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THE ECONOMIC EFFECTIVENESS OF FOREIGN MARKET DEVELOPMENT PROGRAMS: THE CASE OF SOYBEANS AND SOYBEAN PRODUCTS

Gary W. Williams
and
Lester H. Myers

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International Agriculture Service
Chase Econometrics, Inc.
150 Monument Road
Bala Cynwyd, Pennsylvania 19004

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---The Economic Effectiveness of Foreign Market Development Programs: The Case of U.S. Soybeans and Soybean Products

Quantitative measures of returns and the impact on U.S. agriculture from expenditures to promote foreign demand for U.S. soybeans are presented. The average impacts of the expenditures on U.S. agriculture have generally been small in percentage terms. The average returns per dollar invested, however, have been very high.

Biographical Information

Gary W. Williams is Senior Economist, International Agriculture Group, Chase Econometrics. He has primary responsibility for the development and operation of the International Oil Crops Service. Dr. Williams holds a Ph.D. and M.S. degree in agricultural economics from Purdue University. He earned a B.S. in economics from Brigham Young University in 1974. Prior to joining Chase Econometrics, he gained experience as agricultural economist for the U.S.D.A., as Special Assistant to the Deputy Under Secretary for International Affairs and Commodity Programs (U.S.D.A.), and as international economist for the U.S. Central Intelligence Agency. His specialties include applied econometric analysis, model building for world agricultural markets, and applied international trade analysis. He has authored a number of publications on these topics.

Lester H. Myers is director of the International Agriculture Group and Senior Economist, Chase Econometrics. He has primary responsibility for the development and direction of the International Agricultural Services including the Canadian Agriculture Service. Dr. Myers holds a Ph.D. degree in agricultural economics from Purdue University and an M.S. degree in agricultural economics from the University of Connecticut. Prior to joining Chase Econometrics, he was Director of Economic Research for the Florida Department of Citrus and Adjunct Professor of Food and Resource Economics at the University of Florida. Dr. Myers is a specialist in consumer demand studies, industry and government program evaluation, and world trade studies for agricultural commodities. Dr. Myers has authored a number of professional and applied publications on these specialties.

The Economic Effectiveness of Foreign Market Development Programs: The Case of Soybeans and Soybean Products*

Gary W. Williams and Lester H. Myers**

Public and private investment to enhance agricultural output and revenue can be classified as either supply- or demand-oriented. Supply-oriented investments have concentrated on research to improve agricultural productivity. Demand-oriented investments, on the other hand, have attempted to shift the demand schedules for agricultural commodities through promotional activities, thereby enhancing price and stimulating output. While researchers have long debated the sociological implications, economic impacts, and returns to supply-oriented investments (see, for example, Barletta; Evenson; Evenson, Flores, and Hyami; Griliches; Peterson (1967 and 1971)), less concern has been directed at the farm-level impact and returns to demand-oriented investments.

Most demand side studies have considered the impact of generic advertising in the U.S. on domestic sales of agricultural commodities (Clement, Henderson, and Eley; Hochman, Regev, and Ward; Nerlove and Waugh; Thompson and Eiler; Ward). Since the early 1950's, the Foreign Agricultural Service (FAS) of the U.S. Department of Agriculture, cooperating with commodity organizations and industry coopeators (third-party contributors), has invested in the creation, expansion, and maintenance of foreign demand for U.S. produced agricultural commodities. In 1981 alone FAS invested $21.2 million of a total $72.5 million in the development of foreign markets for U.S. cotton, wheat, tobacco, soybeans, and products, feed-grains, rice, poultry, fruits, vegetables, and other commodities. While the amounts invested are a matter of public record, little is known about the returns or the impact on U.S. agriculture from such investments.

Some work has been done by the Florida Department of Citrus to measure the effect of foreign market development expenditures on U.S. exports of orange juice (Lee and Lee, Myers, and Forsee). Lacking alternative measures for other commodities, however, Federal program evaluators and program cooperators generally have had to rely on a simple comparison of gross investments in market development and gross changes in exports to measure program effectiveness and thereby justify continuing investment. Such a comparison is obviously inadequate since many other factors have also affected the volume and value of U.S. agricultural exports over the years, including relative price changes, currency exchange rate fluctuations, trends in livestock and meat production, changes in GNP and personal disposable income, population growth, and changes in

government policies around the world. Particularly during the current period of concern over Federal deficits and intense scrutiny of Federal programs, adequate justification for continuing investments requires a measure of returns per dollar invested and of the unique contribution of foreign market development activities to the observed growth in exports and farm output.

