# EC Enlargement and US Agricultural Exports

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**Abstract:** The impact of the EC enlargement on US agricultural exports to the EC is analyzed using a model differentiating products by origin. Simulation of the enlargement, based on average 1983-85 trade flows, indicates that the integration of Spanish and Portuguese agriculture into the EC variable import levy régime results, *ceteris paribus*, in an 8-percent drop in maize imports by the new EC members. Soyabean exports to the EC increase by 11 percent, benefiting from the combination of increased maize tariffs and duty free entry of oilseeds into the EC. Changes in US maize and soyabean exports to the EC are comparable to total changes in trade flows. The above developments could generate further strains in US-EC agricultural trade relations by increasing the pressure within the EC to balance the CAP reform with the imposition of some form of protection against EC oilseed imports. Simulating the recent EC Commission proposal for an oilseed tax indicates that its imposition would result in a moderate decrease of 3.8 percent in soyabean imports into the enlarged EC because of offsetting changes in maize and soyabean exports into the EC.

## Introduction

The 1986 enlargement of the EC to include Spain and Portugal was viewed by the USA as a positive step in the process of European integration. As indicated by previous experience, however, agricultural interests in the USA are not always in harmony with the often reaffirmed US commitment to the ideal of European unity. Only two months after the Spanish and Portuguese accession, the USA and the EC were disputing the impact of the enlargement on US agricultural exports to the new EC members.

Against a background of declining US agricultural exports in the 1980s, the accession of Spain and Portugal to the EC complicated the already strained US-EC agricultural trade relations, and their conflict over the enlargement brought the two sides to the brink of a trade war. Despite their agreement on compensation for US losses of grain exports to Spain, the underlying causes of the US-EC trade conflict are still unresolved and the future of their agricultural trade relations is uncertain. The process of reform that the Common Agricultural Policy is undergoing and its interaction with the new US farm policy objectives, outlined in the Food Security Act of 1985, account for this uncertainty. The concurrence of such developments with the new round of the multilateral trade negotiations of the General Agreement on Tariffs and Trade, in which the two sides entered with apparently different objectives, will probably generate conditions for a further deterioration in US-EC trade relations precisely when their improvement is necessary for the success of the new GATT round.

In the last two decades, US-EC trade conflicts have shifted from US objections to the EC variable import levies to US reaction to the negative impact of EC export subsidies on world markets (Petit, 1985). Yet the recent US-EC trade dispute shifted attention back to the access of US exports to EC markets and to the complexity of the issues involved. The combination of a highly protectionist grain import régime and free entry of oilseeds (and grain substitutes) into the EC has led to the severe dependence of the latter on the USA for nongrain feed imports (Buchholz, 1984). As a result, the process of CAP reform is directly linked, at least in EC priorities, to the issue of the completion of the CAP; i.e., of balancing any liberalization of the CAP grain régime with the introduction of some form of protection for the EC oilseed and grain substitute markets. The recent EC Commission proposal for the imposition of a tax on the consumption of oilseeds, which is still under consideration despite its withdrawal from the 1987 price package, is just an example of possible EC reforms that can adversely affect US-EC trade relations.

US concerns raised by the enlargement were thus directly related to the CAP reform issue because of the integration of the new EC members into the CAP structures. However, import tariff changes in soyabeans and maize, two products that together accounted for 78 percent of US agricultural exports to Spain and Portugal before the enlargement, were implemented in opposite directions. Grain exports from the USA to Spain and Portugal fell under the variable import levy régime, thus resulting in significantly higher import tariffs,

while the moderate Spanish and Portuguese soyabean import tariffs were abolished because of the zero tariff binding for EC oilseed imports.

Hence, assessing the impact of the enlargement on US farm exports to the enlarged EC is important in terms of the changes it generated in trade flows to the EC and also in terms of its impact on US-EC agricultural trade relations. The objective of this analysis is to assess this impact on US soyabean and maize exports by simulating alternative policy scenarios concerning policy changes in the enlarged EC.

