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Economic Effects of Possible European Community Market Intervention in Soybeans and Their Products

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0. Introduction

The European Community's (EC) Common Agricultural Policy (CAP) supports the prices of many important agricultural commodities at a level considerably above the world markets. The central instrument employed is a system of variable import levies and export subsidies ("export refunds" or "export restitutions").[1] However, this wall of agricultural protection has a few large and important loopholes in it. For example, soybeans, soybean oil, protein meals (including soybean meal), and some

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[1]For details see von Witzke (1985).

"grain substitutes" (such as tapioca, corn gluten feed or citrus pellets) enter the Community at very low or zero tariffs.[2]

These loopholes in the CAP are the result of trade and tariff agreements negotiated in the early 1960's within the General Agreement on Tariffs and Trade (GATT). Although the CAP, in general, may be detrimental to U.S. agriculture, the principal beneficiary of these particular GATT agreements is the United States. However, in recent years, other nations exporting protein meals, grain substitutes, and fats and oils have benefitted as well. One result of these trade agreements, jealously guarded by the United States and others, is that the financial drain of the CAP on the EC budget is exacerbated. Hence, there are periodic proposals within the Community to restrict the entry of these "troublesome" products by one means or another.

The central objectives of this study are to analyze the impacts of changing prices of soybean meal and oil in the Community which might result from EC import restrictions on soybeans and soybean meal and/or a consumption tax on soybean oil. We will examine their effects on EC imports, world market prices, and international trade.[3] First, we will provide a general discussion of relevant aspects of the CAP and a brief survey of selected agricultural commodity trade flows including the relative importance of these commodities for the United States and the European Community. Second, we will review the relevant literature and

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[2]The "grain substitutes" are not perfect substitutes for feed grains. For instance, tapioca and citrus pellets cannot substitute for grain without protein supplements; corn gluten feed and protein meals contain more protein than feed grains.

[3]For a survey of trade policies in the soybean sector see Houck (1985), Womack, Johnson, Young (1985).

discuss the methodological framework of our analysis. Third, we will sketch a brief theoretical model of the world market of soybeans and their products with special reference to the economic impacts of several alternative policy measures now being contemplated by the Community. These include import restrictions and a consumption tax on non-butter fats and oils. Fourth, we will present an estimated model of the world market for soybeans, soybean meal and soybean oil, and use it to simulate the impact of various plausible EC policy measures on the markets for soybeans and their products. The study will conclude with some considerations of the study's results for U.S. agriculture and for EC and U.S. agricultural policies.

1. Some Aspects of the CAP

Originally, the European Community was a large net importer of many important agricultural commodities. Due to technological progress and the CAP, production has grown considerably, and the Community has become a net exporter of many key commodities -- wheat, barley, sugar, dairy products, beef, wine, and olive oil. Some of these have emerged as major competitors for traditional U.S. export markets.

In order to make domestic surplus production competitive on world markets, the Community subsidizes agricultural exports. The export refunds paid are the difference between internal EC prices in European Currency Units (ECU) and whatever the ECU world market prices are.[4] The ECU world market price is the U.S. dollar world price multiplied by the ECU/US$ exchange rate.

Budgetary expenditures have grown tremendously and have created persistent budget crises in the Community. Most of these budget expenditures are for operation of the CAP. Between 1980 and 1985 about two thirds of the EC's total financial resources have been used to finance the CAP. In some years, CAP expenditures reached almost 75% of total Community outlays. Among CAP-related expenditures, export refunds play an important role. Consequently, budgetary expenditures are not only a function of Community price supports and production but also of external world prices and the ECU-US$ exchange rate (von Witzke, 1986).

Table 1 shows the relative budgetary expenditures by the European Agricultural Guarantee and Guidance Fund (EAGGF) by commodity group.

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[4]The ECU is a basket currency unit. Its value is determined by the weighted average of the member countries' currencies.

Table 1: Expenditures for Price Support on Various Markets in Percent of Total Price Support Expenditures, 1980-1985.

	1980	1981	1982	1983	1984	1985[1)]
			Percent			
Total grains	14.8	17.5	14.2	15.3	10.5	14.8
Dairy	42.0	30.4	26.8	27.6	31.6	28.5
Beef	12.0	13.1	9.4	10.9	11.2	11.5
Sugar	5.1	7.0	10.0	8.3	8.7	7.7
Fruits and vegetables	6.1	5.8	7.4	7.5	7.3	6.5
Oils and fats	6.1	9.3	9.8	10.2	8.9	11.2
Wine	2.6	4.2	4.6	4.1	6.0	3.1
Others	11.3	12.7	17.8	16.1	15.8	16.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: EC Commission.

1) budget draft.

Price support in the Community is financed from the Guarantee Section of the Fund. Most costly in budgetary terms are the price supports for dairy and grain production. The expenditures for fruits and vetegables, oils and fats (including olives), and wine do not yet play a major role. This is likely to change, however, when the three new member countries (Greece, Spain and Portugal) have adjusted their production to the CAP (Schmitt and von Witzke, 1981). In an attempt to reduce the expenditures for the dairy market regime, the Community introduced domestic milk production quotas in 1984.

Expenditures on the CAP can be viewed as endogenous rather than exogenous. That is, there are systematic forces that ultimately underlie annual decisions of the EC Council of Ministers on agricultural support prices. It can be shown that past agricultural income growth and budgetary expenditure changes largely determine subsequent CAP decisions, where the change in spendings is also a function of the world prices in U.S. dollars and the ECU/US$ exchange rate (von Witzke, 1986). The value of the U.S. dollar has declined by almost 35% from its highest level (in 1985) against the major European currencies. This aggravates the EC budgetary problem. It could, on one hand, contribute to lower support prices, but, on the other hand, it does make it necessary for the Community to increase the financial resources available for the CAP.

2. Relevance of the CAP for U.S. Agriculture

Two major negative impacts of the CAP on US agriculture are frequently stressed. One is that the growing surplus production of the Community has reduced world market prices of important agricultural commodities further than otherwise would have occurred. The other is that the CAP amplifies world market price instabilities. This is because world market price fluctuations do not directly influence EC supply and demand adjustments. Moreover, any EC supply and/or demand fluctuations do not directly affect EC prices; they are "exported" to the world markets where they aggravate the existing problems.

Analyses of the impact of the CAP on the world wheat market corroborate these assertions (Koester,1982; Sarris and Freebairn, 1983). In the absence of EC price support, the world market price would be about 10% higher and world price fluctuations about 35% less. The CAP alone appears to account for more than 80% of total price policy related world price reductions and about 50% of world market price fluctuations associated with wheat policies around the world (Sarris and Freebairn, 1983).

Despite assistance by the U.S. via its strong dollar and some U.S. agricultural policy instruments which have helped relieve the EC's financial problems (von Witzke, 1986), the Community has remained under severe budgetary pressure. Under its organizing treaty, the EC is not permitted to run a budget deficit. When expenditures exceeded available resources, as in 1984, additional financing became necessary (table 2). The EC Commission expects that it will operate very close to its budget ceiling in 1987. Unanticipated high crop yields in the Community, a weak

U.S. dollar, and/or low world prices could easily create additional financial and political tensions. In the presence of these persistent budgetary problems, the EC is seriously considering seeking additional financial resources from its member nations. In addition, further production restrictions may be sought on a wider scale than perviously.

Domestic production quotas for milk already have been agreed upon. The budget constraint, established in 1978 at 1% of the VAT valuation base, has been raised to 1.4%.[5] A so-called "guarantee threshold" system for other products, similar to a domestic production quota, has been agreed upon in principle (Tangermann, 1984).

In addition, the EC is still contemplating the imposition of new trade restrictions on protein meals and grain substitutes and a tax on the consumption of oils and fats other than butter. These measures would result in additional financial resources for the EC and smaller surpluses of butter and feed grains. Expenditures for export refunds also would tend to decline.

Of course, such measures would have a negative impact on U.S. agricultural exports and farm income. On one hand, EC imports of protein meal, grain substitutes, and soybean oil would decline, and, because the European Community is a large market, world prices for these products also would decline. On the other hand, the Community's financial resources would grow which would tend to result in higher internal support prices (von Witzke, 1986).

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[5]VAT indicates Value Added Tax. The VAT valuation base is similar to GNP in the sense that it reflects the total level of economic activity (for details see von Witzke [1985], Petersen [1984]).

Table 2. Financial Resources of the EC, 1980-1985.

