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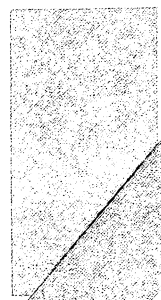
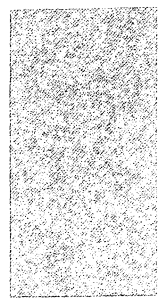
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Soybean Oil Exports

Mary E. Ryan and James P. Houck¹

Soybeans are one of the leading crops in Minnesota and the nation. In 1977, their value to Minnesota farmers was \$747 million while total U.S. production was \$10 billion. Approximately three-fifths of soybean production is exported. Thus, the financial success of the U.S. soybean industry depends heavily on exports.

The research discussed here contributes to an understanding of the important export market of soybean oil. An earlier article (Minnesota Agricultural Economist, No. 582, August-September 1976) presented results of research on exports of soybeans and soybean meal. These studies are part of a University of Minnesota project designed to investigate the major economic forces at work in the soybean market, permitting better decisions by farmers, marketing firms, and government policymakers.

This research examines the relationships between soybean oil and nine of its competitors in the international market for food fats and oils. The object was to determine which factors increase and decrease soybean oil's share of that market.²

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²A more technical report of this research is available as Economic Report 78-8, "Market Share Analysis and the International Market for Fats and Oils," from the Department of Agricultural and Applied Economics, University of Minnesota, St. Paul, MN 55108, Attn: Publications.

INTERNATIONAL FATS AND OILS MARKETS

Soybean oil is a major component of the world's edible vegetable oil sector. This sector includes oils from annual oilseed crops (such as soybeans and sunflower seeds), tree crops (the palm oils), and the oil equivalent of the oilseed and palm products. (Oil equivalent refers to the oil content of the oil-bearing product, such as the oil content of soybeans.) Markets for these vegetable products also are linked to markets for the edible animal fats, mainly butter and lard.

Most of these fats and oils can be substituted for one another in the manufacture of margarine, shortening, and culinary oils. Substitution is not perfect, but within a wide range one raw commodity can be processed so that it resembles another. For instance, coconut oil, lard, and butter are solid at room temperature, while soybean, cottonseed, and sunflower seed oils are liquid. Yet the process of hydrogenation can make the liquid oils firm, permitting their use for margarine and shortening. Because of the substitution possibilities, factors which influence the production, trade, use, and thus the prices of one oil, influence the prices and the sales of the others. When one oil has a price advantage, manufacturers readily try to switch to it. Most fats and oils have some qualities which are unique so substitution is not complete.



Mary E. Ryan



James P. Houck

Table 1. World production and exports of fats and oils in 1955, and 1965, and 1975 (in thousand metric tons, fat or oil equivalent)

Fat or oil	Production			Exports			Exports as a percentage of production		
	1955	1965	1975	1955	1965	1975	1955	1965	1975
Soybean	2,291	3,934	8,313	635	1,769	3,535	28	45	43
Palm	1,234	1,257	2,942	539	550	1,773	44	44	60
Coconut	2,023	2,180	2,868	1,240	1,288	1,544	61	59	54
Sunflower seed	785	3,134	3,980	77	407	705	10	13	18
Rapeseed	1,098	1,496	2,609	43	286	615	4	19	24
Peanut	1,846	3,364	3,057	835	993	705	45	30	23
Cottonseed	1,882	2,747	3,294	358	411	415	19	15	13
Olive	984	1,004	1,419	56	52	40	6	5	3
Total vegetable (incl. palm) ^a	13,216	20,646	30,215	4,227	6,293	9,902	32	30	33
Butter	3,511	4,211	4,544	454	537	758	13	13	17
Lard	3,152	3,884	4,424	356	317	516	11	8	12
Total fats and oils ^b	24,640	35,331	46,242	7,078	9,873	13,677	29	28	30

^aIncludes other oilseed and palm oils not listed.

^bIncludes other oilseed, palm, marine and industrial oils, and animal fats not listed.

