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Soybean Oil Price Forecasts: Can Structural Models Help?

by

Jim L. Matthews

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SOYBEAN OIL PRICE FORECASTS: CAN STRUCTURAL MODELS HELP?

Jim L. Matthews*

A substantial amount of analytical research effort has been devoted to the study of oilseeds and product markets over the years. Much of the work has shed considerable insight about the significant relationships among oilseeds and their products. Most of the analyses have proved highly beneficial to a broad range of users concerned with formulating and implementing policies affecting this sector and with developing marketing strategies. However, only a small proportion of the studies are designed specifically for market forecasting and even fewer of these studies are ultimately used in the preparation of current forecasts. The reasons for this are many but the more apparent ones are: (1) many naive and simple models have not proved very satisfactory, and (2) larger scale and more comprehensive econometric models have proved to be much too cumbersome and complex to be highly supportive of the forecasting function. Furthermore, many of these econometric efforts were designed primarily for the purpose of policy analyses as distinct from forecasting. Nonetheless, a good many can potentially be more effectively used as input to current forecasts by the extraction and clearer presentation of key relationships. (See Houck and Mann; Houck, Ryan and Subnotnik; Matthews, Womack and Hoffman; Baumes, Meyers and Hacklander; Salathe, Price and Gadson; Griffith and Meilke; Pollak, Adams; Paarlberg; and Williams).

*Jim L. Matthews, Ph.D., is an agricultural economist and oilseed outlook analyst with the World Agricultural Outlook Board, U.S. Department of Agriculture.

The principal purposes of this paper today are to discuss briefly the forecasting approach used in USDA, the USDA forecast track record for soybeans and products and to indicate where models and analytical results might be more effectively used in the actual development of such forecasts. Primary attention will be directed to the formulation of price forecasts for soybean oil and other vegetable oils which will highlight one of the most difficult areas to forecast with any degree of accuracy but one where substantial improvement can be made through improved data and data analyses.

USDA Forecasting Procedures

Annual supply, use, and price forecasts for soybeans and soybean products as well as for other major grain and livestock products are updated and released monthly by the Department of Agriculture. The preparation of such forecasts are done by a panel of analysts largely from the Economic Research Service (ERS), Foreign Agricultural Service (FAS), Agricultural Stabilization and Conservation Service (ASCS), and the Agricultural Marketing Service (AMS). The commodity panel(s) are coordinated by a member of the World Agricultural Outlook Board (WAOB). Methods employed by each panel member vary a great deal but almost always include the following kind of inputs:

For U.S. Crop Production Estimates:

* Survey results from Statistical Reporting Service for producer intentions to plant, farrow, etc., and for production and yield estimates during crop growing season based on field samples of crop growing conditions.

* Yield and acreage relationships indicating trends and relationships to economic, technical and policy related factors (primarily for early-season estimates).

For World Crop Production Estimates:

* Field reports from agricultural attaches in various countries based on variety of local source materials, attache judgment and analyses of crop growing conditions, country crop statistics and interpretatioon of policies and other factors influencing crop area and production.

* Crop yield assessment by meteorologist staff of World Board noting status of environmental factors such as rainfall and temperature relative to their norms and indicating their notion of impact on crop yields.

* Historical trends and relationships of crop area and yield for various countries indicating response to economic, policy, and other factors prepared mostly by ERS country analysts.

For World and U.S. Supply, Use and Price Estimates:

* Production estimates for individual crops prepared from prior panel results.

* Field reports from attaches indicating their estimate of supply and use based on local country official data, if available, trend analysis, interpretation of policy and other economic factors.

* Historical trends and relationships of crop supply and use for individual countries showing relationship to economic, policy, and other technical factors prepared mainly by ERS country analysts.

* Monitoring and analysis of within year or year to date development on policies and various marketing trends which bear on annual use forecasts (major activity of all participants).

* Assessments of world and U.S. monetary and general economic trends and outlook.

* Historical information on price trends and relationship of prices to supply and/or stock changes and to various policies influencing price. Price forecasts are keyed quite strongly to estimated supply shifts and to overall general inflation rate assumptions.