One of the oldest and largest of the foreign market development programs is cooperatively funded by FAS and the American Soybean Association (ASA). Since 1956 when the program was established nearly $29 million has been invested in the development of foreign markets for U.S. soybeans and soybean products. Only investments for wheat ($52 million) and cotton ($34 million) have been larger. In recent years 15 to 20 percent of total market development investments have been for soybeans and soybean products. This paper presents the results of a quantitative study designed to isolate and measure the net impact of the ASA and FAS cooperative foreign market development program on the U.S. soybean industry in particular and on U.S. agriculture in general. After a brief discussion of the history of the program, the economic model utilized in the quantitative analysis and the statistical results are presented. The economic impact of the program on U.S. agriculture is then evaluated through simulation analysis. The final section provides implications for current funding activities.

Historical Perspective

Expenditures to develop foreign markets are financed by soybean growers through legislated check-off contributions, FAS and third party industry contributors in the countries of investment. Currently 23 states have legislated checkoff requirements of 1/2 to 1 cent per bushel. Several other states including Indiana and Ohio periodically consider such legislation.

Soybean market development activities occurred almost entirely in Japan before 1970. Since the pre-1970 data is also rather sketchy, later analysis of the program focuses on the period between 1970 and 1980. An examination of the expenditure data indicates that nominal expenditures for market development have increased steadily over the last decade (table 1). The growth rate of these expenditures, however, dropped steadily until 1976 after which there was some increase in the rate. After adjusting the data for changes in the value of the U.S. dollar and inflation in the countries of expenditure, it is evident that the purchasing power of the increasing nominal expenditures in foreign markets declined during much of the last decade.

Table 1. Soybean and Soybean Product Market Development Expenditures by Contributor[1/]

Fiscal Year	ASA	FAS	Third Party	Total	Annual Growth Rate
	- - - - - - - thousand U.S. $ - - - - - -				- - percent - -
1970	130.0	670.6	457.0	1257.6	—
1971	197.0	769.9	1412.0	2378.9	89.2
1972	359.0	962.1	2040.0	3361.1	41.3
1973	703.0	1297.5	1761.0	3761.5	11.9
1974	1115.0	1132.1	2383.0	4630.1	23.1
1975	1575.0	1495.4	2152.0	5222.4	12.8
1976	1890.0	1336.0	2060.0	5286.0	1.2
1977	1988.0	1534.3	2357.0	5879.3	11.2
1978	2628.0	2052.7	3300.0	7980.7	35.7
1979	3397.0	2737.3	3265.0	9399.3	17.8
1980	3441.0	2817.1	3856.0	10,114.1	7.6
Total	17,423.0	16,804.9	25,043.0	59,270.8	

[1/] Excludes expenditures in North America. Totals may not add due to rounding errors.

Third party contributors have provided the largest share of market development funds since 1971. ASA contributed the smallest share of funds between 1970 and 1974. By 1980 the ASA share had jumped to 34%, surpassing FAS with 28% but still under third party contributors with 38%. These funds currently support market development activities in 76 countries. Japan accounted for the largest share of expenditures in the early 1970s. However, by 1980, the European Community accounted for the largest share followed by Japan, other Asian countries, and the rest of the world. In the early years funding was almost entirely for the promotion of soybeans (near 80%). However, the emphasis of funding shifted to soybean meal and oil in the mid-1970s. In 1980 the soybean meal share was 26% and the soybean oil share was about 33%. The share of expenditures for soyfood has remained between 10% and 15% since about 1972.

Economic Model and Statistical Results

The basic tool of analysis is a 96-equation econometric model which allows for simultaneous determination of the supplies, demands, prices, and trade of soybeans and soybean products in the major trading regions of the world. These regions include: the

United States, Brazil, the European Community (nine members), Canada, Japan, Other Asia and Oceania, Africa, and a Rest-of-the-World region. This World Soybean Model has its roots in the Houck, Ryan, and Subotnik formulation of the U.S. soybean industry. The primary differences include explicit inclusion of similar models for major U.S. competitors and trade partners in world markets, endogenous exports and imports by country, and endogenous crush margins. Earlier versions of this model can be found in Williams (1971), Williams (1981), and Williams and Thompson.