Source: U.S. Department of Agriculture

Production and Exports

Soybean oil by far dominates world food oil markets (table 1). While soybean oil production exceeded that of the other vegetable oils in each of the three decades, in 1975 it was more than double that of any other vegetable oil.

World production of all oils expanded from 1955 to 1965, and, except for peanut oil, expansion continued to 1975. (Peanut production fell during the 1970s because of war and poor growing weather in African producing nations.) Other significant production changes since 1955 occurred for coconut oil and sunflower seed oil. Coconut oil production grew more slowly than the other major oils, while sunflower seed oil production grew fastest. In 1975, sunflower seed oil output was more than five times greater than in 1955 and Minnesota contributed to this worldwide growth.

Despite expanded production, coconut, cottonseed, peanut, and olive oil have become less important export oils since 1955. Now, greater shares are used in the producing nations. India, other Asian nations, and Africa are large producers of these oils. Their growing populations and dietary improvements have absorbed the output increases.

The three main export oils are soybean, palm, and coconut, accounting for more than half of the world's edible vegetable oil exports (table 2). Note percentages of exports in the form of oilseeds and as oil. About twice as much soybean

oil is exported as beans than as oil. In contrast, all palm oil is traded as oil because the palm fruit is too perishable to ship. Coconut oil is exported both as copra (the oil-bearing product of the coconut) and as oil.

Figure 1 shows production and exports of soybean, palm and coconut oils and of total vegetable oil. First, look at total vegetable oil production. The declines in 1973 and 1975 are in marked contrast to the steady annual output growth since 1963. Now compare the graphs of total vegetable oil production and exports. Total exports grew more smoothly. The production drops in the 1970s did not lead to parallel cuts in exports. Exports were maintained by drawing down stocks and by reducing consumption in the producing countries.

Figure 1 also shows that production and export patterns fluctuate more for individual oils than for oil totals. This indicates that the share each oil has of the total market shifts often as one oil substitutes for another. Soybean oil, for instance, averaged about 32 percent of the world vegetable oil market over these 16 years. Yet its share fluctuated between 23 and 43 percent. For palm oil, the average is 12 percent and the range is 9 to 18 percent.

Over the 16-year period, world production of all vegetable oils

Table 2. Percentage shares of world vegetable oil exports by commodity, average for 1972-74

	Percent
Soybeans (oil equivalent) ^a	26
Soybean oil	12
Palm oil	14
Copra (oil equivalent)	5
Coconut oil	7
Sunflower seed (oil equivalent)	2
Sunflower seed oil	7
Rapeseed (oil equivalent)	6
Rapeseed oil	3
Peanut (oil equivalent)	3
Peanut oil	4
Cottonseed (oil equivalent)	^b
Cottonseed oil	3
Olive oil	3
Others ^c	5
Total	100