The forecasting process may be viewed as an incremental or stepwise approach. Inputs are applied at each stage of the forecast process and various kinds of analytical tools may be used by individuals in supporting their arguments for individual components in the forecast. While various internal consistency checks are employed as the process proceeds to assure

reasonability of final forecast results, there is frequently no real assurance that this has been achieved. A method for checking the overall consistency of results for reaching a good approximation of a global equilibrium would be desirable. Hence, a case for some sort of global alternative solution, perhaps provided by a large scale econometric model or a smaller scale approximation of the model's solution.

Forecast Track Record For Soybeans and Its Product Derivatives

Annual supply, use and price forecasts for the next crop marketing year in the United States have generally been first published in the month of May and followed up monthly. Production and use forecasts for the rest of the world are first published in July prior to the new crop year. U.S. forecasts following this pattern go back to about 1976 while the more comprehensive rest of world forecasts were initiated in 1977 for production estimates only and later in 1980 extended to use estimates.

The forecast track record for soybean and soybean products over the 1976/77 to 1981/82 period was examined for its general accuracy based on three evaluation measures and the results are shown in table 1. The evaluation measures chosen are quite commonly used in assessing the adequacy of forecasts generated by statistical and econometric models or by any other forecasting procedure. The mean absolute percentage error (MAPE) is used because of its ease in calculation and interpretation. It provides an absolute indication of how predictions compare to actual or reported data. Such a measure is of key interest but gives no indication of forecast performance in a relative sense. Consequently, Theil's U_2 statistic is calculated which provides a comparative measure of how well

Table 1.--Summary of Forecast Evaluation Statistics for Soybeans and Products, 1976 to 1981

Forecast month	Mean average percent error (MAPE)		Theil's U statistic		Turning point errors (TPE)	
	Pct.				Pct.	
	1976-81	1979-81	1976-81	1979-81	1976-81	1979-81
Soybean Prices						
May	19.58	22.53	0.93	1.28	67	67
Aug.	7.95	4.87	.47	0.36	---	---
Nov.	6.93	6.54	.47	0.52	---	---
Feb.	2.94	2.38	.17	0.14	---	---
May	2.80	1.10	.24	0.09	---	---
Aug.	1.68	0.30	.15	0.02	---	---
Soybean Oil Prices						
May	12.77	10.57	1.18	0.93	33	33
Aug.	16.87	14.01	1.31	1.21	50	33
Nov.	14.67	14.69	1.17	1.22	33	33
Feb.	8.07	4.08	0.78	0.34	17	---
May	4.06	2.96	.36	0.30	---	---
Aug.	.87	0.71	.11	0.07	---	---
Soybean Meal Prices						
May	21.11	21.95	1.23	1.46	83	100
Aug.	7.26	3.82	.43	0.28	---	---
Nov.	6.67	5.21	.50	0.62	---	---
Feb.	3.58	3.52	.23	0.27	---	---
May	6.02	3.68	.48	0.27	---	---
Aug.	.65	1.08	.04	0.07	---	---
Soybean Production						
May	8.85	10.37	.59	.67	14	---
Aug.	5.30	3.96	.30	.25	14	---
Nov.	2.62	2.07	.15	.13	---	---
Feb.	1.47	0.97	.09	.06	---	---
May	1.47	0.97	.09	.06	---	---
Aug.	1.47	0.97	.09	.06	---	---

Continued--

Continued--Table 1.--Summary of Forecast Evaluation Statistics for Soybeans and Products, 1976 to 1981

