations in the level of expenditures. In the traditional Vinerian analysis where exports are neglected, a necessary condition for trade creation is a fall in the domestic price. As shown below, this is no longer the case in our model since exports may increase when the domestic price rises and this will in turn lead to an increase in imports.

To help in understanding the classification of sectors in Section IV and to motivate the econometric estimation in Section III, we turn to a discussion of trade creation and trade diversion in the Vinerian spirit using
expenditure shares along the lines suggested by Truman (1975). Because accession to a CU involves both adjustments in home tariffs and the elimination of the CET facing home exports to the CU, one can cover most cases by subdividing sectors into those where the export share in domestic production is high (and where imports usually represent a small share in expenditure) and into those where the share of imports in expenditures is usually high (and where the export share in domestic production is usually low). For sector belonging to the former group (exporting sectors), it is likely that accession to the CU will cause the domestic price to rise (PD > 0) and hence P to rise. For sectors belonging to the latter group (import competing sectors) it is likely that accession to the CU will cause the domestic price to fall. Finally, to reflect the likely effect of Portugal's accession to the EC, we assume that PME > P MR (i.e., that the home tariff is higher than the CET to be adopted upon integration). These assumptions are maintained in the classification in Table 1, which uses Truman's terminology.

The pattern of signs in Table 1 reflects the likely array of cases for import competing sectors. As expected, the outcome depends crucially on the values taken by the elasticities of substitution. Consider \( s_1 > 1 \) and \( s_2 < 1 \). In this case there is a substitution of partner imports for the non-partner imports (\( s_2 < 1 \)) and an "income" effect as total import expenditure increases (\( s_1 > 1 \)). Given the symmetry of import allocation, imports from both sources will increase if this "income" effect outweighs the substitution effect. For simplicity, double sign cases were classified in the Truman terminology on the presumption that the substitution effect outweighs the "income" effect. In this example if the "income" effect dominates then we
Table 1: Change in Expenditures

<table>
<thead>
<tr>
<th>Total Imports</th>
<th>Imports from Partners</th>
<th>Imports from Non-partners</th>
<th>Truman Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>$s_1 = s_2 = 1$</td>
<td>constant</td>
<td>constant</td>
<td>constant</td>
</tr>
<tr>
<td>$s_1 &gt; 1, s_2 = 1$</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>$s_1 = 1, s_2 &lt; 1$</td>
<td>constant</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>$s_1 &gt; 1, s_2 &lt; 1$</td>
<td>+</td>
<td>-(+)</td>
<td>+</td>
</tr>
<tr>
<td>$s_1 = 1, s_2 &gt; 1$</td>
<td>constant</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>$s_1, s_2 &gt; 1$</td>
<td>+</td>
<td>+</td>
<td>-(+)</td>
</tr>
<tr>
<td>$s_1 &lt; 1, s_2 &gt; 1$</td>
<td>-</td>
<td>+(−)</td>
<td>−</td>
</tr>
<tr>
<td>$s_1 &lt; 1, s_2 = 1$</td>
<td>−</td>
<td>−</td>
<td>−</td>
</tr>
<tr>
<td>$s_1, s_2 &lt; 1$</td>
<td>−</td>
<td>−</td>
<td>+(−)</td>
</tr>
</tbody>
</table>
are led to a double trade creation case rather than to external trade creation and internal trade diversion. For the exporting sectors, the "income" effect is much stronger so that, contrary to the import-competing sectors, the signs in parentheses are most likely to occur giving rise to a higher incidence of double trade creation (if $s_1 > 1$) and trade erosion (if $s_1 < 1$).

Since the results derived from the model depend crucially on the assumed values of the various elasticities of substitution, and particularly the values of $s_1$ and $s_2$, we turn to their econometric estimation.