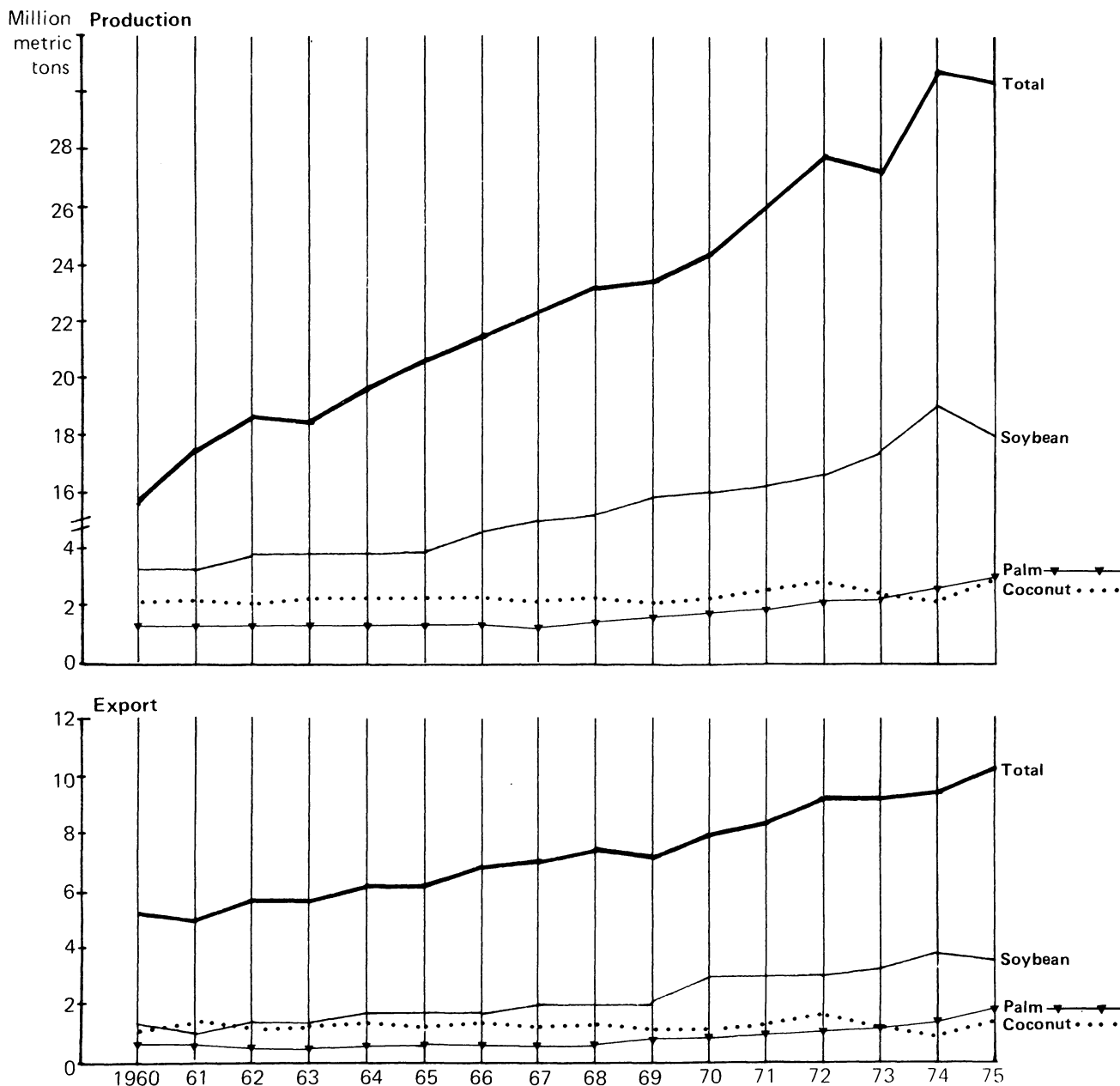
^aOil equivalent means the amount of oil contained in the product, e.g., the oil content of whole soybean kernels and oil.

^bLess than 0.5 percent.

^cIncludes palm kernel and palm kernel oil, sesame seeds, safflower seed and oil, corn oil, and babassu kernels and oil.

Source: Food and Agriculture Organization of the United Nations

Figure 1. World vegetable oil production and exports, 1960-1975



combined grew about 3 percent annually. Meanwhile, exports of total vegetable oils were growing at a faster rate. Exports grew about 5 percent per year. Growth was quite steady for both production and exports. These steady overall trends imply stability in the total market for food oils, but they mask individual oils' differences. For example, the rates of export growth (in the following tabulation) differ greatly. Exports of the top four oils expanded faster than the 5 percent average for total vegetable oils, and cottonseed grew more slowly. Exports of coconut oil did not expand

at all, while peanut oil exports actually fell in 1960-75.

Oil	Export growth rate 1960-75 (percent per year)
Rapeseed	17
Sunflower seed	8
Soybean	8
Palm	7
Cottonseed	2
Coconut	0
Peanut	- 2

The differences in growth rates suggest that different factors were affecting the markets for these oils.

Overall, about one-third of vegetable oil production is exported, (table 1). Among commodities, however, there is considerable variation. Exports take over half of coconut and palm oil production and nearly half of soybean oil output. This means that changes in international conditions could affect these producers.