Figure 1 illustrates the domestic soybean market of a given exporting or importing country in the World Soybean Model. The market in each region is divided into 4 blocks: a soybean block, a meal block, an oil block, and an excess supply or excess demand block. The first three blocks contain behavioral relationships. They specify the manner in which acreage, production, demand, stocks, and prices of soybeans, meal, and oil behave in response to changes in variables like prices, technology, weather, and livestock production. The last block in the domestic markets includes net excess supply (or export availability) relationships in exporting countries and net excess demand (or import demand) relationships in importing countries.

Figure 2 illustrates schematically that the markets of each region are linked in the World Soybean Model through international prices and trade flows. Equations (1) - (10) represent the soybean, meal and oil blocks of any exporting country i. Equations (14) to (23) represent the corresponding blocks in any importing country j.

Figure 1

DOMESTIC SOYBEAN MARKET STRUCTURE

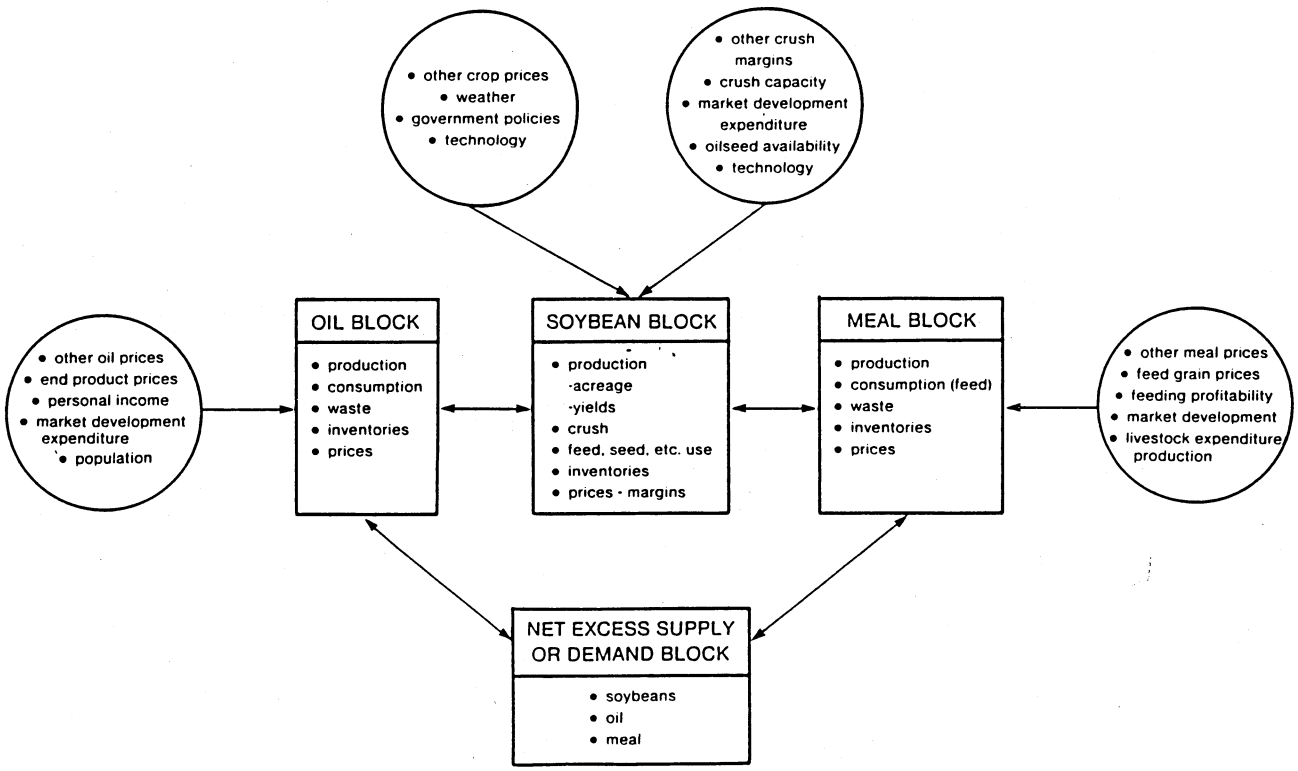
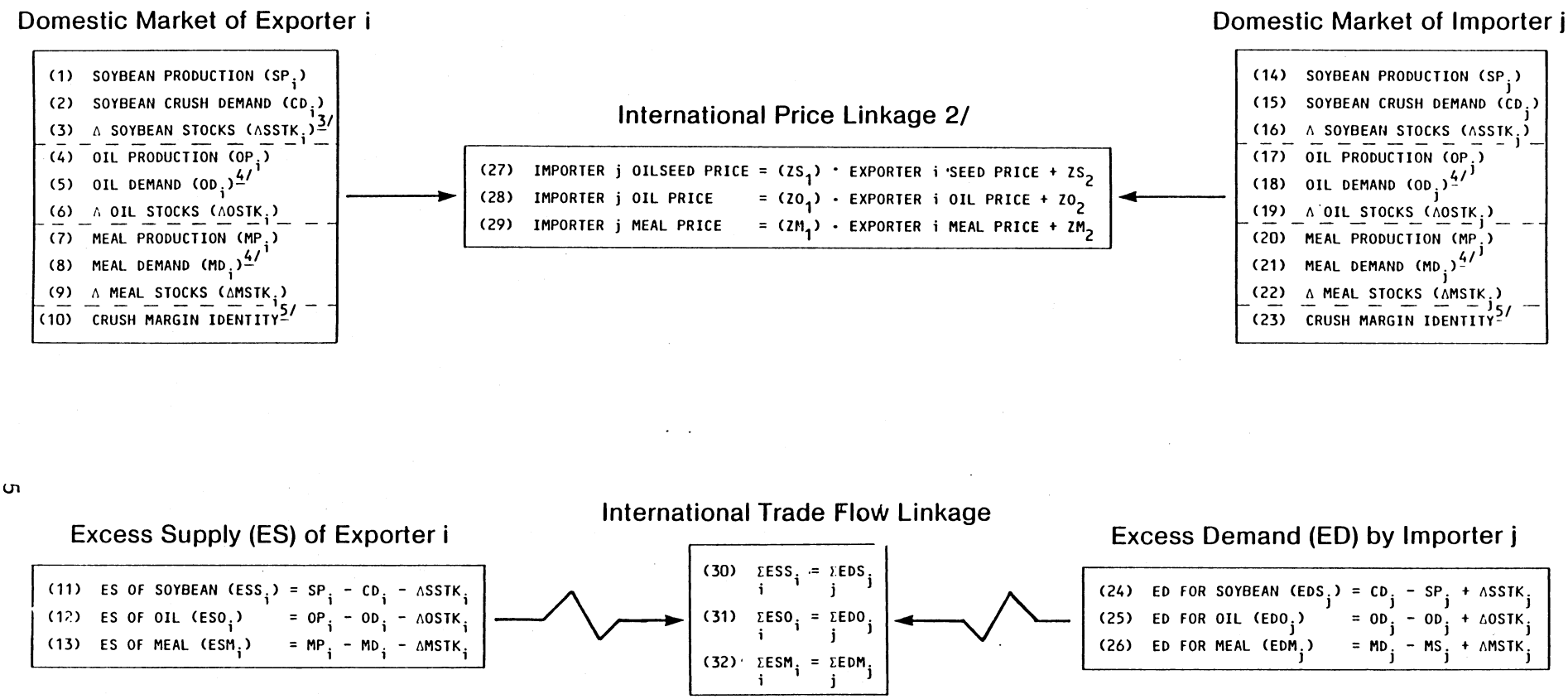