## Methodological Framework

The objective of the present study requires the adoption of a theoretical framework to combine: (a) product differentiation by region of origin and destination, (b) incorporation of trade policies into its structure, and (c) projection of trade flows under alternative assumptions concerning policy changes in the importing regions. Product differentiation by origin and destination is justified by the variability in harvesting seasons among major exporters to the European Community. In addition, the impact of the enlargement requires that the import behaviour of the new EC members is treated separately from that of the EC-10.

A model for differentiated products was first developed by Armington (1969), and was based on the recognition that the perfect substitutability assumption used in world trade models is unrealistic. Consumers do not distinguish commodities only by their kind but also by their place of production. Henceforth, commodities differentiated by *kind* are denoted as "goods" (e.g., soyabeans vs. maize), and those differentiated by *origin* are denoted as "products" (e.g., US vs. Brazilian soyabeans). Three assumptions underlie Armington's model: (1) weak separability of the utility function (which is also assumed to be linearly homogeneous), (2) constant elasticity of substitution between a pair of products in a given market, and (3) equality of the elasticity of substitution between any pair of products in a given market.

Given these assumptions, the methodology developed by Armington treats an importing region's purchasing decision as a two-stage process. In the first stage, expenditure allocation among $n$ imported goods is determined by maximizing importers' utility subject to their income constraint, with resulting import demand functions of the form $X_h = X_h(P_1, P_2, ..., P_n, Y)$, where $X_h$ and $P_h$ are quantity and price indexes for good $h$, and $Y$ is total expenditure. In the second stage, total expenditure on each good ($Y_h$) is allocated among the $m$ products of that good that are differentiated by origin. This allocation is determined as a solution to the problem of minimizing the cost of purchasing total imports of good $h$, with resulting import demand functions of the form $X_{hi} = X_{hi}(P_{h1}, P_{h2}, ..., P_{hm}, Y_h)$. Minimizing the cost of procuring the quantity index $X_{hk}$ subject to $X_h$ and solving for the first order conditions yields the following import demand function for product $X_{ik}$ imported from region $i$ into region $k$ (Armington, 1969; and Sarris, 1980):

$$(1)\quad X_{ik}/X_k = a_{ik}^{\sigma k}(P_{ik}/P_k)^{-\sigma k},$$

where the subscript $h$ of the good is dropped for reasons of notational simplicity, $\sigma_k$ is the absolute value of the elasticity of substitution between imports from different origins in region $k$, $P_{ik}$ is the price of $X_{ik}$, and $P_k$ is the price index of $X_k$ in region $k$.

The core of Armington's model is an expression that links changes in the demand for product $X_{ik}$ to changes in its explanatory variables. This expression decomposes the growth in the demand for $X_{ik}$ into an income effect, an own-price effect, the effect of price changes in all related products of the good in question, and the cross-price effect of related goods. In the most general form, percentage changes in the demand for $X_{ik}$ are given by:

$$(2)\ \tilde{X}_{ik} = \theta_k \tilde{Y}_k + \varepsilon_{iik}\tilde{P}_{ik} + \sum_{\substack{j=1 \\ j\neq i}}^{m} \varepsilon_{jik}\tilde{P}_{jk} + \sum_{\substack{g=1 \\ g\neq h}}^{n} \eta_{gh}\tilde{P}_g,$$

where $\varepsilon_{jik}$ is found as (Alston and Scobie, 1987):

$$(3a)\ \varepsilon_{iik} = -(1-S_{ik})\sigma_k + S_{ik}\varepsilon_k,$$

$$(3b)\ \varepsilon_{jik} = S_{jk}(\sigma_k+\varepsilon_k).$$

Equation *(2)* expresses the demand side of the model used in the present analysis. The tilde (~) denotes percentage changes ($\tilde{x} = dx/x_0$), $X_{ik}$ and $P_{ik}$ are the quantity and price of the product imported from region $i$ into region $k$, $Y_k$ represents total expenditure for the good in question ($h$) in region $k$, $P_g$ is the price of competing good $g$ in region $k$, and $S_{ik}$ is the value share of imports of the product exported from region $i$ to region $k$. Parameters $\sigma_k$, $\varepsilon_k$, and $\theta_k$ are the elasticity of substitution, the import demand elasticity, and the income elasticity for good $h$ respectively, and subscript $j$ corresponds to products of the imported good competing with product $i$ in region $k$. Finally, $\eta_{gh}$ is the cross-price elasticity of good $h$ with respect to good $g$ in region $k$.