	1980	1981	1982	1983	1984[1]	1985[2]
Total EC revenues in mill., ECU	15,166.6	17,479.0	21,240.6	23,200.5	26,660.0	25,692.4
Of which (in %)	-----	-----	percent	-----	-----	-----
- tariffs	38.9	36.6	32.9	30.1	29.6	31.5
- levies	13.2	10.0	10.5	9.9	11.9	9.2
- value added tax (VAT)	47.9	52.6	56.6	59.1	53.9	58.3
- financial contributions	.0	.9	.9	.9	.8	.9
- additional financing	--	--	--	--	3.8	n.a.
VAT rate	.73	.79	.92	1.00	1.00	.98

Source: EC Commission.

1/ Total EC revenues contain additional financing in the amount of 1,003.4 million ECU.

2/ Council draft budget.

3. Production and International Trade in Selected Agricultural Commodities

Following is a brief survey of production of and international trade in soybeans, their products, and other related agricultural commodities. As indicated by table 3, the Community's wheat production has grown significantly in recent years, exceeding U.S. production in 1984/85 and 1985/86 for the first time. Its share in total world production is well above 10% (14% in 1985/86). In coarse grains the Community's share in total world production is below 10% whereas the U.S. share exceeds 30%.

While wheat exports by the EC have doubled between 1978/79 and 1984/85 the Community is still importing some wheat (table 4). This is high quality bread wheat, not (yet) in surplus. The export share in coarse grain has been well below 10% in most years. However, coarse grain exports have almost doubled during the same period, whereas imports have declined by more than two thirds. By far the most important coarse grain is corn. On the one hand, declining coarse grain imports have reduced the budget receipts by the Community via variable levies. On the other, the growing wheat and coarse grain exports have resulted in increasing expenditures for export refunds.

As mentioned, soybean production in the European Community is negligible, but it is the single most important importer of soybeans in the world (table 5). In recent years it has imported about 40% of total world exports. Virtually all soybeans imported are crushed in the EC, where the meal is used as protein feed in animal production. The crushing facilities are concentrated in those areas where animal production is highly concentrated such as the Netherlands, Belgium, and the north-western parts of Germany. Despite the high soybean crushing demand the Community is still importing considerable amounts of soybean meal also (table 6).

The magnitude of soybean and meal imports indicates that any trade restrictions imposed by the Community on these products have a potentially significant impact on world markets and therefore, on major producing or trading countries of which the United States is the most important. The United States alone has contributed about 30 to 40% of total world soybean production. Although the U.S. share in total exports has been declining in recent years as the U.S. dollar has been strong, and as Brazil and Argentina have emerged as significant net exporters it still contributed two thirds of total world exports in 1984/85.[6]

Table 7 exhibits EC imports of two other grain substitutes, namely corn gluten feed and citrus pellets. Imports of corn gluten feed have more than doubled between 1978 and 1984. About 9% of these imports originate in the U.S. Germany, Netherlands and, in recent years, Belgium represent the main corn gluten feed importing member countries of the Community.

EC imports of citrus pellets are quantitatively relatively less important and are characterized by a slightly positive trend. In recent years, the United States has lost its role as the leading source of EC citris pellet imports to Brazil.

Table 8 depicts EC imports and exports of soybean oil. The oil production has been exceeding domestic demand. The EC is a net exporter of soybean oil.

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[6]See also Williams and Thompson (1985).

Table 3: World Wheat and Coarse Grain Production (mill. metric tons)

1. Wheat

	Av. 1962-64	Av. 1972-74	1979-80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
USA	32	46	58	65	76	75	66	71	66
Canada	17	15	17	19	25	27	27	21	22
Argentina	9	6	8	8	8	15	12	13	11
Brazil	1	2	3	3	2	2	2	2	2
South Africa	1	2	2	2	2	2	2	2	2
PR China	23	36	63	55	60	68	81	88	86
India	11	24	36	32	36	38	43	45	45
Australia	9	9	16	11	16	9	22	18	16
USSR	65	93	90	98	80	86	79	73	83
East. Europe (excl. USSR)	18	31	28	35	31	35	35	42	38
EC 1/	32	43	49	55	54	60	59	76	68
World	259	359	424	443	448	479	490	514	505

2. Coarse Grain

	Av. 1962-64	Av. 1972-74	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
USA	131	173	238	198	247	251	137	237	269
Canada	14	20	19	22	26	27	21	22	224
Argentina	9	15	11	21	19	18	17	19	19
Brazil	10	16	21	23	23	20	22	21	22
South Africa	5	8	12	15	9	5	6	8	9
PR China	57	75	83	84	81	82	93	96	88
India	25	26	26	29	27	27	34	31	32
Australia	3	5	6	5	7	4	9	9	8
USSR	59	92	81	80	72	86	99	86	95
East Europe (excl USSR)	40	62	63	62	64	72	67	74	66
EC 1/	44	65	69	70	68	72	64	75	71
World	482	654	744	733	770	779	686	806	841

Source: Toepfer International, Grain and Feeding Stuffs Market Statistics, Edition 1985/86. Hamburg 1985.

1/ Preceding 1973: EC(6); until 1981: EC(9); since 1981: EC(10).

Table 4: World Wheat and Coarse Grain Trade (mill. metric tons)

1. Exports
1.1. Wheat

Exporte	av. 1963-64	av. 1972-75	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
USA	22	30	32	37	42	49	40	39	38
Canada	14	13	13	15	17	18	21	22	19
Argentina	5	2	3	5	4	4	8	10	8
Australia	7	6	7	15	11	11	8	12	17
USSR	2	3	2	1	1	1	1	1	1
EC 1/	–	6	9	10	14	16	16	15	18
World	58	65	77	86	94	101	99	103	108

1.2 Coarse Grain

Exporte	av. 1963-64	av. 1972-75	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
USA	20	38	60	71	72	58	54	56	56
Canada	1	3	4	5	5	7	7	5	4
Argentina	4	7	11	7	10	10	12	11	11
Australia	1	2	3	4	2	3	1	6	7
South Africa	2	2	3	3	4	5	2	–	–
USSR	2	1	1	–	–	–	–	–	–
Thailand	1	2	2	2	2	4	2	3	3
EC 1/	–	4	5	5	6	5	5	5	9
World	39	65	90	101	106	97	90	92	101

Sources

Table 4: World Wheat and Coarse Grain Trade (mill. metric tons) (continued)

2. Imports

2.1. Wheat

Importe	av. 1968-71	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
EC 1/	8	5	5	5	5	5	4	3	2
East Europe (excl. USSR)	2	5	4	6	6	6	5	4	3
USSR	1	7	5	12	16	20	20	21	28
Japan	5	6	6	6	6	6	6	6	6
PR China	5	9	8	9	14	13	13	10	7
South Korea/Taiwan	2	3	2	3	3	3	3	3	3
Other Asia	2	9	14	14	14	16	18	22	21
Egypt	1	4	5	5	6	6	5	7	7
Other Africa	2	7	7	8	9	11	9	11	12
Brazil	2	2	4	5	4	4	4	4	5
Other South America	2	2	4	4	4	4	4	4	4
World	60	71	77	86	94	101	99	103	108

2.2 Coarse Grain

Importe	av. 1968-71	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
EC 1/	14	15	15	13	12	8	6	6	4
East Europe (excl. USSR)	1	9	10	11	11	6	5	4	3
USSR	-	12	10	18	18	20	11	12	27
Japan	11	17	18	19	19	18	19	21	21
South Korea/Taiwan	3	4	6	6	6	7	8	8	8
Brazil	-	-	2	2	2	-	-	-	1
Mexico	-	2	2	5	8	2	7	6	5
World	46	79	90	101	105	103	90	92	101

Source: See Table 3.

1/ See Table 3.