III. Estimating the Elasticities of Substitution

In recent years, several studies have estimated substitution elasticities between imports of alternative suppliers [Hickman and Lau (1975), Grossman (1980)], but few exist between imports and domestic production [Alouze (1977), Shiells, Stern and Deardoff (1983)]. Because of difficulties in estimating elasticities of substitution [see Leamer and Stern (1970)], most empirical studies rely on "guess estimates" [Kreinin (1973), Clague (1976), Donges (1981)]. This cautions for prudence in the evaluation of the estimates below which are derived from Portuguese annual data for 26 sectors covering the period (1962-1978).

The structural model presented in Section II involves the estimation of the following system of equations: allocation of expenditure by industry; domestic demand and supply functions; and finally import demand by source and export demand functions by destination. Estimation of such a system is beyond the availability of Portuguese data although we are fortunate to be able to rely on Martins and Oliveira (1979) for estimation of the elasticity of demand ($\varepsilon^d$), and on the estimates of sectoral production functions by Oliveira and
Santos (1977) for the construction of the elasticities of supply \((e^s)\). This allows us to concentrate on the estimation of elasticities of substitution between domestic goods and imports \((s_1)\) on the one hand, and by import sources \((s_2)\) on the other, which are the most important ones for assessing trade creation and trade diversion.

Estimation was kept as simple as possible. The functional forms are based on the traditional estimation procedure which starts from a Marshallian demand curve and implicitly assumes that demand for each product is a function of all relative prices and income. Assuming that the error terms have the customary properties, we have:

\[
\log \frac{M}{D} = b_0 + b_1 \log PD + b_2 \log PM + b_3 \log Y + u \tag{17}
\]

and

\[
\log \frac{ME}{MR} = c_0 + c_1 \log PMR + c_2 \log PME + c_3 \log Y + v \tag{18}
\]

We proceed to check whether \(b_1 = -b_2\) and \(c_1 = -c_2\), which must hold for estimation of the elasticity of substitution that is a combination of own and cross demand elasticities for imports and domestic production on one hand (17) and for imports from different sources (18) on the other. The results of this test are reported in column 3 of tables 2 and 3. 19/ In the majority of cases we cannot reject the null hypothesis so that we proceed by estimating the following forms which have found support in the literature [Khan and Ross (1977)]:

\[
\log \frac{M}{D} = b_0 + b \log \frac{PD}{PM} + b_3 \log Y + u' \tag{19}
\]
and

\[
\frac{\log ME}{HR} = c_0 + c \log \frac{PMR}{PHE} + c_3 \log Y + v'
\]  
(20)

Estimation proceeds with or without the income term depending upon the results of the test \( b_3 = 0 \) or \( c_3 = 0 \). When the null hypothesis is rejected, the estimated model is not fully consistent with the theoretical model of section II. The reason for proceeding along these lines is the disappointing results obtained with the fully consistent functional forms used by Hickman and Lau (1974) [see results in Corado (1981), Chapter 4]. It is reasonable to assume that no bias results from the estimation of import equations alone since we may safely assume that import supply is infinitely price elastic. However, there is likely to be a downward simultaneity bias on the estimates from not including, due to lack of data, the estimation of domestic supply substitutes.

Equations (17) and (19) were estimated using current and lagged prices (models 1 and 2 respectively in Tables 2 and 3). The criteria for choosing a model were: (i) the estimated elasticity of substitution must have the correct sign (positive); (ii) the income term was included if the t-statistics lead to the rejection of the hypothesis that \( b_3 = 0 \); (iii) if more than one model can be chosen, the one with the highest t-statistics in the price term should be selected. The same criteria were also used for estimation of the elasticity of substitution between sources of imports, \( s_2 \), using equations (18) and (20).
Table 2 presents the summary of results for estimation of the elasticity of substitution between imports and domestic production \((s_1)\). It reports for each sector the results of the test \((b_1 = -b_2)\), the estimated elasticity of substitution and the income coefficient when included, \(R^2\) and the Durbin-Watson statistic for the chosen model. Substitution elasticity estimates range from -0.3 to 2.3 and their average is 0.79. The range of estimates reported in table 2 seems reasonable. Comparing to other studies, the range of estimates is somewhat lower than Alaouze's (1977) estimates for Australia (0.02 to 4.4) based on a regression equation similar to (19). Hickman and Lau (1974) report a 27 country estimated average of 3.03 for the elasticity of substitution between sources of aggregate imports, and estimated the substitution elasticity between sources of Portuguese imports within the range 2.8 to 3.5. The disaggregate estimates in table 2 may appear to be low although the different levels of disaggregation and different time periods make any comparison difficult.