Forecast month	Mean average percent error (MAPE)		Theil's U statistic		Turning point errors (TPE)	
	Pct.				Pct.	
	1975-81	1979-81	1975-81	1979-81	1975-81	1979-81
Soybean Exports						
May	12.54	10.75	0.73	0.55	43	---
Aug.	11.15	11.64	0.69	0.61	14	---
Nov.	8.85	10.11	0.56	0.52	14	---
Feb.	7.40	8.43	0.46	0.42	14	---
May	5.30	4.60	0.31	0.24	14	---
Aug.	1.64	1.46	0.11	0.09	---	---
Soybean Oil Exp.						
May	28.29	30.09	1.13	1.04	57	33
Aug.	24.14	27.61	0.94	0.92	43	33
Nov.	24.72	23.82	0.87	0.76	43	33
Feb.	13.90	15.64	0.60	0.52	29	33
May	7.26	8.11	0.29	0.28	---	---
Aug.	5.16	6.41	0.18	0.19	---	---
Soybean Meal Exp.						
May	10.56	11.42	1.04	1.24	29	33
Aug.	9.80	8.35	0.76	0.71	14	---
Nov.	9.54	6.33	0.73	0.57	14	---
Feb.	7.65	4.90	0.59	0.45	---	---
May	6.57	5.44	0.44	0.40	---	---
Aug.	1.60	2.26	0.13	0.16	---	---
Soybean Meal Exp. sme						
May	11.80	10.83	0.78	0.64	29	---
Aug.	10.24	9.85	0.66	0.56	---	---
Nov.	8.11	7.90	0.54	0.45	---	---
Feb.	6.45	6.60	0.45	0.38	---	---
May	4.67	4.16	0.31	0.26	---	---
Aug.	1.24	0.96	0.10	0.09	---	---

the forecasts generated by USDA compare with the use of a naive no-change predictor. This statistic is computed according to the following formula:

$$U_2 = \sqrt{\sum(P_t - A_t) / \sum(A_t)^2}$$

where the P_t are predicted changes and the A_t are realized changes, defined as:

$$A_t = a_t - a_{t-1}$$

$$P_t = p_t - p_{t-1}$$

and where a_t is the realized outcome for a variable in year t and p_t is the forecast of a_t. This statistic takes on values close to zero when the forecasts are near the reported values. When a naive no change forecast is used, the statistics takes on a value of 1. Consequently, values closer to zero are desired. Values of 1 or more would suggest that the forecast procedure employed is no better or worse than the use of a naive no-change forecast.

Another evaluation measure of interest is the ability for the forecast technique to indicate turning points or the correct direction of change. Turning point errors (TPE) in this period are indicated when the forecasted change is in the opposite direction of the actual direction of change. The TPE statistic is computed as the percentage of directional errors relative to the total number of forecasts made for a particular forecast month.

In general, U.S. price forecasts appear to have an acceptable level of error tolerance for soybean and soybean meal prices beginning with the August forecast. The initial early season forecasts issued in May would appear to have larger than desired errors based on all three evaluation criteria. Much of this price forecasting error can be traced to a fairly

large percentage error in the early season production estimates which is a problem when combined with a generally inelastic demand for soybeans and products. Other sources of price forecasting errors are derived from errors in the estimates for exports or in effect errors related to factors influencing exports. Improvement in early season forecasts will depend importantly on improving the early season U.S. production estimates.

For the purposes of this paper, however, I would like to focus on the price forecasts for soybean oil. The summary evaluation measures in table 1 show that forecast errors for soybean oil prices remain at unacceptably high levels well into the forecast year. Errors in U.S. production estimates for U.S. soybean production is not necessarily the principal factor of concern. Not until February does the mean average percentage error or the Theil-U statistic fall to an acceptable level of error tolerance. In fact, the Theil-U statistics are all over 1.0 in forecasts prior to February suggesting that a naive no change forecast would have done better in minimizing the standard error of the forecast. The high level of error in soybean oil price forecasts are associated closely with a very high level of error in U.S. soybean oil exports. This suggests that improvements in soybean oil price forecasts will depend importantly on improved estimates for factors influencing soybean oil exports. The problem here has been both deficiencies in data as well as in the parameters conveying the effect of economic, policy and technical changes on exports and subsequently on soybean oil prices.

Overview of Some Existing Econometric Models For Their Potential Contribution to Soybean Oil Price Forecasting

The general types of comprehensive oilseeds models that have been constructed in recent years are shown in figure 1. The more common

Figure 1. Generalized Representation of Current Models for the U.S. and World Soybean Economies

Case I. Two Region Model: U.S. and Rest of World for Soybeans and Products only.