Table 5: World Soybean Production and Trade (1000 metric tons)

1. Production

	Av. 1962-64	Av. 1972-74	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86
USA	18 780	36 000	61 770	48 770	54 610	59 610	44 520	50 640	57 380
Brazil	360	7 590	15 140	14 980	12 830	14 750	15 200	17 000	16 400
Argentina	-	420	3 670	3 600	4 150	4 200	7 000	6 500	7 000
Paraguay	-	170	600	580	600	520	550	750	750
PR China	7 000	7 050	7 460	7 940	9 320	9 030	9 760	9 700	10 000
USSR	360	350	470	530	490	540	560	500	550
World	30 430	53 660	93 750	80 900	86 120	93 650	82 560	90 880	97 820

2. Exports

	Av. 1963-65	Av. 1972-74	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
USA	5 500	13 220	20 210	23 840	20 000	25 530	24 550	19 300	16 930
Argentina	-	-	2 800	2 310	2 700	1 730	1 420	2 970	3 290
Brazil	-	2 620	640	1 240	1 710	520	1 110	1 590	3 610
Paraguay	-	-	420	400	670	700	690	540	620
EC 1/	-	-	350	300	210	200	140	90	110
incl. Netherlands	-	-	340	280	200	160	120	80	0
World	5 650	15 910	24 330	27 920	25 650	28 920	28 380	25 370	25 590

Table 5: World Soybean Production and Trade (1000 metric tons) (continued)

3. Imports

	Av. 1963-65	Av. 1972-74	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Japan	1 670	3 400	4 320	4 160	4 210	4 490	4 870	4 730	4.590
USSR	-	n.a.	1 230	1 520	1 370	1 355	1 310	910	980
Spain	90	1.390	2 130	3 050	2 770	3 230	3 120	2 670	2.300
EC 1/	2 600	8 100	11 900	12 820	10 180	12 230	12 020	9 350	10.190
incl. FR Germany	1 260	3 340	3 810	3 950	3 080	3 680	3 530	2 350	2.500
France	150	500	890	920	510	880	950	660	620
Italy	370	1 110	1 460	1 690	1 130	1 460	1 540	1 090	1.760
Netherlands	390	1 380	3 210	3 580	2 690	3 010	2 990	2 860	2.990
Belgium/Lux.	130	630	1 050	950	1 100	1 510	1 600	1 530	1.460
Unit. Kingdom	290	780	1 000	1 180	1 020	1 290	880	500	560
Denmark	380	420	500	380	210	210	200	160	120
Greece	-	10	150	160	170	180	280	190	190
World	5 640	15 840	24 680	27 000	26 140	28 870	28 495	25 330	25.815

Source: See Table 3.

1/ See Table 3.

Table 6. World Soybean Meal Production and Trade (1000 metric tons)

1. Production

	av. 1972-74	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
USA	16 050	22 095	24 590	22 060	22 350	24 230	20 650	22 340
Canada	505	585	770	690	800	825	720	740
Brazil	2 750	7 500	8 110	10 620	9 940	10 600	9 700	9 700
Argentina	150	570	550	740	1 030	1 720	2 370	2 870
Mexico	400	840	1 120	1 250	1 180	1 315	1 830	2 040
Japan	2 060	2 600	2 700	2 700	280	290	2 960	2 930
PR China	2 010	2 380	2 390	2 470	3 100	3 080	2 970	2 950
USSR	325	1 235	1 260	1 230	1 300	1 050	990	830
Spain	1 080	1 680	2 350	2 280	2 530	2 420	2 050	1 580
EC[1/]	6 260	9 020	9 730	8 190	9 280	8 770	7 430	7 870
incl.								
FR Germany	2 560	2 950	3 150	2 580	2 900	2 710	1 930	1 970
France	410	680	740	430	660	725	500	490
Italy	850	1 150	1 320	1 010	1 120	1 280	1 010	1 380
Netherlands	1 065	2 190	2 500	2 190	2 100	1 990	2 155	2 270
Belgium/Lux.	465	830	740	855	1 220	1 240	1 210	1 160
Unit. Kingdon	480	720	910	830	990	490	340	360
Denmark	340	370	310	160	140	140	130	80
World	34 040	51 290	57 530	56 290	58 650	62 030	57 060	60 100

2. Exports

	Av. 1972/74	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
USA	4 410	6 000	7 180	6 140	6 270	6 450	4 860	4 350
Argentina	40	380	260	410	740	1 550	2 120	2 560
Brazil	2 110	5 450	5 480	8 600	7 350	8 240	7 710	8 200
EC[1/3/]	n.a.	545	735	1 080	1 295	1 800	1 635	n.a.
EC[1/2/]	2 090	3 050	3 550	3 810	4 260	5 300	4 590	4 750
incl.								
FR Germany	1 130	1 000	1 200	1 370	1 760	2 110	1 610	1 740
Netherlands	580	1 460	1 760	1 750	1 510	1 960	1 700	1 750
Belgium/Lux.	180	490	500	650	900	1 050	1 130	1 160
World[4/]	6 600	11 880	12 920	15 300	15 350	16 820	15 410	16 100

Table 6. World Soybean Meal Production and Trade (1000 metric tons) (continued)

3. Imports

	Av. 1972-74	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85
Japan	150	240	260	290	100	170	180	60
USSR	-	50	280	1 060	1 260	2 800	760	1 410
Spain	340	460	100	110	120	400	720	800
GDR	n.a.	890	1 060	830	950	1 260	1 130	1 130
EC 1/3/	n.a.	6 046	6 665	7 690	8 530	9 345	9 350	n.a.
EC 1/2/	4 580	8 480	9 420	9 360	11 890	11 990	11 720	12 040
incl.								
FR Germany	920	1 820	1 990	1 850	2 450	2 490	2 510	2 580
France	1 330	2 500	2 710	2 970	3 500	3 330	3 400	3 250
Italy	510	1 090	1 510	830	1 470	1 290	1 050	1 320
Netherlands	710	930	1 060	1 300	1 390	1 630	1 400	1 500
Belgium/Lux.	390	480	600	570	690	660	800	810
Unit. Kingdom	230	650	500	660	960	1 190	1 190	1 090
Denmark	400	740	770	970	1 170	1 160	1 160	1 300
Ireland	100	270	210	200	250	230	170	170
World	9 050	15 460	17 450	18 615	21 105	23 225	21 990	23 130

Source: See table 3.

1/ See table 3.

2/ Incl. intra EC trade.

3/ Excl. intra EC trade.

4/ Imports of net importing countries and exports of net exporting countries.

Table 7: EC Imports of Corngluten Feed and Citrus Pellets (1000 metric tons)

1. Corngluten Feed

1.1. EC Imports by Origin

	av. 1972-73	1978	1979	1980	1981	1982	1983	1984
EC[1/] (extra trade)	790	1 690	2 020	2 600	2 840	2 840	3 570	3 730
incl. USA	740	1 570	1 920	2 480	2 710	2 720	3 370	3 560

1.2 EC Imports by Destination

	av. 1972-73	1978	1979	1980	1981	1982	1983	1984
FR Germany	180	670	800	1 050	1 080	960	1 240	1 140
Netherlands	380	1 140	1 300	1 570	1 250	1 250	1 710	1 910
Belgium/Lux.	20	110	140	150	400	51	110	170
United Kingdom	-	-	-	-	390	520	400	340
EC[1/] (extra trade)	790	1 690	2 020	2 600	2 840	2 840	3 570	3 730

2. Citrus Pellets

2.1 EC Imports by Origin

	av. 1972-73	1978	1979	1980	1981	1982	1983	1984
EC[1/] (extra trade)	970	1 000	1 210	1 570	1 350	1 260	1 430	1 320
incl: USA	680	600	670	930	690	570	610	470
Brazil	260	360	490	610	630	660	770	800
Argentina	10	10	10	10	10	15	20	20

2.2 EC Imports by Destination

	av. 1972-73	1978	1979	1980	1981	1982	1983	1984
FR Germany	20	30	60	150	140	140	220	320
France	-	-	-	40	70	80	80	50
Netherlands	850	840	1 020	1 240	1 010	880	950	780
Belgium/Lux.	40	50	60	70	60	80	90	80
United Kingdom	-	-	10	-	20	40	40	50
EC[1/] (extra trade)	970	1 000	1 210	1 570	1 350	1 260	1 430	1 320

Source: See Table 3

1/ See Table 3.

Table 8: EC Soybean Oil Exports and Imports (1000 metric tons)

	1979	1980	1981	1982	1983	1984
Imports	8	22	10	43	17	27
Exports	405	327	322	361	368	356

Source: EC Commission, The Agricultural Situation in the European Community. Brussels (various volumes).

4. Methodological Considerations: A Brief Literature Survey

Analyses of the impact of the CAP on markets for soybeans and their products, and/or the economic effects of possible EC market interventions on these markets have been based on either linear programming or regression analyses. Programming models usually focus on cost minimization of compound feed at alternative relative prices in the European Community. Although such analysis is helpful in determining relevant substitutabilities and complementarities among feed stuffs, its usefulness for market-wide analysis is limited, mainly because of aggregation problems.[7] Therefore, we will not discuss the results of various programming studies here but provide a brief survey of selected regression analyses of the markets for soybeans and their products.

Several studies have focused on the EC (or member nation) demand for soybeans, their products, and/or other feed components. While these studies provide some quantitative insights into the main questions of this research and, more specifically, into the reaction of EC soybean, meal, and oil demand to alternative EC policy interventions, they do not provide much if any information about how such policies influence world market prices, international trade patterns, and, thus, U.S. agriculture.

