EFFECTS OF EEC AGRICULTURAL POLICY ON EUROPEAN IMPORTS OF MEAT, DAIRY PRODUCTS, AND EGGS

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Trade in temperate zone agricultural products has remained largely outside the trend toward liberalization that has characterized international trade in the last 30 years. One of the most debated issues in this regard has been the European Community's Common Agricultural Policy (CAP) and its effects on world trade. Recent evidence [1, 4, 9, 10, 12] emphasized the implications of the protectionist nature of the CAP in stimulating internal trade and slowing down third countries' farm exports to the EEC. But, no attempt has been made to estimate quantitatively the magnitude of the effect of the CAP system of import protection on EEC supply, consumption, and trade of agricultural products.

The objective of this article is to provide a quantitative estimate of the impact of the CAP on production, consumption, and intra-EEC and world trade, based on an econometric model describing the operation of markets for meat, dairy products, and eggs in the European Community, and to assess the "static" welfare effects of the CAP on EEC trade.[1] The model contains 21 behavioral and 5 technical relationships and is based on annual data for the 1953-72 period. The parameters of the structural relationships are determined simultaneously and are estimated by three-stage least squares.

A brief description of agricultural and trade policies in the EEC is followed by discussion of the theoretical specification of the model and the statistically estimated equations. Finally, the model's forecasting ability within the sample period is evaluated and an attempt is made to capture the effects of the adoption of the CAP on world trade.

AGRICULTURAL AND TRADE POLICIES IN THE EEC

Protection of the European Community's market for agricultural commodities is based on the Common Agricultural Policy (CAP), which was adopted in 1962 and became fully operative by 1968.[2] The CAP was designed to assure the maintenance of high farm incomes through a variety of regulations that differ among commodities. These regulations constitute the CAP's "market" or "price" policy and involve support prices fixed well above world market prices, variable levies on imported agricultural products from extra-EEC sources, and the exporting of surplus production with the aid of export subsidies (or "restitutions"). The costs of financing this system are met through a common fund established from the proceeds of the import levies and contributions from the member governments.

Even though the market or price policies of the CAP differ from commodity to commodity, they have certain common features which result in free trade between member states, a common system of protection against nonmember countries, and a common price and income policy internally. The common price policy relies basically on a "variable levy" system of protection which is applied to all commodity groups included in this study.[3]

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[1]The removal of trade barriers among a group of countries and the erection of a common protection system *vis-a-vis* the rest of the world may produce "static" beneficial effects if it is conducive to the creation of trade, i.e., new trade which displaces present or potential home production. "Static" detrimental effects will arise if economic integration will result in trade diversion, i.e., if intra-union trade will increase because of a shift from a low cost producer outside the union to a higher cost producer within the union.

[2]Prior to the formation of the European Community, the six original members had engaged in different policies directed toward protection of the farm sector through price supports, subsidy measures, and import controls. The adoption of the CAP was largely an attempt to eliminate the diversity of pre-EEC farm support systems of the individual members and still preserve their protectionist features. Furthermore, not all of the original six were equally protectionist. The Netherlands, for example, has traditionally had the least protected agriculture in comparison with the other members.

[3]For a detailed discussion of the set of policy measures and the institutional arrangements of the CAP, see [3, 5, 6].

The calculation of the "variable levies" to be applied on imports from non-EEC countries involves three steps: (1) a "target" or "indicative price" is determined and is a theoretical price toward which the common market price should tend,[4] (2) a "threshold price" is fixed at which imports from nonmember countries can enter the EEC and which is lower than the target price by the transportation cost from the port of entry,[5] and (3) the "import levy" is computed on a daily basis as the difference between the threshold price for a commodity and the world price.

Along with the variable levies, "intervention prices" are used to ensure that a satisfactory level of prices is achieved in the EEC. The intervention price is between 90 and 95 percent of the target price and constitutes a guaranteed price at which government agencies will undertake support buying if the market price shows a tendency to fall below the intervention price. The CAP keeps market prices within two limits; the upper limit is the threshold price and the lower limit is the intervention price. If excess demand or rising costs in the market for an agricultural commodity tend to raise the market price above the threshold price, imports from extra-EEC sources enter the community to fill the gap in demand. If an excess supply causes the market price to fall below the intervention price, the EEC Commission will have to enter the market and support the price.