United States Relations

(1) $A_i = f_i(P_{i-1}, z_{1i})$ Area

(2) $Y_i = f_2(P_{i-1}, z_{2i})$ Yield

(3) $Q_i = A_i * y_i$ Production

(4) $BX_i = ES_{i-1}$ Beginning stocks

(5) $C_i = f_3(P_i, Z_{3i})$ Crush or use

(6) $ES_i = f_4(P_i, Z_{4i})$ Ending stocks

(7) $X_i = f_5(P_i, z_{5i})$ Exports

where Xi is derived as follows from

Rest of World Relations:

(8) $X_i = M_j$ = Imports by Rest of World

(9) $M_j = C_j - Q_j - BS_j + ES_j$ Imports

(10) $C_j = f_6 (P_{j-1}, Z_{6j})$ Consumption

(11) $Q_j = f_7 (P_{j-1}, Z_{7j})$ Production

(12) $ES_j = f_8(P_j, Z_{8j})$ Ending Stocks

(13) $P_j = (P_i * E + T * E) * (1 + d)$ Price in Import Region

where E = Exchange rate, T = Transport cost, d = Tax levy or export subsidy

Substitution of (13) into (10), (11) and (12) and reexpressing equation (8) as a functional identity results in the general relation shown as (7) where Z5i represents a composite of all the variables shown in (9) to (13).

Continued

Figure 1 continued

Solving for the Price (Pi) Requires substitution of relations (5), (6), (7) into the market clearing supply-use identity (14).

(14) $BS_i + Q_i = C_i + X_i + ES_i$ Supply-use identity

to get

(15) $P_i = F^{-1} [Q_i, BS_i, Z_{3i}, Z_{4i}, Z_{5i}]$ U.S. price

Case II. Extension of Case I by disaggregating net import demand for rest of world into two or more regions for soybeans and derivatives:

(16) $$X_i = \sum_{k=1}^{n} NI_k - \sum_{l=1}^{m} NX_l$$

where k = 1, . . . , n importing areas

l = 1, . . . , m exporting areas.

(17) Replicate relations (1) to (6) for each net importer and net exporter.

(18) Replicate relation (13) between United States prices and prices in each importing and exporting area.

(19) Solve system of equations for prices, trade and consumption in each area.

Case III. Extension of Case II by relaxing assumption of known quantities and prices for closely related oilseeds and derivatives. Add additional oilseeds and products. Add additional regions. Becomes a series of linked domestic market models for one or more oilseeds.

Case IV. Extension of Case I to include competing commodities in a simulataneous specification.

Case V. Extension of Case III to include commodities other than oilseeds.

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specification, case I, is a single region or two region model for a single oilseed typified by the work of Houck and Mann, and Houck, Ryan and Subnotnik in the late 1960's and early 1970's. These original specifications for soybeans were later combined with similar models for closely related grains and livestock commodities by various analyst's in the USDA's Economic Research Service in the early 1970's to form a cross commodity modeling framework which is a case IV type of extension shown in figure 1. Individual components of the cross commodity modeling framework for the United States have undergone considerable re-specification with time as well as incorporation of more recent data into the sample period used for parameter estimation purposes. Various combinations of the individual commodity models have been formulated which include a crops model and a livestock model. These formulations have been done primarily for the purpose of conducting policy and program appraisal activities. Some of these efforts were directed, however, more specifically at development of parameters and relationships for annual forecasting purposes, and reported on by Matthews, Womack, Meyers, Baumes and Hacklander among others.

Extensions of the case I Houck type analyses to case III type models which incorporate more regions and additional oilseeds have been made by a number of analysts but the works by Williams, Paarlberg, Griffith, Meilke, Adams and Pollak perhaps are the most promising for eventual use in extracting reduced price forecasting relationships for soybean oil as well as other oils and oilseeds. However, many of these more comprehensive case III type models still require further testing and evaluation before reduced form approximations for forecasting purposes can be undertaken. Meanwhile, further disaggregation of export relationships in case I type

models (case II in figure 1) would appear more feasible for the derivation of reduced form approximations for use in support of forecasting activities.