The remaining vegetable oils considered here are consumed heavily in the producing nations. For them, local conditions are very important in determining how much is available for consumption and what prices producers receive and

consumers pay. Nonetheless, when production falls short and very high prices occur for one commodity, large purchases of other oils often are made on the international market to compensate. Then the world market is affected. For example, sunflower seed, cottonseed, and olive oils are consumed chiefly in producing nations. Less than one-fifth of world production is exported. Yet when producing nations suffer a short crop, they often purchase substitute oils. Such purchases add to world export demand, buoying prices of all export oils.

Prices

Consider food oil prices in figure 2. While aggregate production and exports were expanding rather

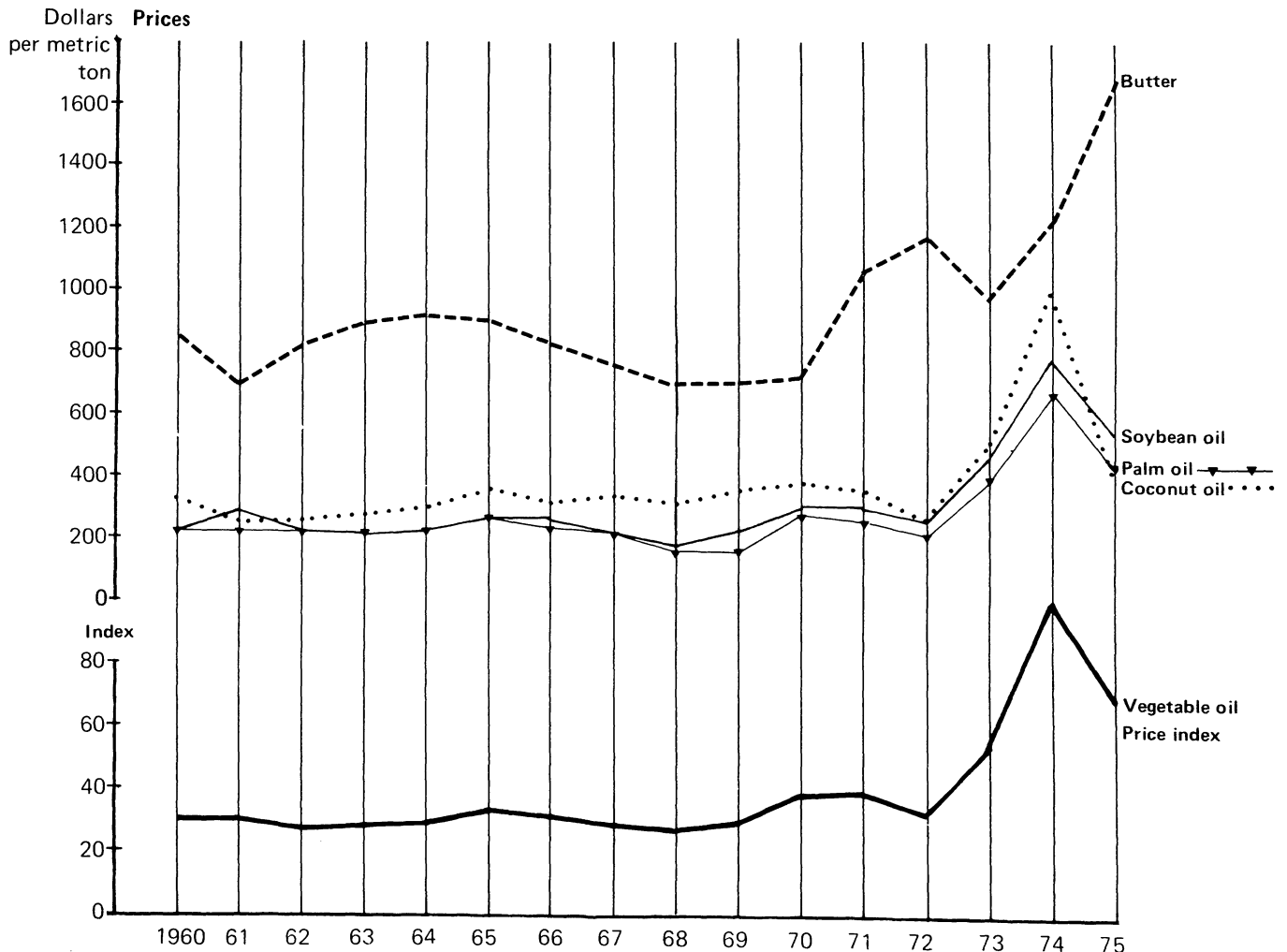
evenly during 1960-75, there was no discernible trend in the overall level of international vegetable oil prices. If the vegetable oil index in figure 2 were adjusted for inflation, 1973 and 1975 prices would be no higher than prices in earlier years. The absence of a long-term trend in prices suggests that aggregate supply and demand for vegetable oils have grown at about the same rates since the early 1960s. The sharp price rise in 1974 indicates an extraordinary situation. It can be traced directly to the 1973 production shortfall seen in figure 1. A similar falloff in world production in 1975 did not drive prices as high because there were larger stockpiles of oil.