One effect of the adoption of the CAP has been to raise internal producer prices (threshold prices) above world market (or import) prices, and the difference between them approximates the degree of import protection in the EEC. The degree of protection has been particularly high in the case of butter, milk, cheese, poultry meat, wheat, oats, and rye [6, 8, 9]. In addition to resulting in higher prices for farm products and a higher degree of protection, the adoption of the CAP has stimulated domestic production. Consequently, the overall degree of self-sufficiency has increased for most agricultural commodities and growing surpluses have accumulated for grains, dairy products, and sugar. The increase in agricultural self-sufficiency, the rise in the degree of import protection, and the removal of nearly all trade barriers among member nations have reduced net import requirements for temperate zone goods from nonmembers, and the growing surpluses of several commodities and the policy of export restitutions have stimulated agricultural exports.

GENERAL MODEL SPECIFICATION

The agricultural sector in the EEC can be disaggregated into several commodity groups for which submodels are established. The estimated model includes five commodity groups selected on the basis of data availability and the fact that all are covered by the variable levy protection system.[6] Each commodity submodel includes a domestic supply equation, a market demand equation, a change in stocks equation (where applicable), an export to non-EEC countries equation, and an intra-EEC import equation. Specification of these relationships is explained hereafter.

Domestic Production

The theory underlying the domestic supply side is the traditional agricultural response to price. The quantity of domestic production in a particular year is primarily the result of farmers' production decisions and available technology. Lack of data for the EEC on some inputs (e.g., labor employed in each product category) prevented the use of the production function approach. Production from domestic sources in period t is a function of the product price (P_t), input prices (INP_t) such as the price of feedstuffs, and selected inputs (IN_t) such as the total livestock numbers in EEC. Thus, the supply function is specified as

$$Q_t = F_1 (P_t, INP_t, IN_t). \quad (1)$$

Prices of the various commodities are treated as exogenously determined because they are fixed each year by decisions made by the EEC Commission.

Domestic Demand

Economic theory suggests that quantity demanded per capita is a function of the income level and the price of the commodity. Thus the per capita market demand equation is specified as

$$PCC_t = f_2 (YP_t, P_t) \quad (2)$$

[4]These prices are known as "target (or indicative) prices" for cereals and milk, "basic prices" for pigmeat, and "guide prices" for beef and veal.

[5]"Threshold prices" are minimum duty-paid import prices for cereals, dairy products, and beef and veal; they are known as "sluicegate prices" for pigmeat, poultry, meat, and eggs.

[6]The individual products included in this study are meat, milk, butter, cheese, and eggs. Data sources are [7, 13].

where YP_t is the real EEC per capita GNP and P_t is the product price.

Change in Stocks

Changes in stocks are expected to be a function of current prices and a general shift variable such as the level of commodity consumption. Consequently, the specification of the function of changes in stocks is

$$(3) \qquad DST_t = f_3(C_t, P_t)$$

where C_t is the level of demand at time t and P_t is the price. A change in stocks equation is included only in the case of butter because changes in stocks for the other products were negligible.

Exports and Intra-EEC Imports

Imports represent an additional source of agricultural supply, whereas exports constitute another component of the demand for agricultural products. Consequently, exports are specified as a function of a time trend (TIME) and the product price

$$(4) \qquad X_t = f_4(TIME, P_t)$$

and intra-EEC imports are treated as a function of real per capita GNP (YP_t) and price

$$(5) \qquad ECM_t = f_5(YP_t, P_t).$$

An identity that defines imports from non-EEC sources completes the model

$$(6) \qquad M_t = PCC_t \times POP_t - Q_t + DST_t + X_t - ECM_t$$

where POP_t is total population in the EEC.

ANALYSIS OF EMPIRICAL RESULTS

Annual observations for the period 1953-72 were used to estimate the parameters of the stochastic equations. The model includes variables for which the values in any one year are determined simultaneously. Three-stage least squares was used to estimate model parameters. The resulting estimated equations, identities, and variable definitions are reported in Table 1. Standard errors for each regression coefficient are in parentheses. Coefficients for most parameters were substantially larger than the respective standard errors.