Figure 2

World Soybean Market Model Structure



1/ i = any exporter, i=1, ..., n; and j = any importer, j=1, ..., k.

2/ The Z's include exchange rates, tariffs, subsidies, and transportation cost

3/ Δ should be read "change in"

4/ The demands for oil in each region are demands for groups of oils with similar uses and characteristics. In this soybean model the oil groups include soybean oil, cottonseed oil, peanut oil, and where appropriate, rapeseed oil. The demands for meal in each region are demands for high protein meals in soybean meal equivalents and include soybean meal, cottonseed meal, peanut meal, and where appropriate, rapeseed meal.

5/ Crush margin = (oil extraction rate) x price of oil + (meal extraction rate) x price of meal - price of soybeans

Equations (11) to (13) and (24) to (26) are, respectively, an exporting country's excess supply and an importing country's excess demand blocks. Note specifically that the excess supply and demand relationships are not behavioral. Rather, excess supply and demand are calculated as the simple differences between the domestic supply and demand schedules in the respective countries.

Equations (27) to (29) are relationships which link the domestic prices in exporting country i and in importing country j in any time period. Z_1 and Z_2 (that is, ZS_1 and ZS_2 for soybeans, ZO_1 and ZO_2 for soybean oil, and ZM_1 and ZM_2 for soybean meal) represent all factors which come between the respective prices of exporting country i and importing country j.

$$Z_1 = E(1-s_i)(1-s_j)(1+t_i)1+t_j) \quad \text{and} \quad Z_2 = E(T_i-S_i+C) + T_j - S_j$$

where:

E is the exchange rate (assumed fixed or unchanging) in units of the importer's currency per unit of the exporter's currency;
s_i and S_i are respectively ad valorem and specific export subsidies;
s_j and S_j are respectively ad valorem and specific import subsidies;
t_i and T_i are respectively ad valorem and specific export taxes;
t_j and T_j are respectively ad valorem and specific import tariffs;
C represents transportation costs (in terms of the exporting country's currency).

Equations (30) - (32) are the internatinal trade flow linkages. These market clearing identities specify that the sum over all exporting countries of the quantity exported of soybeans, soybean meal and oil must equal the sum over all importing countries of the quantity imported of each.

Market development expenditures are incorporated into the World Soybean Model as additional explanatory variables in the demand relationships in the five regions where expenditures occurred: the European Community, Japan, Other Asia and Oceania, Africa, and the Rest-of-the-World region. Expenditures for soybean activities are included in the regional soybean crush equations, soybean oil expenditures in the oil demand equations, and soybean meal and soyfood expenditures in the meal demand equations. The soybean meal and soyfood expenditures are added together since a soyfood sector is not explicitly included in the model and since meal is used not only as a livestock feed supplement but also to produce soy protein and other derivatives used in soyfood products.

Before including the expenditure data in the appropriate demand relationships in each region, the expenditures were adjusted for changes in the value of the U.S. dollar abroad and deflated by an index of inflation for the region. The adjusted data thus represent the real purchasing power of expenditures in each region. Because expenditures can be expected to have an impact on demand beyond the expenditure year, a three-year average of real expenditures was used in the demand relationships.

The estimated elasticities of demand with respect to changes in market development expenditures are given in table 2.[1/] Each elasticity measures the average percent response of the appropriate demand variable to a one percent change in the three-year average of real purchasing power of the appropriate market development expenditures, holding all else constant. The elasticities range from .001 to .08 and, thus, indicate a highly inelastic response of demand in each region to changes in expenditures. That is, the elasticities indicate that, holding all else constant, a given percentage increase in real expenditures leads to a much smaller percentage increase in demand on average. For example, a 100% increase in average real expenditures for soybean market development in the European Community would lead to an average 2.9% increase in E.C. soybean demand, holding all else constant.

Table 2. Estimated Expenditure Elasticities of Demand[1/]

	Soybean Demand	Meal[2/] Demand	Per Capita Oil[3/] Demand
European Community (9)	.029	.061	.042
Japan	.041	.047	.033
Other Asia and Oceania	[4/]	[4/]	.017
Africa	NA	NA	.001
Rest-of-the-World	.045	.037	.080[5/]

NA = Not applicable

1/ All elasticities are significant at the 5% or 10% level except the expenditure elasticity of African per capita oil demand which is significant at the 40% level.

2/ High protein meals including soybean, cottonseed, peanut, and rapeseed meals as appropriate in each region.

3/ Major edible vegetable oils including soybean, cottonseed, peanut, and rapeseed oils as appropriate.

4/ Expenditures for soybean, soybean meal, and soyfood market development in this region were included in the Rest-of-the-World region.

5/ Gross demand for oil rather than per capita.

The highest estimated expenditure elasticity is for meal demand in the E.C. and the lowest is for per capita oil demand in Africa. The latter result is not surprising since expenditures in African countries occurred only in fiscal years 1979 and 1980 and represented less than 1% of worldwide expenditures in those years.

Care must be taken in interpreting and using these elasticities since in a simultaneous system the concept of a partial derivative is not strictly valid, i.e., "all else" cannot be considered to be held constant given a change somewhere in the system. For example, market development expenditures designed to increase the demand for soybean meal in a given region will also likely have an impact on the world demand and price of soybeans. Consequently, it is more meaningful to consider the responses of demand to changes in market development expenditures in a simulation context.