The general patterns of the prices of the three major export oils are

similar to one another and to the overall index of vegetable oil prices (figure 2). A statistical test of that similarity among various oil prices supports the visual evidence. Of those tested, only coconut oil and butter prices indicate unique behavior. The graph of butter prices in figure 2 clearly shows this commodity's individuality. Despite the similar price patterns of palm and soybean oils, occasionally the price of one oil rose or fell more than the other. In other words, the relative prices of the two oils changed. Similar differences occurred among other pairs of prices, too. Such changes in relative prices to changes in export quantities of the respective oils are studied.

Usually, prices change from year to year because people want to buy

Figure 2. Vegetable oil price index and prices of selected export fats and oils, 1960-1975



differing amounts of a commodity or because there is more or less of the commodity available to buy. Less may be available if there is bad weather, if producers plant another crop that appears more profitable, or if a government or group of producers takes special actions which affect the market.

Changes in supplies of fats and oils occur for all of these reasons. A drought in Iowa and Illinois can drastically reduce the world's supply of soybean oil. Expansion of palm oil plantations in Asia and Africa has occurred in part because rubber production became less profitable. Butter production and exports of many nations fluctuate largely because of government programs to aid dairy producers. Sunflower seed production in northwestern Minnesota expanded when grain prices fell and when government programs curtailed grain planting. These are only a few examples of why annual supplies of fats and oils vary.

The amounts of fats and oils which people wish to, and are able to, buy at various prices is called demand. Demand for fats and oils does not vary much year to year. For the world, as well as for individual nations, the main factors influencing demand are populations and consumer incomes. These factors increase the demand at a steady rate. Since sharp annual changes in demand are not apt to occur, they rarely cause annual fluctuations in export volume and prices. Yearly changes in supply are more common.

This overview of the international vegetable oil market highlights five characteristics.

1) The international vegetable oil market is composed of many closely related commodities.

2) Price movements are similar among numerous products, reflecting their substitutability, yet year to year, prices vary. Changes in prices of any two oils come mainly from the factors affecting oil production.

3) Yearly changes in production, exports, and market shares differ by commodity.

4) Aggregate production and exports have grown steadily.

5) The rates of growth for aggregate supply and demand have been

close enough to keep the overall level of oil prices from long-run movement, up or down.

RESEARCH FINDINGS

Statistical methods were used to profile export prices and quantities for soybean oil and each of the other nine fats and oils studied. Besides prices and quantities exported, other factors which influence exports and prices were looked at, too, from 1960-75.

Analysis of markets with close substitutes is difficult; a special technique was used in this research. It analyzes the share each oil has in the market.

The nine fats and oils which compete with soybean oil were grouped in three main categories, or submarkets, on specific properties. The first is the relation between soybean oil and five liquid, edible vegetable oils: peanut, cottonseed, palm, sunflower seed, and rapeseed. The second involves relationships with saturated (solid at room temperature) fats; these are butter, lard, and coconut oil. The third involves olive oil, unique in the market.

The fats and oils in each submarket were analyzed in relation to soybean oil. The main idea was to see how the various fats and oils' market shares (within each subgroup) rise or fall as yearly prices and other factors change. Soybean oil was chosen as the basis for comparison because (1) it is the largest single oil in world commerce, (2) it is the most important to

U.S. agriculture, and (3) its technical and economic properties permit its substitution for most other fats and oils.