Moschini and Surry (1984) analyze the demand for cereals, grain substitutes, and high protein feed in Belgium and the Netherlands.[8] The results of their analysis for these two EC nations indicate that the own price elasticity of demand for these three feed components is rather low, whereas there is considerable substitutability between cereals and the

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[7] For LP approaches see Zeddies amd Doluschitz (1982); Schuhmacher and Hoeh (1984); Mc Kinzey, Paarlberg and Huerta (1986); Hillberg (1986).

[8] See also Surry and Moschini (1984).

other two inputs analyzed, as well as between grain substitutes and high protein feed.

Gardiner (1984) estimates the feed utilization in the European Community using some a priori substitution parameters for a soybean meal/manioc mix, and corn. His results suggest that the own price elasticity of a manioc/soybean meal mix which is nutritionally equivalent to corn is rather low.

Knipscheer and Hill (1982) estimate the EC demand for soybean meal. Again, the own price demand elasticity turns out to be rather low. This contrasts with the findings of an earlier study by Houck, Ryan, and Subotnik (1972). Their estimates suggest that EC meal demand is inelastic but significantly larger than those determined in more recent analyses. These differences might be due to two reasons. First, partial models may underrate the demand elasticity or, second, the EC soybean meal demand elasticity may have declined over time.

An interesting feature of the model by Knipscheer and Hill (1982) is that they relate soybean meal demand to EC animal production which is also subject to price support. One of their conclusions is that the United States benefits from EC price support for animal production at least insofar as soybean meal is concerned (see also Sisson and Schmidt, 1985).

In a similar analysis of EC feed demand, Leuck (1985) finds a close relationship between EC feed imports and animal production. Leuck also simulates demand effects of CAP policy alternatives. If EC grain price support would be reduced gradually, livestock production in the Community would grow tremendously; U.S. exports of grain substitutes and soybean meal would provide a considerable portion of the resulting increase in feed demand. If the Community would not only lower grain but also livestock price supports, the effects on US agriculture would be mixed, as one might expect. However, the results and conclusions of Leuck's analysis have to be interpreted with care because the impacts of EC policy changes on world prices and trade patterns were not modeled.

Using a very simple comparative static model with exogenously introduced elasticities, Mahé (1984) derives somewhat rough estimates of how CAP changes would alter budgetary expenditures. The results indicate that a seperate reduction of EC price support for grain (leaving all other support prices constant) would not result in significant budget savings because it would stimulate both the production of field crops other than grains and animal production. Hence, budgetary expenditures for the disposal of surplus products such as dairy or beef would escalate.

However, a 10% reduction in grain support prices, in conjunction with a 30% tariff on oil cakes and on grain substitutes, would result in substantial reductions of EC budgetary expenditures, according to Mahé. The budgetary consequences of an overall reduction of agricultural support prices in the Community were not analyzed.

Huyser and Meyers (1985) estimated a model of the world market for soybeans and their products that distinguishes between 10 regions involving both countries and country groups. The EC oil market is not treated endogenously, however, and the EC bean and meal demand is not related to animal production. The simulations of EC policy alternatives indicate that a 10% tariff on soybeans or soybean meal would reduce the US soybean export value by 30%. This effect is similar to a 20% reduction of EC corn prices. Alternatively, a 10% depreciation of the US dollar would increase the US export value by 3.85%.

As mentioned before, most economic analyses have focused only on one or few parts of the total soybean complex or have been restricted to one of the major soybean products. Complete regional models for soybeans and their major products have only occasionally been estimated. This is not surprising because modelling several highly interrelated markets such as those for soybeans, soybean meal, and soybean oil is complicated and time consuming. However, if one is interested in the impact of a large country's agricultural policies on world markets, trade patterns, and other nations' agricultures it is useful to estimate a complete regional model of the world markets for soybeans and their products.

One such model was developed by Houck, Ryan and Subotnik (1972). This model was well suited for providing quantitative insights into world soybean and products markets. P.C. Paarlberg (1980) developed a similar model that attempts to quantify the impacts of the low or duty free status of soybean, soybean meal, and soybean oil imports to the EC on US exports and to simulate possible EC import restrictions for high protein meals.

Paarlberg's model was estimated for the time period 1960 through 1975. Although the EC was founded in 1957, the Common Agricultural Policy involving the original 6 member countries did not become fully effective before 1967/68. Moreover, the first enlargement of the EC, to include the United Kingdom, Ireland and Denmark, was concluded in 1973. Hence Paarlberg's analysis of the CAP impact on U.S. agriculture and his policy simulations are based on data for years during which the CAP was not yet fully effective for the EC-6, and it includes only the early years of the EC-9.

In what follows we will develop a regional model of the world markets for soybean meal, soybean oil, and soybean meal that is based generally on the theoretical framework developed by Houck, Ryan and Subotnik. We will distinguish between two regions, namely the Community and the rest of the world, much as in Paarlberg's model. We will base the empirical analysis on a time span that excludes the pre-CAP period. As necessary, the 1973 enlargement of the European Community will be accounted for by dummy variables. As this brief literature review has indicated, animal production and price support in the EC appear to have had significant impacts on the soybean meal and oil markets. Hence, we will attempt to take this phenomenon into account in order to better determine the impacts of the CAP and possible EC agricultural policy changes on U.S. agriculture.

5. Theoretical Considerations

The theoretical interrelations between the markets of soybeans, soybean meal, and soybean oil are discussed in detail in Houck, Ryan, and Subotnik (1972), and in Paarlberg (1980). Therefore, the theoretical considerations for the purpose of this study will be restricted to a graphical discussion of the two-region model estimated here. The regions of concern are the European Community and the rest-of-the-world (ROW).

Figure 1 exhibits the model's basic structure. For convenience, it is assumed that transportation costs are zero and that there are only pipeline stocks. The rows of individual panels in figure 1 depict markets for soybeans, soybean meal, and soybean oil respectively. The columns exhibit supply and demand in the Community and ROW on the left-hand and right-hand sides respectively. The panels in the center reflect the total world relations. As is customary, prices are measured vertically and quantities are on the horizontal axes.

Let the starting point of the discussion be the EC demands for soybean meal (DMEC) and soybean oil (DOEC), panels d and g respectively. Soybean production in the Community is minimal and is neglected here. Hence the demand for soybean meal and oil can only be satisfied by imports of soybeans that are processed in the Community or already processed meal and oil. Because meal and oil are joint products of soybean processing, obtained in relatively fixed proportions, the vertical addition of DMEC and DOEC will yield the total soybean equivalent demand in the Community. This is DEC in panel a of figure 1. Subtracting the per unit crushing and handling margin charged by EC processors generates DEC', the net derived demand for soybeans as beans in the EC. With no significant internal supply of soybeans available, this function (DEC') is also the excess