Low values of the elasticities of substitution between imports and domestic production is to be expected in a semi-industrial country like Portugal. This is likely to be the case if, as was the case during most of the period, the foreign exchange constraint was particularly binding so that most imports did not compete directly with domestic products. Furthermore, bottlenecks are likely to make it difficult for producers to react to relative price changes in the short to medium run. It should also be noted that such results often occur at a disaggregated level and that the estimates are based on yearly observations for a short-time period (1962-1978), a period which also witnesses a revolution in 1974, price fluctuations and tight trade policies, all of which are likely to produce low estimates. Finally,
these estimates, on average, seem to support the "elasticity pessimism" based on the observation that the sliding Portuguese currency has not had the impact on trade flows that was initially expected.

Turning to the individual sectoral estimates, the patterns appear reasonable. For most goods for which the relative import share is high, the results show a low response of the relative shares to price variation indicating that these sectors can be classified as non-competitive. This is the case for iron and steel, machinery, other manufacturing, non-ferrous metals, metal products, other food products, and to a lesser extent for textiles, chemical products, transport equipment and paper and printing. In the primary sector, not surprisingly, we found low price responsiveness, particularly for mining and petroleum. For agricultural products, low responsiveness may be due to low productivity. On the other hand, a relatively larger response to price variations was found for the derivatives of petroleum and coal, basic chemicals, other non-metallic minerals and fisheries. Finally, as expected, the elasticity of substitution exceeded unity for most consumer goods industries: beverages and tobacco, footwear, wood and furniture.