Various versions or specifications of the Houck-type soybean model have emerged over time and take on individual characteristics because of differences in specification of individual relationships, the use of different sample periods for estimation purposes, or by incorporating closely related commodities with the soybean model. Solved reduced form soybean oil price relationships for 4 versions of the case I and IV type models are shown in table 2. Briefly the models are identified as follows:

Model 1. Version prepared by Hacklander and Meyers in mid-to-late 1970's. (Case IV type)

Model 2. Version prepared by Salathe, Price and Gadson in early 1980's and currently housed in USDA's Food and Agricultural Policy Branch. (Case I type)

Model 3. Version prepared by Womack, Meyers, Young and others and housed at University of Missouri. (Case IV type)

Model 4. Version prepared by Matthews, Womack and Hoffman in early and mid-1970's. (Case I type)

Table 2.--Soybean Oil Price Relationships

Price Influencing Factors	Assumed change	Multipliers ($/MT) Model 1	Model 2	Model 3	Model 4	Model 5
General Economy						
U.S. cons. expend.	10%	n.c.	---	73	83	---
U.S. disp. income	10%	---	47	---	---	---
GNP U.S., real	10%	---	---	---	---	27
GNP dev. coun.,real	10%	---	---	---	---	65
U.S. GNP price defl.	10%	---	---	---	---	41
U.S. CPI less food	10%	n.c.	-7	-70	-70	---
U.S. dollars/ECU	10%	---	---	---	---	60
U.S. dollars/SDR	10%	31	2	30	17	---
Livestock Sector						
U.S. lvst. units	10%	-64	-33	-43	-45	---
U.S. lvst. prices	10%	n.c.	-3	-13	-7	---
Japan-EC hog pro.	10%	n.c.	15	8	5	---
Japan-EC poul. pro.	10%	n.c.	15	8	5	---
Corn Sector						
U.S. supply	1 mmt.	---	---	-4	---	---
Farmer-held res.	1 mmt.	---	---	3	---	---
CCC net purc.	1 mmt.	---	---	3	---	---
U.S. corn prices	1 $/mt.	1.1	0.3		-0.3	-0.3
EC corn targ. price	10%	n.c.	---	7	13	---
Exports major comp. less USSR imports	1 mmt.	---	---	-2.5	---	---
Soybean Sector						
U.S. supply	1 mmt.	-16	-35	-17	-15	-11
CCC loans	1 mmt.	n.c.	33	15	13	10
USSR-PRC net imp.	1 mmt.	n.c.	-12	-4	-5	---
S. Amer.exp., s.m.e.	1 mmt.	13	12	4	6	---
P.L. 480 soyoil exp.	100tmt.	n.c.	72	82	35	---
S. Amer. exp., o.e.	100tmt.	-4	---	---	---	-5
Other Oils and Fats						
U.S. animal fat use	100tmt.	-49	---	-78	-33	-5
U.S. palm oil use	100tmt.	-49	---	-78	-33	---
U.S. other oil use	100tmt.	-49	---	-78	-33	-5
E. Asian veg. oil exports	100tmt.	---	---	---	---	-5