Simulation Analysis

The measurement of the impact of market development programs on U.S. agriculture is accomplished through iterative simulation of the World Soybean Model and the Chase U.S. Agriculture Model.[2/] After obtaining a baseline solution which closely represents actual data for the historical period, market development expenditures (total, by region, by contributor, and by commodity) are removed from the World Soybean Model. The resulting iterative simulation solution values are then compared to the baseline solution values.

The average simulated impacts on the U.S. soybean industry attributed to market development expenditures are summarized in table 3. The time path of adjustments are provided in Williams, Myers, and Callahan. These results indicate that market development expenditures between 1970 and 1980 were responsible for increasing U.S. soybean acreage by an average 1.23 million acres (2.3%), production by 34.7 million bushels (2.3%), soybean crush by 12.8 million bushels (1.4%), the farm price of soybeans by 8 cents/bu (1.7%), the wholesale prices of soybean meal and oil by $4.17/ton (3%) and 0.2 cents/lb (1.2%), respectively, and cash receipts by $301.9 million (4.0%). U.S. exports of soybeans average 21 million bushels (4.1%) higher, soybean meal exports 665 thousand tons (11.6%) higher, and soybean oil exports 176 million lbs. (11.7%) higher, reaching over 30% higher in 1976. Total soybean, soybean meal, and soybean oil export revenues increased by an average of over $342 million (7.5%).

Table 3. Average Impact of Soybean Market Development Expenditures on the U.S. Soybean Industry, 1970-80

	Average Change	Average % Change
Soybeans		
Acreage (mil acres)	1.23	2.3
Production (mil bu)	34.71	2.3
Crush (mil bu)	12.77	1.4
Farm Price (US$/bu)	0.08	1.7
Cash Receipts (mil US$)	301.85	4.0
Soybean Products		
Wholesale Soymeal Price (US$/ton)	4.17	3.0
Wholesale Soyoil Price (US¢/lb)	0.24	1.2
Exports		
Soybeans (1000 mt)	571.59	4.9
Soymeal (1000 mt)	602.98	11.6
Soyoil (1000 mt)	79.94	11.7
Total Revenue (mil US$)	341.58	7.5

The ASA and FAS foreign market development program indirectly affects other sectors of U.S. agriculture through its impact on the U.S. soybean industry. However, these indirect effects have been small and spread over a large number of commodities. In the crop sector, the 1.23 million increase in soybean harvested acreage results in some shifting of acreage among crops with a small net decline of about 80,000 acres in crops other than soybeans. The remainder of the soybean acreage increase comes from set aside (about 20,000 acres), new land, and more intensive use of land such as an increase in double cropping of wheat and soybeans. Both average prices and cash receipts of crops other than soybeans increase by less than 1%.

In the livestock sector, the slightly higher cost of feedstuffs as a result of the program contributes to a small decline in meat production and about a 1% increase in livestock prices at the farm level. Livestock cash receipts also increase by about 1%. High protein consuming animal units decline marginally.

The measured net impact of the program on the consumer price index (CPI) for food and consequently on the CPI for all goods and services is extremely small. Both the index of prices received and paid by farmers increase by less than 1%.

Export returns (the increase in soybean, soybean meal, and oil export revenue) for all program contributors average about $62 per dollar invested (table 4). Grower returns (the increase in soybean cash receipts) average about $58 per dollar invested. The average export return per ASA dollar is about $281. The average export returns per FAS dollar and per Third Party dollar are somewhat lower. These returns are derived by dividing the export revenue gain from the sum of expenditures by the expenditures of each respective individual contributor. This amounts to assuming that the program would not exist if any one of the three contributors pulled out of the program.

On average, the returns to expenditures were higher per dollar expended in the European Community than in any other region (table 5). Export and grower returns per dollar invested in the EC averaged $88 and $76, respectively. Export and grower returns per dollar invested in Japan were the lowest and most consistent at $20. Returns per dollar in Other Asia and in the Rest-of-the-World region were high in the early 1970s. Between 1975 and 1980, however, export and grower returns averaged $67 and $56, respectively, per dollar spent in Other Asia and $66 and $55, respectively, per dollar spent in the Rest-of-the-World region.

Because of the variability in the level of funding from year to year, the loss of export and grower revenue from a one-year (1971) cut in funding of soybean meal and oil promotional activities was analyzed. The results indicate that for every dollar not spent in 1971, the cumulative net loss over the following 9 years was $133. This occurs because the drop in demand for soybean meal and oil brought about by the drop in expenditures leads to a drop in the demand for soybeans to crush as well. The implication, therefore, is that a shift in the emphasis of funding from soybeans to soybean products would likely result in a gain of export revenue.