Product prices have a positive sign in all production equations, except egg prices which declined steadily during the sample period. The expected positive income coefficient and negative price coefficient were obtained in all per capita consumer demand equations with the exception of the price of cheese.

An extensive number of validation measures were calculated to evaluate the efficacy of the model as a predictive device within the sample period. Values for key validation measures are shown in Table 2. The comparatively low root mean square errors for all equations suggest that the model would reproduce sample data with a high degree of accuracy. The Theil coefficients were calculated on the basis of changes in endogenous variables [11] and were acceptable except for the intra-EEC imports of milk and butter. The correlations between actual and predicted values were high for all equations of the model, predicting also a high proportion of turning points (except the equations for the per capita consumption of butter and the intra-EEC imports of eggs) for the period 1953-72.

To obtain an approximate order of magnitude of the quantitative effects of the variable import levy of the CAP, the estimated model was used to derive for the years 1968-72 (the period when the single market stage of the CAP was in operation) the value of total EEC imports (TM) and imports from intra-EEC (ECM) and non-EEC sources (M) under free trade conditions (Table 3). The free trade ideal situation was approximated by solving the model and equating domestic prices in the Common Market with world prices. Imports from extra-EEC sources are obtained after accounting for the free trade value of domestic production, consumption, change in stocks, exports to non-EEC countries, and intra-EEC imports according to identity [6].

Results for the import side of the model (Table 3) indicate that trade diversion (where intra-EEC imports increased because of a shift from low cost producers outside the European Community to higher cost producers within the community) was the common pattern for all commodity groups considered, except eggs. There was no appreciable stimulation of intra-EEC imports of eggs because EEC egg prices paralleled the overall egg price decreases in world markets during the sample period. The largest stimulation of intra-community imports was in milk and butter. Here, imports from EEC countries would have declined by one half under free trade conditions. This finding is consistent with the high degree of protection of dairy products afforded by the variable import levy system [9].

The extent of diversion of trade from non-EEC sources was particularly severe in the

case of milk. Milk imports would have been nearly 700 percent larger than actual levels in 1972 if world prices had prevailed in the EEC. This finding reflects the substantial effect of the CAP in stimulating domestic output, exports, and intra-EEC imports of milk and in depressing milk consumption. Comparatively high trade diversion away from non-EEC sources was shown for all other products. Extra-EEC imports under free trade conditions in 1972 would have been about 180 percent higher than actual for imports for meat, 70 percent for butter, 85 percent for cheese, and 150 percent for eggs.

Because the model detected no appreciable divergence between actual and predicted value when simulating world price conditions during the pre-CAP period, the differences shown for the post-CAP period may be attributed to the net impact of the variable levy protection system. The evidence suggests that adoption of the CAP has affected the pattern of farm trade between the Common Market and the rest of the world. Conclusions must be qualified, however, because a crucial assumption of the methodology was that existing world prices would have prevailed even under free trade conditions for agricultural products.

TABLE 1. THREE STAGE LEAST SQUARES ESTIMATES OF THE COMMON MARKET AGRICULTURAL MODEL[a]

I. Meat

(I.1) $AQ_t = -1463.63 + 29.45\ LIVE_t - 138.41\ AP5_t + 26.27\ AP1_t - 35.12\ AP3_t$
(639.17) (1.76) (108.03) (2.99) (7.31)

(I.2) $PCAC_t = 208.5 + 369.80\ YP_t - .040\ AP1_t - 1.29\ AP3_t$
(11.74) (9.47) (.095) (.153)

(I.3) $AX_t = 195.20 + 7.72\ TIME - .829\ AP9_t$
(44.68) (2.09) (.606)

(I.4) $AECM_t = -526.92 + 819.99\ YP_t + 2.23\ AP1_t - 5.54\ AP3_t$
(108.55) (87.44) (.867) (1.44)

(I.5) $AM_t = PCAC_t \times POP_t - AQ_t + AX_t - AECM_t$

II. Milk

(II.1) $LQ_t = -53844.80 + 5325.86\ COW_t - 24.19\ AP5_t + 825.22\ LP2_t$
(6539.66) (409.94) (643.68) (193.53)