Table 2a.--Soybean Oil Price Forecasts, 1981/82

Price Influencing Factors	Units change	Rept. Change 1980/81 to 1981/82	Price effect ($/metric ton) Model 2	Model 3	Model 4	Model 5
General Economy						
U.S. cons. expend.	%	4.2	---	30.66	34.86	---
U.S. disp. income	%	6.1	28.67	---	---	---
GNP U. S., real	%	-1.1	---	---	---	-2.97
GNP dev. coun., real	%	3.7	---	---	---	24.05
U.S. GNP price def.	%	6.0	---	---	---	24.60
U.S. CPI less food	%	5.7	-3.99	-39.90	-39.90	---
U.S. dollars/ECU	%	-18.4	---	---	---	-110.40
U.S. dollars/SDR	%	-5.2	-1.04	-15.60	-8.84	---
Livestock Sector						
U.S. lvst. units	%	-1.8	5.94	7.74	8.10	---
U.S. lvst. prices	%	6.5	-1.95	-8.45	-4.55	---
Japan-EC hog prod.	%	0.7	1.05	0.56	0.35	---
Japan-EC poul. prod.	%	5.0	7.50	4.00	2.50	---
Corn Sector						
U.S. supply	mmt.	24.7	---	-98.80	---	---
Farmer-held reserve	mmt.	28.6	---	85.80	---	---
CCC net purchases	mmt.	1.6	---	4.80	---	---
U.S. corn prices	$/mt.	-24	-7.20		7.20	---
EC corn targ. price	%	8.1	---	5.67	10.53	---
Exports major comp. less USSR	mmt.	-1.1	---	2.75	---	---
Soybean Sector						
U.S. supply	mmt.	4.50	-157.50	-76.50	-67.50	-49.50
CCC loans	mmt.	0.76	25.08	11.40	9.88	7.60
USSR-PRC net imp.	mmt.	0.251	-3.01	-1.00	-1.26	---
S.Amer. exp., s.m.e.	mmt.	-1.179	-14.15	-4.72	-7.07	---
P.L. 480 soyoil exp.	100tmt.	-0.045	-3.24	-3.69	-1.58	---
S.Amer. exp., o.e.	100tmt.	-5.90	---	---	---	29.50
Other Oils and Fats						
U.S. animal fat use	100tmt.	0.04	---	-3.12	-1.32	-0.20
U.S. palm oil use	100tmt.	-0.59	---	46.02	19.47	---
U.S. other oil use	100tmt.	0.95	---	-74.10	-31.35	-4.75
E.Asian veg. oil exp.	100tmt.	2.64	---	---	---	-13.20
Estimated Change			-124	-134	-70	-95
Price Last Year			502	502	502	502
Forecast			378	368	432	407
Reported			418	418	418	418

Table 2b.--Soybean Oil Price Forecasts, 1982/83

Price Influencing Factors	Units	Estim. Change 1981/82 to 1982/83	Price effect ($/metric ton) Model 2	Model 3	Model 4	Model 5
General Economy						
U.S. cons. expend.	%	8.0	---	58.40	66.40	---
U.S. disp. income	%	6.1	28.67	---	---	---
GNP U.S., real	%	3.0	---	---	---	8.10
GNP dev. coun., real	%	2.1	---	---	---	13.65
U.S. GNP price def.	%	3.8	---	---	---	15.58
U.S. CPI less food	%	4.1	-2.87	-28.70	-26.60	---
U.S. dollars/ECU	%	-3.0	---	---	---	-18.00
U.S. dollars/SDR	%	-2.5	-0.50	-7.50	-4.25	---
Livestock Sector						
U.S. lvst. units	%	0.6	-1.98	-2.58	-2.70	---
U.S. lvst. prices	%	2.8	-0.84	-3.64	-1.96	---
Japan-EC hog prod.	%	1.1	1.65	0.88	0.55	---
Japan-EC poul. prod.	%	-1.0	-1.50	-0.80	-0.50	---
Corn Sector						
U.S. supply	mmt.	36.8	---	-147.20	---	---
Farmer-held reserve	mmt.	36.6	---	109.80	---	---
CCC net purchases	mmt.	4.4	---	13.20	---	---
U.S. corn prices	$/mt.	2	0.60	-0.60	-0.60	---
EC corn target price	%	8.7	---	6.09	11.31	---
Exports major comp. less USSR	mmt.	5.6	---	-14.00	---	---
Soybean Sector						
U.S. supply	mmt.	6.20	-217.00	-105.40	-93.00	-68.20
CCC loans	mmt.	1.52	50.16	22.80	19.76	15.20
USSR-PRC net imports	mmt.	1.244	-14.93	-4.98	-6.22	---
S. Amer. exp., s.m.e.	mmt.	0.223	2.68	0.89	1.34	---
P.L. 480 soyoil exp.	100 tmt.	0.976	70.27	80.03	34.16	---
S. Amer. exp., o.e.	100 tmt.	2.05	---	---	---	-10.25
Other Oils and Fats						
U.S. animal fat use	100 tmt.	0.43	---	-33.54	-14.19	-2.15
U.S. palm oil use	100 tmt.	0.20	---	-15.60	-6.60	---
U.S. other oil use	100 tmt.	-0.21	---	16.38	6.93	-1.05
E.Asian veg. oil exp.	100 tmt.	4.47	---	---	---	-22.35
Estimated Change			-86	-55	-16	-70
Price Last Year			418	418	418	418
Forecast			332	363	402	348
Reported			397 1/	397 1/	397 1/	397 1/