An important concern to all contributors is the impact of market development activities on the soybean industries and exports of U.S. competitors in the world soybean market. The research results indicate that U.S. market development expenditures increase Brazilian soybean, soybean meal, and oil exports by an average of 13.2%, 0.5% and 5.7%, respectively. Actual volume increases in Brazilian exports, however, are many times smaller than the corresponding increases in U.S. exports. The U.S. shares of expanding world export markets for soybean meal and oil are higher as a result of the program. The U.S. share of the world soybean market remains about the same.

Table 4. Average Returns per Market Development Dollar by Contributor, 1970-1980[1/]

Average Returns to:	Total	Contributor		
		ASA	FAS	Third Party
	US$/dollar invested			
Exports	61.9	280.8	220.2	141.8
Growers	57.7	292.4	201.7	130.2

[1/] Returns calculated by dividing the revenue gain from the sum of expenditures by all three parties by the expenditure of each respective contributor. This amounts to assuming that the program would not exist if any one of the three contributors pulled out of the program.

Table 5. Average Returns per Market Development Dollar Invested in Specified Region by Contributor, 1970-1980[1/]

Average Returns to:	E.C.	Japan	Other Asia	Rest of the World
	US $/dollar invested			
Exports				
ASA	347.7	140.0	236.7	309.6
FAS	496.2	73.1	272.9	172.2
3rd Party	191.0	38.6	147.5	413.2
All Contributors	88.1	19.8	64.3	107.4
Growers				
ASA	349.3	154.7	234.1	267.5
FAS	411.3	68.1	254.0	167.9
3rd Party	162.4	37.5	139.6	361.5
All Contributors	76.4	19.2	60.7	108.7

[1/] Returns calculated by dividing the revenue gains from expenditures by all contributors in a given region by total expenditures in that region. This amounts to assuming that expenditures in other regions would continue unaffected if expenditures in any one region were discontinued.

Implications for Future Funding

This study considered only the historical impacts of the ASA and FAS cooperative foreign market development program. No attempt was made to generate a forecast baseline nor simulate different scenarios over a forecast period. Consequently, caution must be taken in using the conclusions of this study for current and future planning. Obviously, any number of events could transpire to greatly modify the findings of this study. Nevertheless, several implications for future funding seem clear.

First, entrance into new markets generally results in high initial returns per dollar spent. The returns then decline over time as funding increases. However, while returns per dollar may be high in the early years, the actual volume of U.S. exports generated can be very small. While the per dollar returns in more mature markets such as Japan may be lower, the volume of U.S. exports and the level of export revenue generated are likely to be much greater because of the greater population and livestock base and consumer acceptance. Thus, the criteria for investment should consider not only the expected return per dollar invested but also the U.S. export potential of the investments. Even though average returns per dollar expended tended to be higher in new markets in this study, the conclusion cannot be drawn that future allocations to these or other new markets should be increased at the expense of reduced expenditures to more developed markets.

A second implication is that the maintenance of returns per dollar in a given region requires annual adjustments in the level of nominal expenditures for movements in the value of the U.S. dollar abroad and inflation in the regions of expenditure. Failure to maintain the level of real expenditures will result in a loss of export revenue beyond the year in which real expenditures drop.

Third, a shift in the emphasis of funding from the promotion of soybeans to the promotion of soybean products leads to greater export revenue per dollar expended.

Fourth, as long as Brazilian policies continue to insulate the domestic Brazilian market from changes in world market conditions, the impact of market development expenditures on Brazilian exports will be smaller than on U.S. exports.

Footnotes

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** Gary W. Williams is Senior Economist and Lester H. Myers is Director, International Agriculture Service, Chase Econometrics, Inc., Bala Cynwyd, Pennsylvania. The views expressed are those of the authors and do not necessarily represent those of Chase Econometrics or the American Soybean Association.

1/ Due to space limitations, only the statistical results from incorporating market development expenditures into the demand relations in each region are presented here. The parameter estimates and other pertinent statistical information for all equaitons in the world soybean model prior to incorporating market development expenditures as well as model validation statistics can be found in Williams (1981).

2/ Space limitations also preclude a discussion of the iterative simulation process. For more detail see Williams, Myers, and Callahan.

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