The estimates for the elasticity of substitution between imports from the EC and non-EC countries are presented in table 3. The range of estimates for $s_2$ varies from -0.6 to 3.3. It is very encouraging that, as one would expect on a priori grounds, $s_2 > s_1$ for most goods, although the lack of reliability of the data casts doubt on the accuracy of individual coefficients. Looking at sectoral results, the responsiveness to relative price changes of imports differentiated by source are high for metal products, transport equipment, iron and steel, non-ferrous metals, other manufacturing,
<table>
<thead>
<tr>
<th>Institution Sector</th>
<th>Choose Model 1/</th>
<th>Test</th>
<th>Substitution Elasticity</th>
<th>Income Coefficient</th>
<th>Years</th>
<th>( \beta )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Agriculture &amp; Forestry</td>
<td>1 (-1.704) *</td>
<td>1.672 *</td>
<td>0.0113</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Livestock</td>
<td>2 (-1.823) *</td>
<td>2.322 *</td>
<td>0.0256</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Fishing and Preservation</td>
<td>1 (-1.900) *</td>
<td>2.491 *</td>
<td>0.0256</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Mining and Petroleum</td>
<td>1 (-1.112) *</td>
<td>0.855 *</td>
<td>0.0256</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Meat and Poultry</td>
<td>2 (-1.316) *</td>
<td>1.176 *</td>
<td>0.0256</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Fruit Preserves</td>
<td>1 (2.541) *</td>
<td>1.946 *</td>
<td>-0.010</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Other Food Products</td>
<td>1 (-1.239) *</td>
<td>0.844 *</td>
<td>1.032 *</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Beverages and Tobacco</td>
<td>2 (-1.331) *</td>
<td>0.316 *</td>
<td>-0.126</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Textiles</td>
<td>1 (-1.257) *</td>
<td>1.094 *</td>
<td>-0.010</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Clothing</td>
<td>2 (-1.267) *</td>
<td>1.154 *</td>
<td>-0.010</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Footwear</td>
<td>2 (1.073) *</td>
<td>1.367 *</td>
<td>0.0085</td>
<td>1.2179 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Wood and Furniture</td>
<td>2 (1.073) *</td>
<td>2.556 *</td>
<td>0.0085</td>
<td>1.2179 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Paper, Pulp and Printing</td>
<td>1 (-0.229)</td>
<td>1.736 *</td>
<td>-0.007 *</td>
<td>0.9044 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Basic Chemicals</td>
<td>1 (2.197)</td>
<td>0.211</td>
<td>-0.100</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Other Chemical Products</td>
<td>1 (2.197)</td>
<td>0.295</td>
<td>-0.100</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Derivatives of Petroleum and Coal</td>
<td>1 (-0.236)</td>
<td>0.110</td>
<td>2.000 *</td>
<td>2.1372 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Glass and Other Non-Metal Minerals</td>
<td>1 (-0.197)</td>
<td>0.862</td>
<td>0.0151</td>
<td>1.1589 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Iron and Steel</td>
<td>1 (-0.197)</td>
<td>1.068</td>
<td>-0.324</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Non-Ferrous Metals</td>
<td>1 (-1.520)</td>
<td>1.633</td>
<td>0.0857</td>
<td>1.4279 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Metal Products</td>
<td>1 (1.027)</td>
<td>2.747</td>
<td>-0.376</td>
<td>1.2292 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Non-Electrical Machinery</td>
<td>1 (-0.229)</td>
<td>0.295</td>
<td>-0.100</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Electrical and Equipments</td>
<td>1 (-0.423)</td>
<td>1.170</td>
<td>-0.925</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Transport Equipment</td>
<td>1 (-0.423)</td>
<td>2.337</td>
<td>-2.287</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Other Manufacturing</td>
<td>2 (-0.413)</td>
<td>1.191</td>
<td>0.016</td>
<td>1.0035 *</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1/ \( t \) statistics in parentheses. One star denotes significance at 5% level. "Test" is a test on the null hypothesis \( H_0: \beta = 0. \)
2/ Model 1 has current prices and model 2 has lagged prices as independent variables.
3/ One star denotes significance for non-autocorrelation and two stars denotes the test is inconclusive at 5% level.
textiles and agricultural goods. Lower elasticities were obtained for chemical products, non-electrical machinery, paper and printing, other non-metallic minerals, other food products, basic chemicals, derivatives of petroleum and coal and a negative elasticity was obtained for mining and petroleum.

To summarize, one may use the notion of trade creation and trade diversion presented in Table 1 to classify sectors: (1) trade creation (Truman's cases, 1, 2, and 3), and hence domestic costs of adjustment, are likely to be small since most sectors have low elasticities of substitution between imports and domestic production (low values of $s_1$); (2) external trade creation and internal trade diversion (case 2) is unlikely to occur since for those sectors for which $s_1 > 1$, $s_2$ is also greater than unity; (3) imports displacement (external trade diversion — cases 3 and 4) is also likely to be significant since most sectors have high elasticities of substitution between sources of imports (and high values of $s_2 - s_1$).

IV. A Classification of Sectors According to Trade Creation and Trade Diversion

The estimates in Section III indicate the likely pattern of trade creation and trade diversion on the import side. When combined with estimates of the elasticity of domestic demand and the elasticity of foreign demand for exports, one can use the model presented in Section II to estimate the effects of a country's accession to a CU. The details of such a model are contained in Corado and de Melo (1983). Application of the model with the elasticities estimated in Section III give the results in Table 4 on the static effects of abolishing both the tariffs facing imports from the EC and the CET facing home
exports. The results indicate that for Portugal the relative size of trade creation and trade diversion is closer to the one found for the Netherlands and Belgium-Luxembourg than the one found for the EEC in ex-post studies of integration. Our ex-ante study also indicates that trade creation would be twice as large as trade diversion but it represents only a 2.9 percent increase in total imports while trade diversion represents a 3.1 percent decline in imports from the non-partner country. Prewo (1974) and Balassa (1975) found that trade diversion exceeded trade creation in the Benelux and nearly exceeded trade creation in Netherlands, but that trade creation was several times larger than trade diversion for the EEC as a whole. Our results suggest that domestic production for domestic consumption would decline by only .2 percent.