1/ USDA interagency estimates as of 5/11/83.

Table 2c.--Soybean Oil Price Forecasts, 1983/84

Price Influencing Factors	Units	Fore. Change 1982/83 to 1983/84	Price effect ($/metric ton) Model 2	Model 3	Model 4	Model 5
General Economy						
U.S. cons. expend.	%	9.0	---	65.70	74.70	---
U.S. disp. income	%	7.7	36.19	---	---	---
GNP U. S., real	%	4.0	---	---	---	10.80
GNP dev., real	%	3.3	---	---	---	21.45
U.S. GNP price def.	%	4.6	---	---	---	18.86
U.S. CPI less food	%	4.8	-3.36	-33.60	-33.60	---
U.S. dollars/ECU	%	3.0	---	---	---	18.00
U.S. dollars/SDR	%	2.3	0.46	6.90	3.91	---
Livestock Sector						
U.S. lvst. units	%	1.0	-3.30	-4.30	-4.50	---
U.S. lvst. prices	%	1.5	-0.45	-2.05	-1.05	---
Japan-EC hog prod.	%	2.0	3.00	1.60	1.00	---
Japan-EC poul. prod.	%	2.8	4.20	2.24	1.40	---
Corn Sector						
U.S. supply	mmt.	-40.9	---	163.60	---	---
Farmer-held reserve	mmt.	-36.8	---	-110.40	---	---
CCC net purchases	mmt.	-9.5	---	-28.50	---	---
U.S. corn prices	$/mt.	16	4.80		-4.80	---
EC corn targ. price	%	4.3	---	3.01	5.59	---
Exports major comp. less USSR	mmt.	-3.5	---	8.75	---	---
Soybean Sector						
U.S. supply	mmt.	-1.80	63.00	30.60	27.00	19.80
CCC loans	mmt.	-2.72	-89.76	-40.80	-35.36	-27.20
USSR-PRC net imp.	mmt.	0.466	-5.59	-1.86	-2.33	---
S. Amer. exp., s.m.e.	mmt.	0.863	10.36	3.45	5.18	---
P.L. 480 soyoil exp.	100 tmt.	0	0	0	---	---
S. Amer. exp., o.e.	100 tmt.	0.90	---	---	---	-4.50
Other Oils and Fats						
U.S. animal fat use	100 tmt.	0.70	---	-54.60	-23.10	-3.50
U.S. palm oil use	100 tmt.	0.10	---	-7.80	-3.30	---
U.S. other oil use	100 tmt.	-0.21	---	16.38	6.93	-1.05
E.Asian veg. oil exp.	100 tmt.	1.98	---	---	---	-9.90
Estimated Change			20	20	18	42
Price Last Year			397 1/	397 1/	397 1/	397 1/
Forecast			417	417	415	439
Reported			420 1/	420 1/	420 1/	420 1/

1/ USDA interagency forecasts as of 5/11/83.

For purposes of additional comparison, the forecasts obtained from a directly fitted reduced form price relationship are shown as model 5. The variables in this relationship represent a small subset of variables that are thought to account for a significant portion of the explained soybean oil price variance in a large scale world soybean model of the Case III-type developed by Williams. The Williams model has been further documented by Paarlberg for housing in USDA. Ultimately, this model may be solved for parameters and variables that drive the soybean oil price equilibrium and provide key background information for formulation of USDA oilseed and oil price forecasts.