Following Sarris (1983), export supply flows of the $i$th exporting region, expressed in terms of percentage changes, are assumed here to be given by:

$$(4)\ \tilde{X}_i = \beta_i \tilde{p}_i + \phi_i \Delta t,$$

where $p_i$ is the internal export price (excluding all export subsidies or taxes), $\beta_i$ is the export supply elasticity, and $\phi_i$ is a trend constant.

Import and export prices are linked by identities of the form:

$$(5)\ \tilde{\tau}_{ik} = \tilde{P}_{ik} - E_{ik}\tilde{p}_i,$$

where $E_{ik}$ is the price transmission elasticity and $\tau_{ik}$ is an exogenous shifter through which changes in policy variables, such as tariff changes or exchange rate fluctuations, can be introduced into the model. Finally, the model is closed by the following clearing condition that restricts export supply from region $i$ to equal the summation, across all regions $k$, of import demand from region $i$:

$$(6)\ 0 = \tilde{X}_i - \sum_{k=1}^{m} H_{ik}\tilde{X}_{ik}.$$

$H_{ik}$ is the base period quantity share of exports from the $i$th exporting region to the $k$th market. Equations *(2)*, *(4)*, *(5)*, and *(6)* form a system of $N$ equations, where $N = 2m^2 + 2m$, that yields percentage changes in its endogenous variables that result from exogenous variable changes. Trade policy changes and their impacts on trade flows can be evaluated by varying the value of the $\tau_{ik}$ parameters, while different assumptions concerning the exogenously determined variables ($Y_k$, $\phi_i$) could shed light on the importance of these variables in determining trade flows.

## Data and Empirical Specification

Since the focus of this analysis is US exports into the EC and its new member states, the world is divided into five regions: the USA (US), the EC-10 (EC), Spain and Portugal (SP), other major exporters (OE), and the residual rest of the world (RW). Trade data were

obtained from the EC *Analytical Tables of Foreign Trade*, UN *Commodity Trade Statistics*, and USDA supply and use tables. Prices used are per-unit values in real terms and adjusted for exchange rate fluctuations. Average trade shares ($S_{ik}$, $H_{ik}$) for maize and soyabeans, in volume terms for exports and value terms for imports, were calculated from trade flow matrices constructed for the 1983-85 period.

First-stage import demand equations were estimated using time-series annual data for the 1966-85 period and were specified as:

$$(7)\ lnM = b_0 + b_1 lnPC + b_2 lnPS + b_3 lnY + b_4 lnS + b_5 T + b_6 D.$$

$M$ is the quantity of imports for soyabeans or maize, $PC$ and $PS$ are import prices of maize and soyabeans respectively, $Y$ and $S$ represent real income and domestic supply in the importing region, $T$ is time, and $D$ is a dummy variable for the period after the first EC enlargement. Due to the log-linear form of the import demand equations, estimated coefficients were the elasticities of the corresponding variables ($b_2 = \varepsilon_k$, $b_3 = \eta_k$, and $b_4 = \theta_k$).

The elasticities of substitution $\sigma_k$ were estimated from equation *(1)* by transforming it into a logarithmic form and then pooling cross-section, time-series data on imports from all origins into an importing region (Figueroa, 1986). Export supply elasticities were derived from simultaneously estimating the demand for and supply of exports of a region by using the methodology proposed by Goldstein and Khan (1978). The structural form of the estimated system is given by:

$$(8a)\ lnX_t = c_0 + c_1 ln(PX/PXW)_t + c_2 lnYW_t + c_3 lnX_{t-1}, \text{ and}$$

$$(8b)\ lnPX_t = d_0 + d_1 lnX_t + d_2 lnP_t + d_3 lnY_t + d_4 lnPX_{t-1}.$$

$X$ and $PX$ are quantity and price indices of exports, $PXW$ and $YW$ are trade-weighted indices of the world export price and the importers' real income, $P$ is the domestic price index, and $Y$ is an index of export capacity. The export supply elasticities were recovered from the estimated structural equations as $\beta_i = (1-d_4)/d_1$. Elasticity values used in model simulations are reported in Table 1. Except for the assumed values of the $\sigma_k$ and $\beta_i$ parameters for *RW*, all other reported elasticities are based on estimated equations whose results were generally very robust.