In spite of an increase in total domestic demand for most goods, the relatively large size of trade diversion estimates was expected from the relative size of substitution elasticities reported in Section III. In fact, 88 percent of trade creation is accompanied by trade diversion, i.e., by increased demand and declining domestic production for domestic use, and 12 percent of trade creation represents double trade creation. The latter -- corresponding to an increase of imports from both sources with an expansion of demand and a decline in domestic production -- is mainly due to export expansion. The incidence of double trade creation (12 percent), which has not been incorporated in previous ex-ante studies is smaller, in percentage, than Truman's ex-post estimates for Benelux (55 percent) or Netherlands (39 percent).

The results above also reflect the abolition of the CET on home exports. When the CET is abolished, the price of exports seen by the partner
country buyers falls more than the price of exports seen by third country buyers. The difference is attributable to the CET change. Accordingly, not only the level of exports changes, but the export share going to the EC and the ROW also changes. On the other hand, with expanding export demand, there is an upward pressure on the equilibrium domestic price. Therefore, domestic production for domestic consumption changes and, if the cross price effects are significant, the volume of imports will also be affected, as explained in Section II. The results of table 4 correspond to a 2.8 percent increase in total exports, to a 24.5 percent increase in exports to the partner and to a 1.4 percent decline of exports to the non-partner. 24/

Table 4: SUMMARY OF TRADE CREATION AND TRADE DIVERSION (millions of 1970 escudos)

<table>
<thead>
<tr>
<th></th>
<th>Trade Creation</th>
<th>Trade Diversion</th>
<th>Domestic Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>1246</td>
<td>-689</td>
<td>-552</td>
</tr>
<tr>
<td>Double Trade Creation</td>
<td>147</td>
<td>32</td>
<td>-102</td>
</tr>
<tr>
<td>Internal Trade Creation and</td>
<td>1099</td>
<td>-709</td>
<td>-450</td>
</tr>
<tr>
<td>External Trade Diversion</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Corado and de Melo (1983).

Finally, table 5 uses Truman's terminology introduced in Table 1, but including both the substitution and consumption effects. Several exporting sectors indicate a pattern of double trade creation suggesting that cross-price effects via exports and domestic price adjustment are significant. However, most sectors show that trade creation is accompanied by trade
Table 5: CLASSIFICATION OF SECTORS ACCORDING TO TRADE CREATION AND TRADE DIVERSION 1/