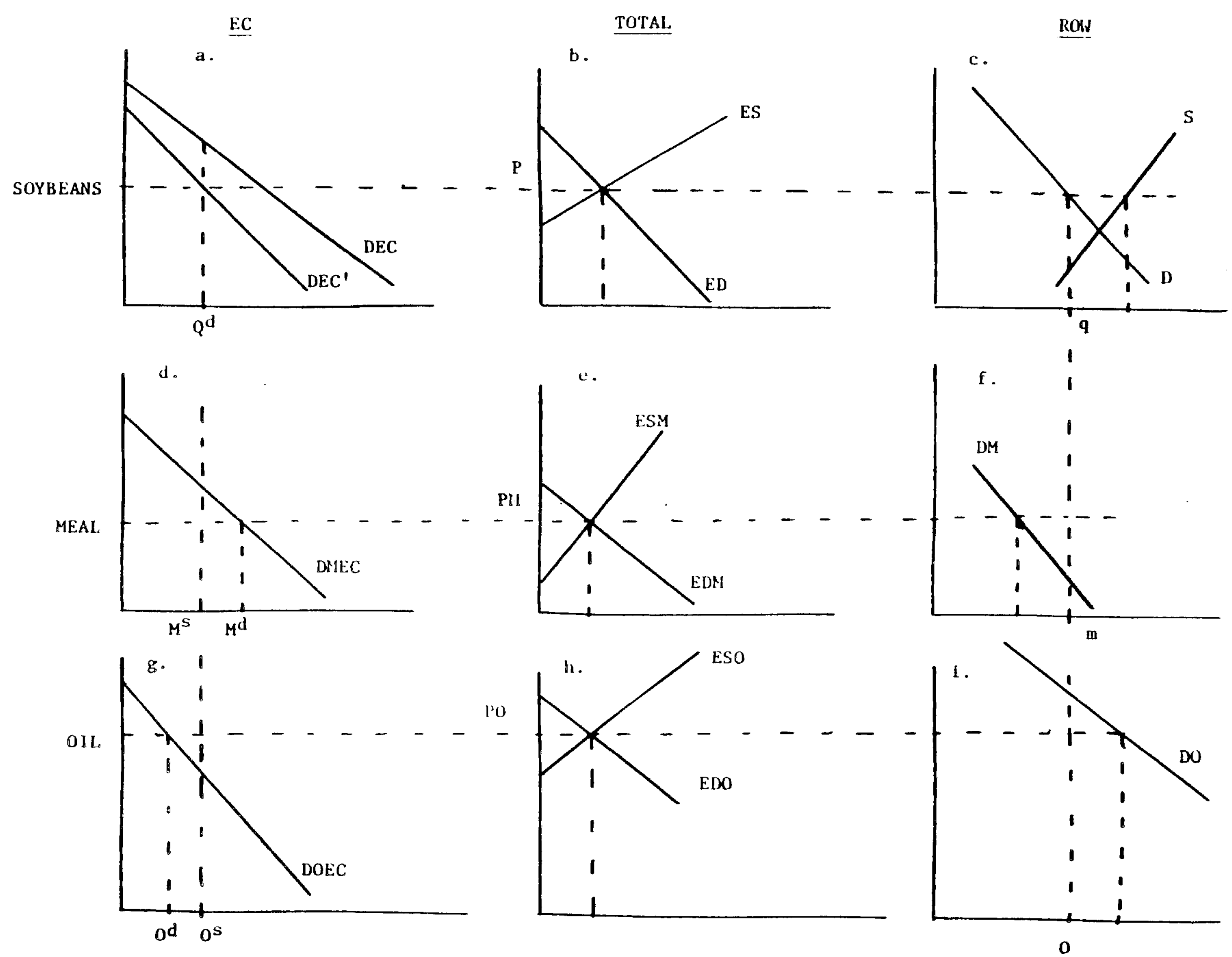

Figure 1: Structure of the World Soybeans and Products Market Model.

demand for soybean imports shown as ES in panel b.

This excess demand function interacts with the excess supply function of ROW in panel b to form the world price of soybeans, P. Panel c reflects the ROW demand and supply functions for soybeans that underlie the ES function of panel b.

The world price formation process for soybeans also generates the volume of EC soybean imports as Q^d in panel a. The fixed technical conversion ratios for beans into meal and oil generate internal EC supplies of these products at M^s and O^s in panels d and g respectively. These are the domestic supplies of soybean products available from EC processors.

If there were no international trade in meal and oil, then these two quantities would prevail in EC markets and determine market prices internally along DMEC and DOEC. However, with trade possible in both products, other equilibrium solutions are clearly possible.

Consider world market prices for meal and oil formed at PM and PO respectively. If these particular prices prevail and if no trade barriers exist for these products by the European Community, meal will be imported in the amount of M^d - M^s, and oil will be exported in the amount of O^s - O^d, panels d and g of figure 1. This is basically the actual situation for the Community in recent years.

Now consider how PM and PO are determined within this relatively simple framework. The center panels, e and h, display the Community's excess demand for meal as EDM and its excess supply of oil as ESO. These functions are derived as the horizontal difference at various prices between the internal demand function and the quantity of meal and oil supplied by EC processors from imported whole soybeans.

The ROW excess supply of meal (ESM) and excess demand for oil (EDO) are formed from panels c, f, and i in figure 1. The ROW demands for meal and oil are added vertically as usual, and D in panel c is that addition less the appropriate crushing and handling margin. Together with the ROW supply of soybeans (S) the ES of beans is determined and shown in panel b. The total ROW crush of beans is indicated as q in panel c. This crushed volume of soybeans translates via fixed technical coefficients into given supplies of meal and oil indicated as m and o respectively in panels f and i.

These fixed supplies of meal and oil interact with their respective ROW demand functions to form the appropriate excess supply function for meal and excess demand for oil, panels e and h. With these relations, the model is closed as PM and PO are formed. Meal exports flow from ROW to EC and oil exports flow from EC to ROW.

This framework is the basis for the statistical estimations that follow. It also provides the point of departure for analysis of various tax and trade policy interventions that might be applied by the Community to these interconnected markets.

6. Empirical Analysis

The model proposed here consists of 29 equations of which 11 are behavioral in nature and 18 are identities or technical relations. The European Community produces only marginal amounts of soybeans, which have been neglected in this analysis. Consequently the soybean supply of ROW is identical to world soybean supply. Due to data limitations, EC stocks of soybeans, meal, and oil have been neglected. The particular specification of this model follows earlier efforts by Houck, Ryan, and Subotnik and by Paarlberg. Preliminary analysis was used as the basis for the final selection of included variables in each behavioral equation.

6.1 Model specification

The soybean acreage harvested in ROW (SBHARW) is a linear function of the world soybean (PSBW) and corn price (PCW), both lagged one period (-1), where corn acts as proxy for the main competing crops. A linear time trend (TIME) and a dummy variable (DDV1) have been added to the soybean acreage equation. The dummy variable accounts for a discontinuity in the data base:

(1) $SBHARW = a_o + a_1 \cdot PSBW(-1) + a_2 \cdot PCW(-1) + a_3 \cdot TIME + a_4 \cdot DDV1 + u_1$

The world soybean production can then be calculated by multiplying the soybean acreage by the yield per acre (SBYLD):

(2) $QSBPW = SBYLD \cdot SBHARW$

The world soybean demand QSBDW is the sum of the crushing demand in the ROW (QSBCRW) and the EC (QSBCEC) and the demand for other uses such as feed, seed, or food (QSBODW):

(3) $QSBDW = QSBCRW + QSBCEC + QSBODW$

The EC soybean crushing demand (QSBCEC) is a linear function of the EC crushing margin (SPDEC), the price of alternative high protein meals in the EC (PAMEC), a linear time trend as a proxy for the growth in EC crushing capacity over time and a dummy varaible (DV) that accounts for the first EC enlargement:

(4) $QSBCEC = b_o + b_1 \cdot SPDEC + b_2 \cdot PAMEC + b_3 \cdot TIME + b_4 \cdot DV + u_4$

The soybean crushing demand in ROW (QSBCRW) can be expressed as a linear function of the prices of soybeans (PSBW), soybean meal (PSMW), and soybean oil (PSOW) world market price, and the crushing capacity (CVSOY). A dummy variable (DDV5) has been added to account for a discontinuity in the data base:

(5) $QSBCRW = c_o + c_1 \cdot PSBW + c_2 \cdot PSOW + c_4 \cdot CVSOY + c_5 \cdot DDV5 + u_5$

The demand for non-crush soybean uses (QSBOW) is a linear function of the soybean acreage harvested:

(6) $QSBODW = d_o + d_1 \cdot SBHARW + u_6$

Market equilibrium implies that the sum of soybean production in ROW and beginning stocks (BSSBRW) equals the sum of world soybean consumption and ending stocks (ESSBRW):

(7) $BSSBRW + QSBPW = QSBDW + ESSBRW$

The world ending stocks of soybeans are a function of world soybean supply and world meal production, where the ending stocks of any period are equal to the beginning stocks of the subsequent period.