Table 1—Estimated Elasticity Values Used in Model Simulations

| | Maize | | | | | Soyabeans | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| * | US | EC | SP | OE | RW | US | EC | SP | OE | RW |
| $\varepsilon_k$ | -- | -0.80 | -0.25 | -- | -0.45 | -- | -0.29 | -1.24 | -- | -0.60 |
| $\eta_k$ | -- | 0.16 | 0.40 | -- | 0.57 | -- | 0.21 | 0.45 | -- | 0.18 |
| $\theta_k$ | -- | 2.80 | 1.69 | -- | 3.33 | -- | 3.70 | 1.57 | -- | 1.04 |
| $\sigma_k$ | -- | 1.59 | 6.43 | -- | 2.50 | -- | 2.78 | 4.80 | -- | 2.50 |
| $\beta_i$ | 1.11 | 0.88 | -- | 0.69 | 1.00 | 0.29 | -- | -- | 2.84 | 1.00 |
| $E_{ik}$ | -- | 0.25 | 0.75 | -- | 0.50 | -- | 0.90 | 0.85 | -- | 0.50 |

*$\varepsilon_k$ is the own-price elasticity of import demand, $\eta_k$ is the cross-price elasticity of import demand between maize and soyabeans, $\theta_k$ is the income elasticity of import demand, $\sigma_k$ is the elasticity of substitution, $\beta_i$ is the export supply elasticity, and $E_{ik}$ is the price transmission elasticity.

Export growth rates ($\phi_i$) were obtained by applying the detrending technique, while real income growth rates ($Y_k$) of the importing regions were obtained from the IMF *Financial Statistics*. Changes in trade policy variables implied by the EC enlargement were simulated by changing the value of the $\tau_{ik}$ parameters that correspond to the price differential between the export price in the *i*th exporting region and the import price in the *k*th importing region. Post-enlargement levels of tariff changes for SP were estimated by weighting tariff changes in each country by its import market share. Finally, values of the price transmission elasticities ($E_{ik}$) were obtained from Meyers, Devadoss, and Helmar (1966).

## Results and Policy Implications

Results of the four alternative scenarios used in model simulations are reported in Table 2. Scenario A simulates the impact of the enlargement including the quota imposed under the US-EC agreement on maize exports to Spain, while the oilseed tax proposal of the EC Commission was simulated by scenario B. Both scenarios A and B incorporate the assumption that past export and income growth trends would continue. In order to isolate the impact of the enlargement from the interaction of export and income growth effects, scenarios A and B were also simulated by setting $\phi_i$ and $Y_k$ equal to zero (scenarios C and D, respectively).

Table 2–Simulated Impact of the EC Enlargement on Maize and Soyabean Trade Flows*

| | Maize Scenarios | | | | Soyabean Scenarios | | | |
|---|---|---|---|---|---|---|---|---|
| Trade Flow | A | B | C | D | A | B | C | D |
| | Percentage changes | | | | | | | |
| EC imports: | | | | | | | | |
| From US | -0.23 | 0.40 | 0.19 | 0.82 | -0.12 | -2.20 | -0.91 | -3.00 |
| From OE | -2.07 | -1.44 | 0.21 | 0.83 | -0.01 | -7.81 | 1.33 | -6.40 |
| Total | 0.44 | 1.05 | 0.21 | 0.82 | -0.12 | -3.54 | -0.42 | -3.84 |
| SP imports: | | | | | | | | |
| From US | 0.40 | 4.30 | -8.37 | -4.47 | 3.25 | -10.79 | 11.25 | -2.79 |
| From OE | -21.62 | -17.75 | -7.90 | -4.04 | 3.23 | -20.03 | 14.92 | -8.34 |
| Total | -2.40 | 1.45 | -8.17 | -4.32 | 3.00 | -12.00 | 11.20 | -3.80 |
| Total exports: | | | | | | | | |
| Of US | 9.37 | 9.63 | -0.67 | -0.41 | 0.95 | -0.43 | 0.53 | -0.85 |
| Of OE | 2.78 | 2.94 | -0.44 | -0.27 | 0.80 | -6.37 | 2.65 | -4.53 |