<table>
<thead>
<tr>
<th>SIC Code</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>Double trade creation (Internal and External) a/</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Livestock</td>
</tr>
<tr>
<td>9</td>
<td>Fruit</td>
</tr>
<tr>
<td>10</td>
<td>Edible Oils</td>
</tr>
<tr>
<td>11</td>
<td>Animal Feed</td>
</tr>
<tr>
<td>18</td>
<td>Clothing</td>
</tr>
<tr>
<td>19</td>
<td>Footwear</td>
</tr>
<tr>
<td>21</td>
<td>Wood</td>
</tr>
<tr>
<td>22</td>
<td>Cork</td>
</tr>
<tr>
<td>24</td>
<td>Paper Paste (Pulp)</td>
</tr>
<tr>
<td>30</td>
<td>Resins</td>
</tr>
<tr>
<td>48</td>
<td>Commerce</td>
</tr>
<tr>
<td>50</td>
<td>Other Services</td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>Internal Trade Creation and External Trade Diversion b/</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Agriculture</td>
</tr>
<tr>
<td>2</td>
<td>Forestry</td>
</tr>
<tr>
<td>4</td>
<td>Fishing</td>
</tr>
<tr>
<td>6</td>
<td>Mining (non-metallic)</td>
</tr>
<tr>
<td>7</td>
<td>Meat</td>
</tr>
<tr>
<td>8</td>
<td>Milk Products</td>
</tr>
<tr>
<td>12</td>
<td>Other Food Products</td>
</tr>
<tr>
<td>13</td>
<td>Beverages</td>
</tr>
<tr>
<td>14</td>
<td>Tobacco</td>
</tr>
<tr>
<td>15</td>
<td>Textiles — Wool</td>
</tr>
<tr>
<td>16</td>
<td>Textiles — Cotton</td>
</tr>
<tr>
<td>17</td>
<td>Other Textiles</td>
</tr>
<tr>
<td>20</td>
<td>Leather Products</td>
</tr>
<tr>
<td>23</td>
<td>Furniture</td>
</tr>
<tr>
<td>25</td>
<td>Paper Products</td>
</tr>
<tr>
<td>26</td>
<td>Printing</td>
</tr>
<tr>
<td>27</td>
<td>Rubber Products</td>
</tr>
<tr>
<td>28</td>
<td>Plastic Products</td>
</tr>
<tr>
<td>29</td>
<td>Basic Chemicals</td>
</tr>
<tr>
<td>31</td>
<td>Inedible Oils; Pesticides</td>
</tr>
<tr>
<td>32</td>
<td>Paints, Varnishes, Lacquers</td>
</tr>
<tr>
<td>33</td>
<td>Other Chemical Products</td>
</tr>
<tr>
<td>34</td>
<td>Coal and Petroleum Derivatives</td>
</tr>
<tr>
<td>35</td>
<td>Glass and Glass Products</td>
</tr>
<tr>
<td>36</td>
<td>Cement</td>
</tr>
<tr>
<td>37</td>
<td>Other non-metal Mineral Products</td>
</tr>
<tr>
<td>39</td>
<td>Non-ferrous Metals</td>
</tr>
<tr>
<td>40</td>
<td>Metal Products</td>
</tr>
</tbody>
</table>
Table 5 (Continued)

<table>
<thead>
<tr>
<th>SIC Code</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>Non-electrical Machinery</td>
</tr>
<tr>
<td>42</td>
<td>Electrical Machinery and Equip.</td>
</tr>
<tr>
<td>43</td>
<td>Shipping, Repair &amp; Construction</td>
</tr>
<tr>
<td>44</td>
<td>Transport Equipment</td>
</tr>
<tr>
<td>45</td>
<td>Other Manufacturing</td>
</tr>
<tr>
<td>5</td>
<td>Mining — Metallic</td>
</tr>
<tr>
<td>38</td>
<td>Iron and Steel</td>
</tr>
</tbody>
</table>

1/ Classification based on quantities evaluated at base year prices.

a/ Increase in imports from EC and ROW. Case 1 of Table 1.

b/ Increase in imports from EC and decrease in imports from ROW. Case 3 of Table 1.

c/ Decrease in total imports and decrease in imports from non-partners. Case 4 of Table 1.

diversion and a decline in domestic production. As expected, large internal trade-creating sectors include capital goods particularly transport equipment, electrical machinery, and intermediate goods such as chemical products. Large external trade-diverting sectors are again transport equipment, machinery, metal products, basic chemicals and agriculture. Total demand for capital goods sectors would expand twice as much as demand for intermediates and consumer goods combined.

The classification of sectors in table 5 is suggestive of how resources would likely be reallocated following the changes in trade policy implied by a "small" semi-industrial country joining a CU. However, in
assuming the likely impact at the sectoral level of Portugal's entry into the EC, the role of several relevant features not included in the analysis should be kept in mind. First, the role of Spain's simultaneous entrance to the EC is not explicitly recognized here although it would likely dampen trade creation on the export side. Second, trade flows particularly trade creation, are likely to be amplified if account is made for economies of scale and economic growth. Third, costs of adjustment and trade imbalance would be attenuated if there is further horizontal as well as vertical specialization in Portuguese manufacturing (Balassa (1975) and (1981)). However, our analysis captures some of the benefits from horizontal specialization since sectoral expansion is usually accompanied by a concurrent import increase.