(8) $ESSBW = e_o + e_1 \cdot QSBSW + e_2 \cdot QMPW + u_8$

The world soybean meal production (QMPW) can be calculated by multiplying the amount of soybeans crushed in the ROW and the Community by the respective conversion rates (Θ_{1i}):

(9) $QMPW = \Theta_{11} \cdot QSBCEC + \Theta_{12} \cdot QSBCRW$

The world soybean meal demand (QMDW) is the sum of EC (QMDEC) and ROW meal demand (QMDRW):

(10) $QMDW = QMDEC + QMDRW$

The soybean meal demand of the Community (QMDEC) is a linear function of the EC soy meal price relative to the price of corn (PSMPC) and the volume of EC animal production (ECAPP). DV accounts for the 1973 enlargement:

(11) $QMDEC = f_o + f_1 \cdot PSMPC + f2 \cdot ECAPP + f_3 \cdot DV + u_{11}$

The demand for soybean meal in ROW (QMDRW) can be expressed as a linear function of the relative soy meal to corn price on the world market (PSMPC) and the extent of animal production in ROW (APPRW). Again a dummy variable was employed to account for a discontinuity of the time series used:

(12) $QMDRW = g_o + g_1 \cdot PSMWPC + g_2 \cdot APPRW + g_3 \cdot DDV_{11} + u_{12}$

Market equilibrium implies:

(13) $BSMW + QMPW = QMDW + ESMW$

The world ending stocks of soybean meal are a function of the world soybean supply:

(14) $ESMW = h_o + h_1 \cdot QSBSW + u_{14}$

The strucure of the soybean oil market is, _mutatis mutandis_ analogous to that of the meal market. The world soybean oil production (QOPW) can be calculated by summing up the quantities of soybeans crushed in ROW and the

EC multiplied by the respective conversion rates (Θ_{2i}):

(15) $QOPW = \Theta_{21} \cdot QSBCEC + \Theta_{22} \cdot QSBCRW$

The total demand for soybean oil in the world (QODW) is the sum of EC and ROW demand:

(16) $QODW = QODEC + QODRW$

The Community's soybean oil demand (QODEC) can be expressed as a linear function of the relative EC soybean oil to butter price (POBTEC) and the price of alternative vegetable oils (PPOEC) The dummy variable accounts for the 1973 enlargement of the European Community:

(17) $QODEC = i_o + i_1 \cdot POBTEC + i_2 \cdot PPOEC + i_3 \cdot DV + u_{17}$

The ROW demand for soybean oil is a linear function of the relative soybean oil to alternative oils world price (PSOPAO), ROW income (YDUS), and a dummy variable (DDV18) that accounts for a discontinuity in the time series:

(18) $QODRW = j_o + j_1 \cdot PSOPAO + j_2 \cdot YDUS + j_3 \cdot DDV16 + u_{18}$

Market clearing implies:

(19) $BSOW + QOPW = QODW + ESOW$

The world ending stocks of soybean oil are a function of the world soybean supply:

(20) $ESOW = k_o + k_1 \cdot QSBSW + u_{20}$

The two regions, world and EC prices are linked by the following identities:

(21) $QMMEC = QMDEC - \Theta_{11} \cdot QSBCEC$

(22) $QOEEC = \Theta_{21} \cdot QSBCEC - QODEC$

(23) QSBMEC = QSBCEC

(24) QMERW = QMMEC

(25) QOMRW = QOEEC

(26) QSBERW = QSBMEC

(27) $PSBECU = (1 + \rho_B) \cdot (\alpha_o + \alpha_1 \, PSBW) \cdot ECUUSD$

(28) $PSMECU = (1 + \rho_M) \cdot (\beta_o + \beta_1 \cdot PSMW) \, . \, ECUUSD$

(29) $PSOECU = (1 + \rho_O) \cdot (\gamma_o + \gamma_1 \cdot PSOW) \cdot ECUUSD$

Brief definitions of symbols used:

SBHARW = soybean area harvested in the world (1000 ha)

SBYLD = average soybean yield per hectare in the world (mt/ha)

QSBPW = world soybean production (1000 mt)

QSBCEC = EC soybean crush (1000 mt)

QSBCRW = soybean crush in ROW (1000 mt)

QSBODW = world demand for feed, seed, food, and waste of soybeans (1000 mt)

QSBDW = world soybean demand (1000 mt)

ESSBW = world ending stocks of soybeans (1000 mt)

BSSBW = world beginning stocks of soybeans (1000 mt)

PSBW = soybean world market price (US$/mt)

PCW = corn world market price (US$/mt)

DDV = data dummy variable to account for discontinuities in data series

SPDEC = EC crushing margin

PAMEC = EC price of alternative high protein meal in soybean meal equivalents (ECU/mt)

DV = dummy variable to account for 1973 enlargement of the EC

PSMW = world soybean meal price (US$/mt)

PSOW = world soybean oil price (US$/mt)

CVSOY = soybean crushing capacity in ROW (1000 mt)

QMPW = world soybean meal production (1000 mt)

QMDW = world soybean meal demand (1000 mt)

QMDEC = EC soybean meal demand (1000 mt)

QMDRW = ROW soybean meal demand (1000 mt)

ESMW = world soybean meal ending stocks (1000 mt)

BSMW = world soybean meal beginning stocks (1000 mt)

Θ_{11} = meal yield per unit of crushed beans in the EC

Θ_{12} = meal yield per unit of crushed beans in ROW

PSMC = EC price ratio of soybean meal to corn

ECAPP = animal production in the EC (beef, prok, poultry meat and cow milk, 1000 mt)

PSMWPC = world price ratio of soybean meal to corn

APPRW = animal production in ROW (beef, prok, poultry meat and cow milk, 1000 mt)

QOPW = world soy bean oil production (1000 mt)

QODW = world soybean oil demand (1000 mt)

QODEC = EC soy bean oil demand (1000 mt)

QODRW = ROW soybean oil demand (1000 mt)

ESOW = world soybean oil ending stocks (1000 mt)

BSOW = world soy bean oil beginning stocks (1000 mt)

Θ_{21} = oil yield per unit of beans crushed in the EC

Θ_{22} = oil yield per unit of beans crushed in ROW

POBTEC = EC ratio of soybean oil to butter price

PPOEC = EC price of alternative vegetable oil (ECU/mt)

PSOPAO = ratio of world soybean oil to alternative oil price

YDUS = per capita income in ROW (US real per capita personal disposable income)

QMMEC = EC soybean meal imports (1000 mt)

QOEEC = EC soybean oil exports (1000 mt)

QSBMEC = EC soybean imports (1000 mt)

QMERW = ROW soybean meal exports (1000 mt)

QOMRW = ROW soybean meal imports (1000 mt)

ECU = European Currency Unit

ECUUSD = ECU/US$ exchange rate

ρ_B = tariff rate in EC on soybeans

ρ_M = tariff rate in EC on soybean meal

ρ_O = tariff rate in EC on soybean oil

α_o, α_1 = parameters of transportation cost function for soybeans, EC-RW

β_o, β_1 = parameters of transportation cost functionfor soybean meal, EC-RW

γ_o, γ_1 = parameters of transportation cost function for soybean oil, EC-ROW

6.2 Estimation Results

The behavioral equations of the model were estimated with two-stage least squares for the period 1969-1982. For the data base used see the Appendix. The econometric results are summarized in table 9.

In the acreage of soybeans harvested in the world (eq. (1)), the economic explanatory variables have the expected signs and are significant. SBHARW increases with increasing world soybean price and declines with increasing world corn price.

In eq. (4) all economic explanatory variables are highly significant and have plausible signs. The crushing margin indicates the profitability of processing soybeans in the Community. The crush demand grows with

Table 9: 2 SLS Estimates of the Soybean and Products Model 1/

Eq. No.	Dependent Variable	Estimated Equation	Statistics
1	SBHARW	- 2242608 + 57.91 PSBW(-1) - 58.04 PCW(-1) + 1152.66 TIME +2888.8 DDV1 -3.619 3.305 -1.718 3.658 1.626 (.281) (-.135)	$\bar{R}^2$ = .9551 S.E. = 1701.3 DW = 1.965
4	QSBCEC	- 1181694 + 40.89 SPDEC - 23.01 PAMEC + 603.92 TIME + 1673.6 DV -5.283 2.585 -2.769 5.204 2.564 (.055) (-.442)	$\bar{R}^2$ = .9327 S.E. = 594.4 DW = 1.085
5	QSBCRW	- 16942 - 161.42 PSBW + 102.16 PSMW + 30.65 PSOW + 2.066 CVSOY + 4231.7 DDV5 -2.927 -2.029 1.830 2.031 7.811 1.607 (-7.9) (.381) (.302) (1.371)	$\bar{R}^2$ = .9779 S.E. = 1952.2 DW = 2.009
6	QSBODW	- 2667.9 + .1915 SBHARW -2.955 9.914 (.750)	$\bar{R}^2$ = .8579 S.E. = 621.8 DW = 1.681
11	QMDEC	- 22088 - 1956 PSMPC + .2925 ECAPP - 523.89 DV -3.870 - 1.984 6.543 -.5209 (-.190) (2.921)	$\bar{R}^2$ = .9192 S.E. = .995.7 DW = 2.533
12	QMDRW	- 50281 - 626.66 PSMWPC + .2028 APPRW + 6580.8 DDV11 - 5.176 -.607 8.569 3.483 (-.034) (2.517)	$\bar{R}^2$ = .9777 S.E. = 1299.6 DW = 2.617
17	QODEC	764.05 - 280.98 POBTEC + 1.990 PPOEC + 184.21 DV 4.740 -4.623 3.081 1.288 (-.363) (.609)	$\bar{R}^2$ = .9610 S.E. = 82.09 DW = 3.101
18	QODRW	- 12205 - 1931.6 PSOPAO + 5.353 YDUS + 1290.4 DDV16 -3.961 -1.811 8.260 2.064 (-.294) (2.846)	$\bar{R}^2$ = .9612 S.E. = 497.8 DW = 2.012
8	ESSBW	- 5325.0 + .7233 QSBSW - .0245 QMPW -4.015 4.291 -3.400	$\bar{R}^2$ = .8849 S.E. = 1156.1 DW = 1.304
14	ESMW	- 1127.0 + .0294 QSBSW -7.023 14.006	$\bar{R}^2$ = .9376 S.E. = 148.52 DW = 1.619
20	ESOW	- 69.22 + .0020 QSBSW -4.762 10.745	$\bar{R}^2$ = .8980 S.E. = 134.93 DW = 2.275

Source: Own Computations

1/ Elasticities at the mean in parantheses.

increasing crushing margin and declining price of alternative meals. The time trend can be considered as a proxy for the growing EC crushing capacity. The dummy variable accounts for the 1973 enlargement.