Results for each submarket are discussed in two parts: first, the impact of prices on market shares; then, the influence of other factors.

Liquid vegetable oil market. This submarket includes peanut, cottonseed, palm, sunflower seed, and rapeseed oils in relation to soybean oil. The four factors found to affect soybean oil's share of this market were: the prices of these commodities, exports of food oils from the U.S. under Public Law 480 (Food for Peace), the price of soybean meal, and a measure of long-term changes in tastes and preferences.

Table 3 gives an example of how price changes affect market shares in each submarket. The example shows how much the market share of each oil *increases* if its price *falls* 10 percent relative to the price of soybean oil. A 10 percent *rise* in relative prices would *decrease* market shares by the percentages in table 3. A smaller or larger change in relative prices has a proportionally smaller or larger impact on market shares.

The example does not apply when the soybean oil price changes but no changes occur in prices of competitive oils. Then soybean oil's market share changes. For instance, if no changes occur in prices of the five liquid oils listed but soybean oil's price falls 10 percent, soybean oil's share of this submarket increases 6 percent.

Table 3. Effect of relative price changes on market shares

These oil prices fall 10 percent relative to soybean oil	Percentage increase in submarket share
<u>Liquid oil submarket</u>	
Palm	8.3
Sunflower seed	9.9
Peanut	9.9
Rapeseed	10.0
Cottonseed	10.4
<u>Saturated fat-soybean oil submarket</u>	
Coconut oil	2.0
Butter	2.4
Lard	2.5
<u>Olive-soybean oil submarket</u>	
Olive	9.3

The data and discussion in table 4 illustrate the interworkings of relative prices and market shares.

The price of palm oil was about 13 percent lower in 1974 and about 23 percent lower in 1975 than the price of soybean oil. Stated differently, the relative price of palm oil to soybean oil fell 11 percent from 1974 to 1975. At the same time, soybean oil's share in the market, consisting of soybean, palm, sunflower seed, rapeseed, peanut, and cottonseed oils, fell 6 percent and palm oil's share rose 22 percent. According to table 3, an 11 percent decline in the palm-soybean oil price rates would increase palm oil's market share by 9 percent. The difference between 9 percent and the 22 percent change observed was caused by factors other than the prices of the two oils.

Recall that changes in production are the chief causes of price changes. In 1975, soybean oil output was less than in 1974 while palm oil output grew. The greater supply of palm oil, relative to soybean oil, can be considered the main reason that palm oil prices fell more than soybean oil prices. Those price changes led to the market share changes just discussed.

The other factors affecting soybean oil's share in the liquid vegetable oil submarket follow:

(1) Shipments of soybean oil under the U.S. Food for Peace program, P.L. 480. This includes shipments of food oil to nations experiencing natural disasters, such as drought and earthquakes. Also included are shipments to third world countries. The U.S. government offers them special financial arrangements. Presumably, U.S. shipments of soybean oil under these programs increase soybean oil's share of the world market.

When exports under P.L. 480 rise, so does soybean oil's market share relative to peanut oil, palm oil, and sunflower seed oil. No measurable effect was found for the soybean oil-cottonseed oil or the soybean oil-rape seed oil relationships.

(2) The price of soybean meal. Because meal and oil are obtained when soybeans (and several other oil-bearing products) are crushed, the meal and oil markets are inter-

Table 4. Price and export changes, soybean and palm oil, 1974-75

	Soybean oil		Palm oil	
	1974	1975	1974	1975
World exports (thousand metric tons)	3,794	3,560	1,432	1,735
Price (dollars per metric ton)	792	547	686	420
Submarket share	48%	45%	18%	22%
Percentage change in market share, 1974 to 1975	-6%		+22%	

Table 5. Price and export changes, soybean and coconut oil, 1974-1975

	Soybean oil		Coconut oil	
	1974	1975	1974	1975
World exports (thousand metric tons)	3,794	3,560	946	1,475
Price (dollars per metric ton)	792	547	994	394
Submarket share	69%	57%	17%	24%
Percentage change in market share, 1974 to 1975	-17%		+39%	

twined. When meal prices rise, relative to oil prices, soybean oil's share of this submarket falls. Most likely, this results from cutbacks in exports of soybeans — hence of soybean oil. An impact of the price of soybean meal is important only in the peanut oil-soybean oil relationship. When soybean meal prices rise, in comparison with oil prices, soybean oil exports fall, relative to peanut oil exports.