V. Conclusions

This paper developed and estimated an ex-ante model for assessing the trade creating and trade diverting effects of a country's accession to a CU. The concepts of trade creation and trade diversion that emerge from the model are considerably more elaborate than the standard ones in the literature. Application of the model to the accession of Portugal to the EC led to a classification of sectors according to whether they would give rise to trade creation or trade diversion. The pattern of elasticities of substitution between imports and domestic production on the one hand, and between EC and non-EC trading partners on the other, are usually plausible as they generally conform to a priori expectations; so are the figures for trade creation and trade diversion as compared with other ex-post estimates for small countries within the EC. The results indicate that several exporting sectors in the
primary and consumer goods group give rise to double trade creation, whereas intermediate and capital goods producing sectors would give rise to internal trade creation and external trade diversion.
Footnotes

1/ See surveys by Lipsey (1960), Robson (1971), Krauss (1972), and El-Agraa and Jones (1981).


3/ For surveys of the empirical literature see Sellekaerts (1973), Balassa (1975), Corden (1975), El-Agraa (1980).

4/ The argument for ex-ante models is elaborated in Mayes (1978).

5/ For a complete derivation of the model, discussion of estimation techniques and data sources, see Corado (1981).

6/ An important unexplained source of two-way trade is economies of scale in differentiated products. For theoretical models explaining this source of intraindustry trade see Krugman (1979), Helpman (1981) and Ethier (1982). For empirical evidence supporting the presence of product differentiation at a disaggregated level, see Isard (1979).

7/ The weak separability assumptions leading to (1) are: (a) the marginal rate of substitution between imports and domestic products for domestic use of the i\textsuperscript{th} good is independent of the quantities consumed of any other good; and (b) for a given good, the marginal rate of substitution between imports from partners and non-partners is independent of the level of home consumption of the domestic product. In customs union empirical applications, Clague (1971) proved that the Verdoorn-Johnson formula implies the separability and homogeneity assumptions. See Deaton and Muellbauer (1980), Ch. 5, for a full discussion of separability.
8/ For products, "income" effects denote changes in the demand for a product (e.g. ME or MR) resulting from a change in Mi holding relative prices constant. In terms of the notation employed below, strong separability implies that the "income" elasticity of partners $E_{ME, M}$ is equal to the "income" elasticity of non-partners, $E_{MR, M}$

\[
\left(\frac{\delta \log ME}{\delta \log M} - \frac{\delta \log MR}{\delta \log M}\right) = 0
\]

9/ From footnote 8, the proportionality factor is identical for imports from partners and non-partners, and the cross-price effect, $\epsilon_{j, PD}$ is given by

\[
\epsilon_{j, PD} = \epsilon_{j, M} \frac{\delta \log M}{\delta \log PD}; \quad j = ME, MR
\]

10/ The only thorough test of separability and homogeneity assumptions so far is the aggregate study of UK imports from different sources by Winters (1982). At a disaggregated level, the separability assumption has been widely used [Clague (1972), Alauze (1977), Grossman (1982), Shills, Stern and Deardoff (1983)]. Furthermore, the separability assumption is justified in a disaggregated sectoral customs union analysis whose objective is to separate trade creation from trade diversion.

11/ See Wonnacott and Wonnacott (1981) for a theoretical argument of why even a small country is not likely to be "small" for all commodities.

12/ One could easily formally incorporate such a distinction by using a constant elasticity of transformation function. See Powell and Gruen (1967). This option is not pursued because it is not followed up in the empirical analysis and would not add to the qualitative results of the model.
In this model, the abolition of the CET by the partner is the main reason for the non-constancy of the TOT. For a theoretical argument see again Wonnacott and Wonnacott (1991).

The full expression for PWE is obtained by logarithmic differentiation of \( PWE = PD \cdot (1 + te) \) where \( te \) is the CET and the exchange rate is assumed fixed at unity.