*Percentage changes are based on average 1983-85 trade flows. Scenario A corresponds to the impact of the enlargement and scenario B to the oilseed tax under the assumption that past export and real income growth trends would continue, while scenarios C and D simulate A and B by ignoring the above trends.

As a result of the adoption of the variable import levy régime by SP, total maize exports to SP decrease by 2.4 percent, while US maize exports increase by 0.4 percent because of the positive impact of their past trend. The significant drop in OE exports to SP (21.6 percent) is also attributed to the influence of past trends, since isolating export and income effects results in a 7.9 percent decline of OE exports to SP. Under the same scenario (D), total and US maize exports to SP decline by 8.2 percent and 8.4 percent, respectively. Finally, due to the small share of the SP market in total US and OE maize exports, the drop in total exports of both the USA and OE is under 1 percent.

The combination of the developments in the SP maize market with those in the SP soyabean market, where import tariffs were abolished, results in a significant shift of soyabean exports to SP. As a result of the enlargement, total and US soyabean exports to SP increase by 3.0 percent and 3.3 percent, respectively. In fact, isolation of the enlargement from other factors indicates that its impact causes corresponding increases of

11.2 percent and 11.3 percent in the above exports. Total US and OE soyabean exports increase by 0.5 percent and 2.6 percent, respectively, under the same scenario (C).

Changes in EC trade flows under scenarios A and C are residual effects of tariff changes in the SP market and are thus insignificant. However, the impact of the imposition of the oilseed tax would be more significant. Under scenario B, total soyabean exports to the EC decline by 3.5 percent, while US exports drop by 2.2 percent. Under scenario D, respective declines are 3.8 percent and 3.0 percent, while maize exports to the EC increase by 0.8 percent, *ceteris paribus*. In SP, the impact of the tax outweighs the impact of the increase in maize tariffs, resulting in a drop of 12.0 percent in soyabean imports and an increase of 1.5 percent in maize imports. Scenario D, however, indicates that the oilseed tax alone causes postenlargement decreases of 4.3 percent and 3.8 percent in SP maize and soyabean imports respectively, while US maize and soyabean exports fall by 4.5 percent and 2.8 percent.

The impact of the oilseed tax on US exports is smaller than US concerns would seem to indicate. This is due to several factors. First, because of the low value of the US export supply elasticity, US exports drop less than OE exports. Second, the low own- and cross-price import demand and price transmission elasticities minimize import substitution possibilities between maize and soyabeans in the EC. Finally, the adverse impact of the enlargement on maize exports into SP limits the substitution impact in the SP, thus resulting in parallel and significant, instead of opposing and significant, impacts on both maize and soyabean markets.

In terms of annual trade flows and based on 1983-85 averages, the enlargement results, *ceteris paribus*, in a decline of 450,000 tons of maize imports and an increase of 380,000 tons of soyabean imports into SP. US maize exports drop by 360,000 tons, while US soyabean exports increase by 250,000 tons. The oilseed tax results in a total decline of 390,000 and 130,000 tons of soyabean exports to EC and SP, while combined maize exports to both the EC and SP drop by 280,000 tons.

The above results provide quantitative evidence of the fact that the EC enlargement might result in the development of trends similar to those observed in the past in the EC. The combination of a highly protectionist EC grain régime with the free entry of oilseeds distorts trade flows to the EC. As a result of the generated imbalances, which derive from the inconsistencies of the CAP, potential moves towards a lower level of protection for EC agriculture generate the possibility for some level of protection in the oilseed and grain substitute markets, and put further strains on US-EC trade relations.