The crushing demand of ROW, in eq. (5) can largely be explained by the price of soybeans and their products which influences the profitability of crushing, and the crushing capacity. All of these variables have plausible signs and are highly significant. Increasing soybean, and declining meal and oil prices reduce the profitability of crushing and, thus, the crushing demand in ROW.

The demand for uses other than crushing, such as seed (eq. 5), is positively affected by the acreage of soybeans harvested. Because of multicollinearity in the variables that could explain the soybean demand for other purposes, only SBHARW was used as explanatory variable.

The European Community's soybean meal demand (eq. 10) can be expressed as a function of the ratio of EC soymeal to corn price and the volume of EC animal production (meat and milk). A dummy variable was added to account for the 1973 enlargement. The economic explanatory variables have plausible signs and are highly significant. In the soybean meal-to-corn price ratio, corn acts as a proxy for EC feed grains. The respective elastiticy is rather low.

The negative sign of the soybean meal to corn price ratio indicates that in essence corn and soybean meal are substitutes.[9] This is consistent with the hypothesis that the relatively high price of feedgrains inside the Community has reduced feedgrain use, ceteris paribus, and increased soybean meal consumption (see also Gardiner, 1984;

[9]Of course, feed grains and high protein meals are not perfect substitutes but an appropriate mix of protein meal and a carbohydrate energy feed (e.g. tapioca) can be considered almost perfect substitutes.

Knipscheer and Hill, 1982; Knipscheer and Dixon, 1982, Moschini and Surry, 1984). Some authors, however, found that corn and soybean meal are complementary (Paarlberg, 1980; Sisson and Schmidt, 1985). In Paarlberg's (1980) study this result might be due to the time period on which the analysis was based which includes -- as already mentioned -- years during which the CAP was not yet fully effective, the EC-6, and the EC-9. The results of Sisson and Schmidt (1985) are rather inconclusive. In some member countries, they found corn to be complementary and in others not; in many cases the t-values are not significant. In both studies multicollinearity might have influenced the results as well.

As has frequently been argued, the U.S. has clearly benefitted on the soybean and meal market from EC price supports for feed grains. But even more importantly, the United States has benefitted on these markets also through price support and growing production in the Community's livestock sector. This is evidenced by the strong interrelationship between the volume of EC animal production and the soybean meal demand. The demand elasticity of soybean meal with respect to animal production is rather high.[10] A more detailed analysis of the impact of the Common Agricultural Price Policy on EC soybean meal demand undoubtedly deserves further attention, but is beyond the scope of this study. Nevertheless, we can conclude that EC import tariffs or levies on soybeans or meal would have a negative impact on U.S. exports. The quantitative effect apparently would be rather limited, because the respective price elasticity is low. However, an import quota on soybeans and soybean meal, a restrictive price policy, or domestic production quotas in the Community on the markets for animal products could reduce U.S. exports significantly.

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[10]See also Sisson and Schmidt (1985), Knipscheer and Hill (1982).

At first glance, the demand elasticity of soybean meal with respect to EC animal production may appear to be rather high at +2.9.[11] In a general sense, this elasticity can be interpreted as the inverse of the production elasticity of soybean meal, implying that, ceteris paribus, a one percent increase in soybean meal consumption is associated with a .3423 percent increase in the volume of EC animal production. The magnitude of the production elasticity appears to be at the upper end of the range one may expect. If so, the estimated demand elasticity may even be on the low side.

The EC direct price elasticity for soybean meal demand is in the range of those found in other recent studies (see section 3) but much smaller than in earlier analyses (Houck, Ryan and Subotnick, 1972). Knipscheer, Hill and Dixon (1982) hypothesize that (a) the high relative prices of feedgrains to oilseeds inside the Community may have made European compound feed manufacturers and livestock farmers less sensitive to soybean meal prices and (b) the expanding animal production in the Community has "shifted the demand curve to the right, causing it to become more inelastic in recent years." (Knipscheer, Hill and Dixon, 1982). Another plausible explanation is that the growing nutrient intake and thus productivity per animal acts to reduce the substitutability of high protein meals in feed ratios because of biological constraints to the intake of the volume of feed per animal.

In eq. (11), the demand for soybean meal in ROW can largely be explained by the animal production in ROW. The world market price of soy meal relative to corn has no significant impact on demand. Again, a dummy variable accounts for discontinuity in the data time series. The soybean

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[11]This is also true for the respective demand elasticity in ROW.

oil demand by the European Community is a function of the Community's soybean oil price relative to its butter price and the EC price of alternative oils. Another dummy variable accounts for the 1973 enlargement. The economic explanatory variables have the expected sign and are highly significant. The demand elasticity of the oil to butter price ratio is rather low as is the cross price elasticity of alternative oils.

The soybean oil demand in ROW (eq. 16) can be explained largely by the world price of soybean oil relative to the world price of alternative oils and an income indicator. Both coefficients have the correct sign and are highly significant. Again, a discontinuity of the time series data was accounted for by a dummy variable.

The last three regressions are concerned with the world ending stocks of soybeans, soybean meal and oil respectively. As expected the world soybean supply is the central determinant of these stocks.

6.3 Simulation Results

Following are simulations of price changes in the Community of soybean meal and oil relative to their principle substitutes, caused by possible EC market interventions. The analysis is based on 1980-82 averages. The policy instruments considered are a consumption tax on all fats and oils except butter, and a tariff on soybean meal (with a comparable tariff on soybeans).

Table 10 exhibits the effects of a 5%, 10%, and 20% tariff on soybean meal and other high protein meals. The tariff on meal is converted into a comparable tariff on soybeans. While the impact on soybean oil price inside the Community is significantly lower than the tariff rate, such a tariff would make soybeans and soybean meal more expensive and the EC

Table 10: The Percentage Effects of an EC Import Tariff on Soybean Meal (with a Comparable Tariff on Soybeans) on Selected Variables[1]

Variable[2]	5%	Tariff Rate 10%	20%
	(percentage change)		
PSBW	-2.0	-3.8	-7.7
PSMW	-3.4	-6.3	-11.8
PSOW	- .1	- .2	- .4
PSBEC	1.9	3.9	7.8
PSMEC	2.1	3.8	6.9
PSOEC	.8	1.6	3.4
QSBCEC	- .4	- .9	-2.0
QSBCRW	.1	.2	.3
QMDEC	- .3	- .6	-1.1
QMDRW	.1	.2	.4
QMPEC	- .4	- .9	-2.0
QMPRW	.1	.2	.3
QODEC	- .2	- .4	- .8
QODRW	.0	.1	.1
QOPEC	- .5	- .9	-2.0
QOPRW	.1	.2	.4

Source: Own computations.

[1]Base year: average of 1980-1982.

[2]PSBEC = EC soybean price in ECU.
PSMEC = EC soybean meal price in ECU.
PSOEC = EC soybean oil price in ECU.

demand would decline. However, the reduction would be rather low. The structure of EC imports would change as well. As the decline in soybean crush exceeds the decline in soybean meal demand, the Community would import relatively more soybean meal. As a consequence, the EC production of soybean oil and, thus, EC oil exports would decline.

The world market prices of soybeans and meal would be negatively affected. Not surprisingly, the meal price would decline relatively more than the soybean price. The ROW soybean meal demand would increase slightly as a consequence of the declining world price.

As mentioned before, the central motivation of intervention in the markets for soybeans and their products is to extend the budgetary resources available to the Community. An import tariff on soybean meal may generate some additional revenue. All other things being equal, the impacts of such an instrument on the EC demand for soybean meal and thus on EC imports, would be rather limited. However, the impact on the world market price of soybeans and soybean meal could be considerable if the EC introduces a relatively high tariff rate.