(II.2) $PCLC_t = 2934.26 + 975.01\ YP_t - 47.49\ LP2_t$
(101.82) (106.58) (12.23)

(II.3) $LX_t = 126.30 + 31.32\ TIME + 9.19\ LP2_t$
(62.51) (3.32) (7.05)

(II.4) $LECM_t = -978.49 + 338.001\ YP_t + 69.85\ LP2_t$
(90.47) (95.36) (10.99)

(II.5) $LM_t = PCLC_t \times POP_t - LQ_t + LX_t - LECM_t$

III. Butter

(III.1) $UQ_t = -106.97 + 598.9\ UP1_t - 28.88\ LP1_t + 56.59\ TIME$
(256.81) (142.3) (10.78) (5.65)

(III.2) $PCUC_t = 66.24 + 24.64\ YP_t - .226\ UP2_t$
(8.81) (4.63) (.062)

(III.3) $DUST_t = 1026.22 - .252\ UC_t - 446.4\ UP1_t$
(120.06) (.040) (56.6)

(III.4) $UX_t = 339.02 + .087\ UOWQ_{t-1} - 242.59\ UP1_t$
(61.34) (.049) (32.39)

(III.5) $UECM_t = -134.37 + 75.59\ YP_t + .387\ UP2_t$
(29.05) (14.50) (.222)

(III.6) $UM_t = PCUC_t \times POP_t - UQ_t + DUST_t + UX_t - UECM_t$

IV. Cheese

(IV.1) $CQ_t = 627.49 + 5.13\ CP5_t + 48.02\ TIME$
(38.95) (.695) (2.86)

(IV.2) $PCCC_t = 9.93 + 46.81\ YP_t + .186\ CP5_t$
(2.44) (3.65) (.050)

(IV.3) $CX_t = 29.16 + 2.12\ TIME + .426\ CP5_t$
(6.71) (.465) (.112)

(IV.4) $CECM_t = -144.21 + 97.77\ YP_t + 1.64\ CP5_t$
(7.66) (10.96) (.149)

(IV.5) $CM_t = PCCC_t \times POP_t - CQ_t + CX_t - CECM_t$

V. Eggs

(V.1) $EQ_t = 959.53 + 6.13\ CHIC_t - 14.96\ EP1_t$
(634.19) (.841) (5.04)

(V.2) $PCEC_t = 111.78 + 35.49\ YP_t - .517\ EP2_t$
(9.95) (3.27) (.091)

(V.3) $EX_t = 10.41 + .764\ TIME - .032\ EP2_t$
(11.39) (.261) (.133)

(V.4) $EECM_t = 347.40 - 19.26\ YP_t - 2.31\ EP2_t$
(70.10) (24.27) (.628)

(V.5) $EM_t = PCEC_t \times POP_t - EQ_t + EX_t - EECM_t$

where:
AQ = EEC meat production at time t
PCAC = EEC meat consumption per capita
AX = EEC meat exports to non-EEC countries
AECM = intra-EEC meat imports
AM = extra-EEC meat imports
LIVE = total livestock numbers in the EEC
YP = real GNP per capita in the EEC
TIME = t = (0, 1, 2, . . ., n)
AP5 = price of feedstuffs at time t in the EEC
AP1 = wholesale beef price at time t in the EEC
AP3 = wholesale pigmeat price at time t in the EEC
AP9 = average wholesale meat price at time t in the EEC
LQ = EEC milk production
PCLC = EEC milk consumption per capita
LX = EEC milk exports to non-EEC countries
LECM = intra-EEC milk imports
LM = extra-EEC milk imports
COW = total EEC number of cows at time t
LP2 = producer fluid milk price in the EEC
UQ = EEC butter production
PCUC = EEC butter consumption per capita
DUST = change in butter stocks
UX = EEC butter exports to non-EEC countries
UECM = intra-EEC butter imports
UM = extra-EEC butter imports
UP1 = EEC producer butter price
UP2 = EEC wholesale butter price
LP1 = EEC producer milk price
$UOWQ_{t-1}$ = butter production in other OECD countries at $time_{t-1}$
CQ = EEC cheese production
PCCC = EEC cheese consumption per capita
CX = EEC cheese exports to non-EEC countries
CECM = intra-EEC cheese imports
CM = extra-EEC cheese imports
CP5 = EEC producer cheese price
EQ = EEC egg production
PCEC = EEC egg consumption per capita
EX = EEC egg exports to non-EEC countries
EECM = intra-EEC egg imports
EM = extra-EEC egg imports
EP1 = EEC producer egg price
CHIC = number of live poultry in the EEC
EP2 = EEC wholesale egg price

[a]Standard errors are in parentheses.