## Note

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## DISCUSSION OPENING—*Folkhard Isermeyer* (Institut für Agrarökonomie, Universität Göttingen)

Estimating how the EC-enlargement will affect international trade flows is certainly a complex problem. The authors have tried as far as possible to consider the interdependent nature of supply and demand in different product markets, and they have presented a fairly comprehensive and highly sophisticated world trade model that is able to explain both supply and demand of soyabeans and maize. This attempt is very commendable.

One serious problem that often arises with such models is that testing the quality of the model empirically is almost impossible. Therefore, the following questions are designed to give a little assistance for a discussion of possible shortcomings in the construction of the model.

In the first stage, the importer's expenditures for different goods are estimated using time series data from 1966 to 1985. Two questions arise: first, given the tremendous structural change in the EC since 1966, do figures for the late 1960s and the early 1970s contain any useful information for today's problems?; and, second, should one include other prices than those of maize and soyabeans in the analysis, especially the prices of small grains, grain substitutes, and important animal products, since they clearly have an impact on the import demand of soyabeans and maize?

In the second stage, the import demand for one good is allocated to different exporting countries. This is the core of the model, and we will have to discuss whether it is also the core of the problem. In other words, are consumer preferences, differences in product quality, or different harvesting seasons among major exporters really the important factors that determine, for example, whether the USA or Brazil obtains a greater share of an increased European import demand for soyabeans? A second set of questions touches on the measurement of elasticities of substitution. Imagine the "true" long-term elasticity of substitution to be infinite. Are top-quality statistics available on cif prices that make equation *(1)* calculate this "true" result? If not, the authors may be measuring the quality of price statistics. What are they trying to measure after all: long-, medium-, or short-term elasticities of substitution? How do they explain the considerable differences in the results between Spain/Portugal and the EC-10? And then, if the "true" long-term elasticity of substitution is really less than infinite, are the authors still justified in regarding the two products as one good? Where should the fine line be drawn between products and goods in a world in which almost everything is substitutable?

The way the model is built, it should be able to tell us how world prices will develop as a consequence of the EC-enlargement. A presentation of price results would have been of great help in assessing the quality of the model. For example, we would have learned whether internal agricultural supply in Spain and Portugal is considered, whether it will increase when these countries join the Common Market, and what the impact on world

prices will be. I would also be very interested in seeing which price developments are responsible for the remarkable result that due to the EC-enlargement the EC-10 will import fewer soyabeans from the USA and more soyabeans from other exporters.

An advantage of the model is that policies such as the oilseed tax can be incorporated. Yet the model would be more valuable if products other than maize and soyabeans, particularly grain substitutes, were included. Consider, for example, the case if the EC were to erect strong political barriers against a further expansion of grain substitute imports (e.g., by strengthening the voluntary export restrictions). In this case, Spanish farmers might find it more profitable to feed European grain instead of a soyabean/grain substitute mixture. Even in Spain, pigs cannot be kept profitably on a pure soyabean diet. In contrast to the model results, the world price of soyabeans might thus fall and the world price for cereals might rise as a consequence of the EC enlargement.

## GENERAL DISCUSSION—*Ming-Ming Wu, Rapporteur* (Department of Agricultural Marketing, National Chung-Hsing University)

The authors were asked whether they obtained statistically reliable results on supply elasticities. In reply, they stated that several other products were included in the estimation of first-stage import demand. Reported elasticities are those for which empirical estimates were statistically significant. Sensitivity analysis, which could not be included due to space limitations, focused on testing the validity of the results by using various parameter values. The obtained results were not qualitatively different from those of the reported results.

Furthermore, the authors said, the study has several limitations related to the exclusion of domestic change in the Spanish and Portuguese grain market as a result of the enlargement and to the impact of other cross-product effects. These, however, do not directly affect the conclusions, which focus on the immediate impact of the enlargement on US agricultural exports.

Participants in the discussion included S. Tarditi.