The high value of the U.S. dollar during the first half of this decade may well have had a relatively more pronounced negative impact on U.S. soybean and meal exports. Compared to its peak, the U.S. dollar has declined by almost 35% against the ECU. An EC tariff would make exports from all third countries more expensive in the Community, not just U.S. exports. The high value of the U.S. dollar, acted as an export tax making only U.S. soybeans and their products more expensive, but not those of other exporting countries. This provided a price umbrella under which U.S. competitors could increase their exports to the Community as well as to other importing countries.

Since the substitution impact of an EC soy meal tariff on consumption inside the Community is rather limited, the EC could pursue a different strategy in order to reduce the budgetary pressure -- impose an import quota. Table 10 implicitly contains information about the economic effects of quantitative import restrictions. A 20% tariff on soybean meal would reduce EC demand by 1.1%. Consequently, a quota that reduces the import of soybean meal by 1.1% would be equivalent in its effects to a 20% tariff. A quota that would reduce imports by 5% would have the price effects of an import tariff of about 90%.

The European Community has contemplated a consumption tax on firtually all vegetable oils in the amount of 75 ECU/mt. Table 11 depicts the effects of such a tax. It also shows simulations of alternative tax rates (65 and 85 ECU/mt) for comparison. The price of soybean oil inside the Community would increase significantly. Because the price elasticity of demand is rather low, EC soybean oil demand would decline by only about 3%.

Since soybean crushing in the Community would not change, soybean oil exports would grow. Soybean meal consumption would not be directly affected. Consequently a vegetable oil tax would have little effect on the world soybean meal price.

World soybean and soybean oil prices would decline. Generally, any given EC intervention on the soybean oil market would have a less pronounced effect than on the meal market because the EC share in net imports of oil and the respective price elasticity of demand are lower than for soybean meal. Moreover, a consumption tax has, *ceteris paribus*, a less pronounced impact on EC demand than import restrictions because a

Table 11: The Percentage Effect of an EC Vegetable Oil Consumption Tax on Selected Variables[1]

Variable[2]	Tax 65 ECU/mt	75 ECU/mt	85 ECU/mt
	(percentage change)		
PSBW	- .4	- .7	-1.1
PSMW	.0	.0	.0
PSOW	-1.9	-2.2	-2.4
PSBEC	- .7	- .8	-1.0
PSMEC	.0	.0	.0
PSOEC	11.1	13.0	14.5
QSBCEC	- .0	- .0	- .0
QSBCRW	.0	.0	.0
QMDEC	.0	.0	.0
QMDRW	.0	.0	.0
QMPEC	- .0	- .0	- .0
QMPRW	.0	.0	.0
QODEC	-2.5	-2.9	-3.3
QODRW	.3	.4	.5
QOPEC	- .0	- .0	- .0
QOPRW	.0	.0	.0

Source: Own computations.

[1]Base year: average of 1980-1982.

[2]PSBEC = EC soybean price in ECU.
PSMEC = EC soybean meal price in ECU.
PSOEC = EC soybean oil price in ECU.

tax would increase prices inside the EC of both domestic and imported agricultural goods whereas any import restrictions would not directly affect prices of domestically produced substitutes.

7. Summary and Conclusions

Loopholes in the CAP which originate from GATT negotiations in the early 1960s have resulted in the fact that some agricultural commodities such as soybeans and their products, tapioca, citrus pellets, or corn gluten feed enter the Community at zero or very low tariffs. EC farmers have substituted imported feeding stuff for the relatively more expensive domestic feed grains. Similarly, consumers in the Community have been substituting away from domestic butter into margarine and other imported vegetable oils.

The EC has been under tremendous financial pressure in recent years, which has been aggravated by these loopholes in the CAP. Not surprisingly, there are periodic proposals within the Community to restrict the consumption of these agricultural commodities in one way or the other.

The central objective of this study was to analyze the impacts of EC import restrictions on soybeans and soybean meal, and of a domestic consumption tax on soybean oil. After a brief survey of the CAP and the relative importance of EC imports of soybeans and their products, the literature pertinent to the purpose of this study has been reviewed. In section 5 the theoretical foundations of a two-region model of soybeans and their products have been sketched. The results of the empirical analysis have been discussed in section 6.

The regression model consists of 29 equations of which 11 are behavioral in nature. The 2 SLS estimates indicate, among other things, that the EC demand elasticities for both soybean meal and soybean oil are rather low. The magnitude of the estimated coefficients are within the ranges found in other recent studies. They indicate that an import tariff on soybean meal or a tax on the consumption of "vegetable oils" would not have a very pronounced effect on EC imports of soybeans and their products. Of course, this imples that an EC import quota would be a relatively more effective instrument for a reduction of EC consumption of imported soybeans and their products.

The volume of animal production in the Community has a significant effect on EC demand for soybean meal. The CAP has various negative effects on U.S. agriculture. However, the United States has undoubtedly benefitted on the soybean and soybean meal market from EC price support on feed grains, but it has also benefitted on these markets from price support and expanding production in the EC livestock sector. Any sizeable change in animal production in the Community will significantly affect imports of soybeans and soybean meal.

The rather modest reaction of EC soybean meal and oil demand to their prices indicates that other agricultural policy decisions in the European Community as well as recent developments in production technology and plant breeding may have a much more pronounced effect on future EC imports of soybeans and their products than most trade policy maneuvers.[12]

As already mentioned, EC soybean meal imports are closely linked to the extent of animal production. The domestic production quota, introduced in 1984, has reduced milk production in the EC. All other things being equal, this had a negative impact on U.S. exports.[13] This aspect warrants further quantitative analyses.

The European Community will remain under financial pressure

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[12]As mentioned above import quotas have a potentially significant effect on EC consumption of soybeans and their products.

[13]See section 4.

especially after the value of the U.S. dollar has declined significantly vis-à-vis the currencies forming the ECU. Increasing budgetary tensions contribute to reduced support prices which also reduce animal production in the Community and thus EC imports of soybeans.

Lower agricultural support prices make domestic EC feedgrains and butter more competitive. This will contribute to a reduction of EC demand of soybeans and their products as well. According to the Council of Economics Advisers to the Federal Agricultural Minister in West Germany (1983), any given reduction in feed grain support prices would reduce EC demand for soybean meal significantly more than an equivalent import tariff on soybean meal.

The EC pays production subsidies to farmers who grow oilseeds. This together with new varieties of soybeans, sunflower and rape seeds may boost domestic self-sufficiency in vegetable oils and high protein meals. Although there are no comprehensive studies of the comparative advantages of these crops in the European Community, the production potential, especially in the Mediterranean areas, is no doubt significant especially if the Community continues to pay subsidies on the oilseed production. This development could generate a much more pronounced impact on U.S. exports of soybeans and their products to the Community than the various policy interventions analyzed in this study.

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Appendix: Time Series Data Used

(1) Data for the following variables were collected from USDA Foreign Agriculture Circular: Oilseeds and Products, FOP 6-81, 11-82, 10-83, 6-84, 6-85:

SBYLD, SBHARW, QSBPW, QSBCEC, QSBCRW, QSBODW, ESSBW, BSSBW, QMPW, QMDW, QMDEC, QMDRW, ESMW, BAMW, QOPW, QODW, QODEC, ESOW, BSOW.

(2) World prices are prices received in the U.S. They were calcualted as August-September averages at Illinois County Points (close to Decatur). Data for the following variables were collected from: USDA Statistics on Oilseeds and Related Data, 1965-1982, SB 695, 1983:

PSBW, PCW, PSBW, PMWPC, PSOW, PAOW, PSOPAO.

(3) EC prices were calculated on a marketing year basis using c.i.f. Rotterdam prices in ECU/mt. The sources of the following variables are: FAO Monthly Bulletin of Statistics for data October 1986-September 1977; USDA, Foreign Agriculture Circular: Oilseeds and Products FOP 4-82, 6-84 for the period 1978-1982:

PSBEC, PSMEC, PSOEC, SPDEC, PCEC, PAMEC, POBTEC, PAOEC.

(4) Other sources are:

CVSOY: ASA Soya Bluebook, 1968-1982.

APPRW, ECAPP: FAO Production Yearbook, 1968-1982.

ECUUSD: EUROSTAT EC Grains, Oilseeds and Livestock: Selected Statistics, 1960-1980; USDA/ERS Statistical Bulletin SB703, 1983; EC Commission Report on the Agricultural Situation in the Community, 1982.