TABLE 2. VALIDATION OF THREE STAGE LEAST SQUARES MODEL

Equation Variable	Root Mean[a] Square Error	Correlation Between Actual and Predicted	Old Theil[b] Coefficient	New Theil[b] Coefficient
AQ	289.9	.99	.39	.78
PCAC	0.0007	.99	.18	.18
AECM	67.7	.98	.35	.69
LQ	1620.3	.98	.55	1.13
PCLC	0.01	.90	.10	1.03
LECM	100.3	.95	.44	.76
UQ	52.4	.97	.63	1.06
PCUC	0.0006	.69	.83	1.29
UECM	17.9	.88	.70	.96
CQ	34.4	.99	.24	.48
PCCC	0.0002	.99	.33	.60
CECM	8.5	.99	.34	.65
EQ	108.5	.97	.42	1.04
PCEC	0.0004	.95	.38	.80
EECM	36.7	.36	.56	1.12

[a]The figures are expressed in 1000 metric tons except PCAC, PCLC, PCUC, PCCC, PCEC which are in 1000 metric tons per person.

[b]Theil Coefficients are based on first differences, not actual variates.

TABLE 3. ESTIMATES OF TRADE DIVERSION IN THE EEC COMPARED WITH FREE TRADE (1000 METRIC TONS)

Commodity	Year	Total Imports TM	$\widehat{TM}$	TM-$\widehat{TM}$[a]	Intra-EEC Imports ECM	$\widehat{ECM}$	ECM-$\widehat{ECM}$	Non-EEC Imports M	$\widehat{M}$	M-$\widehat{M}$	
Meat	68	1381	2219	-838	708	773	-65	673	1446	-773	TD[b]
	69	1576	2283	-707	768	859	-91	808	1424	-616	TD
	70	1702	2860	-1158	906	909	-3	796	1951	-1155	TD
	71	1840	3246	-1406	1033	964	69	807	2282	-1475	TD
	72	2258	4163	-1905	1123	997	126	1135	3106	-2031	TD
Milk	68	564	7204	-6640	531	239	292	33	6965	-6932	TD
	69	737	7756	-7019	699	276	423	38	7480	-7442	TD
	70	690	13302	-12612	659	337	322	31	12965	-12934	TD
	71	831	11636	-10805	800	444	356	31	11192	-11161	TD
	72	1214	13644	-12430	1195	519	676	19	13125	-13106	TD
Butter	68	83	938	-855	66	33	33	17	905	-888	TD
	69	76	986	-910	69	41	28	7	945	-938	TD
	70	146	977	-831	142	49	93	4	928	-924	TD
	71	130	708	-578	117	65	52	13	643	-630	TD
	72	128	718	-590	119	73	46	9	645	-636	TD
Cheese	68	271	317	-46	191	186	5	80	131	-51	TD
	69	292	380	-88	223	201	22	69	179	-110	TD
	70	328	415	-87	244	213	31	84	202	-118	TD
	71	360	412	-52	282	245	37	78	167	-89	TD
	72	390	421	-31	310	273	37	80	148	-68	TD
Eggs	68	156	195	-39	116	195	-79	40	0	40	NE[b]
	69	183	203	-20	151	203	-52	32	0	32	NE
	70	197	202	-5	179	202	-23	18	0	18	NE
	71	209	290	-81	187	194	-7	22	96	-74	TD
	72	218	515	-297	197	182	15	21	333	-312	TD

[a]$\widehat{TM}$, $\widehat{ECM}$, and $\widehat{M}$ are imports estimated under world prices. TM, ECM, and M are actual imports.

[b]TD denotes trade diversion, and NE no integration effect, according to the classification scheme of integration effects proposed by the EFTA Secretariat [2].

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