A full derivation of these expressions is available as an appendix from the authors upon request.

The uncompensated cross-elasticity of imports from the non-partner with respect to the price of imports from the partner is given by:

\[
\frac{\delta MR}{PWE} = q_2 \left( s^*_{ME, MR} - e^d \right)
\]

where the Allen elasticity is given by

\[
s^*_{ME, MR} = s_1 + \frac{1}{1 - q} (s_2 - s_1).
\]

Complementarity on the import side exists if the expression above is negative, i.e., if \( s^*_{ME, MR} < e^d \). The export demand effect on imports work through the domestic price change:

\[
\frac{\delta ME}{PD} = q_1 \left( s_1 - e^d \right)
\]

If \( s_1 > e^d \) then imports from both sources increase if domestic price rises. In this model, export effects and complementarity on the import side may lead to the double trade creation reported below.

This involves setting \( e^d = 1 \). The use of expenditures rather than quantities in Table 1 avoids an extremely cumbersome taxonomic exercise and brings out the role of \( s_1 \) and \( s_2 \). However, the classification in Tables 4 and 5 is based on quantities evaluated at
base year prices. For further discussion see Truman (1975), p. 367, footnote 7.

18/ Four series (with sources in parentheses) were required for estimation: (1) trade flows (OECD series C and Portuguese Central Planning Department); (2) domestic production (Portuguese National Statistical Institute); (3) import prices constructed as trade-weighted domestic WPI for ten major trading partners (IFS); (4) domestic prices (Portuguese Ministry of Industry and Technology). For a full description of data sources, estimation techniques, and detailed results, see Corado (1983).

19/ For sectors where we reject the null hypothesis, our functional forms are inappropriate. Except for fruit preserves, basic chemicals and non-electrical machinery, these are sectors where imports are small share (< 10%) of consumption. These results are likely to reflect the influence of non-tariff restrictions that have been important since 1972. For these cases, the estimates of $s_1$ and $s_2$ below, can be interpreted as weighted averages of the relevant elasticities of demand [see Leamer and Stern (1970), Chapter 3].

20/ Estimates for $s_1$ based on the static and dynamic functional forms derived in Hickman and Lau (1974) ranged from -.5 to 1.5 with an average of .45.

21/ Inconclusive, insignificant and/or wrong signs for the elasticity of substitution at a disaggregated level are common. Shiells, Stern and Deardorff (1983) estimated $s_1$ for 41 three-digit SIC U.S. industries with annual data for the period 1962-78. They report (p. 16) only 16 positive and statistically significant values ranging from 0.45 to 6.5.

22/ The exceptions are minerals and petroleum, derivatives of petroleum and coal, basic chemicals, glass and other non-metallic minerals.
The estimates for these sectors may reflect the existence of contracts with particular sellers.

23/ Trade policy changes were simulated using cross-section data for 1970. This year was chosen because detailed data was available and because it was a year relatively free of government controls, non-tariff barriers and currency devaluations which followed the 1974 revolution. The results in Tables 4 and 5 do not include the effect of adopting the prospective CET (on imports from non-partners). The results from the adoption of a fictitious prospective CET appears in Corado and de Melo (1983). For a partial ex-post analysis following the 1972 agreement between Portugal and the EEC see Lopes (1982) and Balassa (1981).

24/ Export expansion is not overly optimistic. Lopes (1982) found that Portuguese exports increased 9.7 percent between 1952 and 1972 and, induced by declining foreign demand and domestic instability, fell by 3.2 percent between 1972 and 1978.

25/ In this group domestic production rises in three cases: other manufacturing, non-electrical machinery and printing. For these sectors imports are complements with domestic production.

26/ For theoretical models which indicate the gains from trade with economies of scale see for instance, Krugman (1981) and Ethier (1982).

27/ For a further discussion of some of these, as well as other related issues, see de Macedo (1983).
Bibliography


Corado, C. and J. de Melo (1983), "A Simulation Model to Estimate the Effects of Portugal's Entry into the EC" (mimeo).