The results for models 2, 3 and 4 are of particular interest since they best represent examples of extractions from either case I or case IV type models. Most of the explained price variance is thought to be accounted for by the subset of exogenous variables shown in the left margin of table 2. Individual impacts of key factors influencing soybean oil price changes shown in table 2 indicate how a specified assumed annual change for each factor influences soy oil prices. Observations of some interest to the forecast analyst are as follows:

* Soybean oil prices in model 2 are more dependent on supply driven changes in the U.S. soybean sector rather than demand changes suggesting a much more price inelastic set of demand relationships. Such a formulation, if correct, will likely generate significantly larger price swings because of the greater variability in supply factors.

* Model 3 in contrast to model 2 indicates more price responsiveness to demand factors than does model 2. Exchange rate changes are indicated to be much more significant with a 10 percent drop in the value of the dollar relative to the SDR contributing to an estimated $30 per metric ton drop in the price of soybean oil.

* Both models 2 and 3 indicate considerable price sensitivity to changes in P.L. 480 exports.

* Model 3 indicates that prices are quite sensitive to competing availabilities of animal fats and other oils including palm, whereas model 2 would indicate little effect from these factors on price.

* Provided that the specification in model 3 is more reasonable in terms of capturing demand influences, availability of palm oil for U.S. consumption is a very elusive variable to forecast in the absence of considerable knowledge about consumption and supply patterns outside the United States.

* Because of the preceding remark, extraction of a set of parameter results from either case II extensions for oilseeds or from case III (Williams type model) would be highly desirable. A more precise empirical treatment of exchange rate influences may also be an important result.

* The directly estimated reduced form equation (model 5) does indicate that competing supplies of palm and soy oil from the major exporter-producer countries is of much greater significance than indicated by results from models 2, 3 and 4. Consequently, derivations of reduced form relationships based on either case II or Case III type models are sorely needed. In addition, model 5 results do provide strong indications that real incomes in developing countries is a much more important factor influencing soy oil prices than suggested by solutions from the Case I type models.

* A difficulty with model 5 results is the strong dependency on the dollar exchange rate when measured in terms of the ECU. This variable was chosen because of the importance of the exchange rate to soybean and meal trade between the U.S. and the EEC. However, the results appear quite questionable and indicate a major difficulty with directly estimated reduced form equations based on a small subset of variables because of the difficulty is constructing an aggregate representative measure of the exchange rate factor for soybeans and products.

Forecasts based on the parameters from models 2, 3, 4 and 5 are shown in tables 2a, 2b and 2c. In general the forecast results show a great deal of consistency for the three year period considered in spite of the considerable differences in the parameter estimates. Most of the derived forecast solutions tend to indicate a larger price drop in 1981/82 than actually occurred and this tendency is also evident in 1982/83. This may be due to some oversight of a significant price influencing factor or to

limitations inherent in models that are largely linear in nature. With soybean oil prices unusually low relative to other commodities in this timeframe, more substitution of vegetable oils for other inputs in final products may be occuring than is normally the case particularly in nonfood uses of vegetable oils. Hence the consumption, price relationship is nonlinear particularly at the extreme limits of price ranges.

Summary Remarks

The strong suggestion that emerges from this paper is that large scale econometric models can play a much more significant role in the formulation of price forecasts for such commodities as soybean oil in the USDA. Extraction of parameter results from a class of Houck type models offer considerable guidance in understanding the set of complex forces influencing prices. Derivations of parameter results from extension of the Houck type modeling efforts should offer significant improvements on parameter estimates for forecasting purposes. More comprehensive world data series constructed by USDA analysts for oilseeds and their derivatives in the past three years also hold significant promise in capturing current developments and trends in oilseeds and oil markets permitting a stronger interaction between data and data parameters. Moreover, the extraction of key forecast parameters from large-scale models can be readily adapted for easy use on micro processors for interaction of parameters with key data influencing the price forecast.

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