(3) A measure of tastes and preferences and other factors. A trend toward soybean oil exports was found for comparisons with palm, peanut, rapeseed and sunflower seed oils, after accounting for effects of prices and P.L. 480 shipments. There was no discernible trend just in the cottonseed-soybean oil market shares.

Market for saturated fats and soybean oil. Price relationships are an important factor affecting soybean oil's penetration of the coconut oil, butter, and lard submarket.

Table 3 notes the effect of a 10 percent fall in the price of each of these commodities, relative to soybean oil's price. If soybean oil's price drops 10 percent while prices of these items remain unchanged, then soybean oil's share of this sub-

market rises 1.2 percent. The impact of relative price changes is much less for this submarket than for the liquid oil market. Because the other vegetable oils are more similar to soybean oil than the saturated fats, it is easier to substitute one oil for another.

To illustrate price and export changes in the saturated fat-soybean oil market, 1974 and 1975 data for soybean oil and coconut oil are given in table 5.

In 1974, the price of coconut oil was about 25 percent higher than soybean oil while in 1975 it was 28 percent lower than the price of soybean oil. Stated differently, the relative price of coconut oil to soybean oil fell 43 percent. At the same time, soybean oil's share in the saturated-fat market fell 17 percent and coconut oil's share rose 39 percent. The large increase in coconut oil's market share (and the loss of soybean oil's market share) can be attributed to the drop in the coconut oil price relative to soybean oil.

Again, figure 1 shows that soybean oil production was down in 1975 from 1974. Meanwhile, output of the other main export oils — palm and coconut — was rising. These diverse production changes led to the price advantage for coconut oil

in 1975 and the consequent increase in its export market share.

Besides prices, four other factors contribute to changes in market shares in this submarket.

(1) Shipments of soybean oil under P.L. 480. These tend to increase the soybean oil market share. When P.L. 480 shipments rise, so does the market share for soybean oil in the saturated-fat submarket.

(2) The price of soybean meal. This is important in the competition between soybean oil and butter or lard exports. An increase in the soybean meal price is associated with a loss in the soybean oil market share. There was no significant impact of soybean meal prices in the relationship between coconut and soybean oil exports.

(3) U.S. pork production. Since lard is a byproduct of pork production, lard supplies fluctuate with pork production. When there are increases in U.S. pork production,

more lard is available to export. Thus, increased pork production leads to increased lard exports relative to soybean oil exports.

(4) A measure of changes in tastes and preferences and other factors. This shows a shift to soybean oil away from butter, lard, and coconut oil, for reasons other than the effects of prices, P.L. 480 shipments, and U.S. pork production.

Olive oil. The olive oil-soybean oil comparison was examined separately because olive oil has a distinct flavor which makes it an often preferred cooking/salad oil. Oil prices, meal prices, and measures of taste and preference were important in this comparison.

Here, a 10 percent decrease in olive oil prices increases its market share by 9 percent relative to soybean oil. However, since the volume of soybean oil exports surpasses olive oil, the effect on soybean oil exports is negligible.

Similarly, an increase in the price of soybean meal, relative to the oil price, depresses soybean oil exports. And, lastly, the measure of tastes and preferences shows a shift from soybean oil to olive oil.

CONCLUDING COMMENTS

Soybean oil is at the center of the complex, highly competitive international market for food fats and oils. A small price change causes buyers to shift to the lower priced product. This research studied changes in the shares of the market commanded by the major export fats and oils and estimated how large a change in market shares is associated with changes in relative oil prices. Other factors contributing to changes in market shares also were found. This knowledge makes the workings of the international fats and oils market easier to comprehend while providing clues to future market changes.

Jerome W. Hammond Editor
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