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The World Economic Situation of Fats and Oils[1]

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FATS and oils are a group of commodities which belong among the world's strategic raw materials. They hold this rank in normal times on account of their importance in international trade and their decisive importance as a main element in national diets and the efficiency of workers in industrialized countries. During times of war their strategic raw-material quality arises from the fact that fats and oils are an excellently storageable staple with more calories per ton and cubic yard than any other food and therefore suited to serve as a food stockpile. That, in industrialized countries in peace as well as in war, up to one-third of the amount of fats used provides for soap, oil paints, and coatings for buildings, ships, vehicles, and machinery and that glycerine is one of the byproducts of soap-making, add to the importance of these raw materials.

This is enough to make fats interesting to the economist as a commodity group. But there is enormously much more to the economics of fats; in fact, so much that real economic studies of fats are exceedingly rare. Today fats are used chiefly as food, and at the same time they are also used for making soap, for manufacturing oil paints, and for miscellaneous industrial purposes. A century ago they were used quite differently. Aside from improving man's diet as an important food, fats were needed as the main lubricant of all revolving wheels and axles—wheels of carts and wagons, of the rolling stock of railroads, and of all steam engines and machinery. They also were the only fuel for lighting homes, barns, and factories—used for this purpose in the form of candles and oil for lamps. So extensive was this use that only a small balance remained from which to make soap. The discovery of petroleum in 1868 introduced a competitive fuel for lamps and in due time a competitive series of lubricants. Lighting gas, and since the turn of the century, electricity as well, eliminated the use of fats for lighting, and the mineral-oil industry eliminated the use of fats for lubrication. Thus progress of technology has played havoc with the economic utility of fats and their value. It has completely wiped out major uses and thus entire markets, but it has expanded the demand for other uses and thereby augmented the importance of fats as raw materials. Today the chief use, which also fetches the highest price, is the use as food. As a food, the position of this commodity is solidly anchored in specific qualities, and these qualities promise to gain even more significance in the future. The five chief qualities are:

1. Fats are the most concentrated source of caloric energy in food. They have, per unit of weight, 2.4 times the heat energy of pure starch, have no indigestible ballast or residue, and therefore yield much work energy per unit.
2. Fats neither require mastication nor involve much metabolic work or delay for fuel utilization of their energy.
3. Fats permit the use of a time-saving process in preparing meat, eggs, seafood, and potatoes—deep frying or pan frying; in making bread, fine bakery goods, and biscuits, fats are an essential ingredient. Hence the wealthier nations consume quantities of fats in the preparation of animal proteins, and the poorer ones in combination with potatoes and baked cereals and pulses.
4. Fats are the vehicle for nearly all taste and flavor in food and are therefore essential in the preparation of almost any type of food. Hence, the more a diet is composed of starch, the more do fats serve as a flavoring agent.
5. Fats are the vehicle for the fat-soluble vitamins A and D.

All five of these qualities have a great economic impact in the modern industrialized society. The efficiency of industrial workers, farmers, and soldiers depends to a large extent on the proportion of fats in their diet and the time involved in preparing a meal; the efficiency of the cooks depends on the availability of frying fats. The more women are gainfully employed and short of time to prepare meals, the more are fats valued as a time saver.

Beyond these qualities more refined distinct differences as to taste, melting point, creaminess, smoking point, mixability, resistance to oxidation, or length of shelf life help to determine the strength of demand, and thus the price. But the price is also determined by the supply, and it, in turn, by the costs of producing fats. And here we face the weirdest situation because fats are produced in countries on all stages of economic development, at the most distant reaches of the globe, on land and in the deep icy seas of the Arctic and Antarctic, in the tropical jungles and on farms right under the smokestacks of 20th-century industries.

As raw material for industrial uses, fats serve as a chief base for coap and thus are essential for cleanliness and sanitation. The more food fats are consumed, the more is a fat solvent needed for dishes. Drying oils offer the most convenient material for coating surfaces. The more new construction is going on, the more the economy expands the more coatings are needed.

TECHNOLOGICAL progress has had a powerful impact upon the production, processing, utilization, and consumption of fats. It leads to shifts which sometimes come slowly and sometimes abruptly. In the modern age of chemistry it was inevitable that fats would soon become a more versatile group of raw materials than they had been. Today it is quite obvious that chemistry will continue to bring about more changes of considerable magnitude in the production, processing, and use of fats. Although there

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are literally hundreds of kinds of fats, we consider in this country 27 varieties to be of commercial importance. Many of them are substitutable, and all of them are competitive in some way. As a result, fats are a group of commodities with extremely sensitive prices. Fats prices display a nervous, hectic temper, and fats are therefore considered to be a highly speculative commodity group. He who has to hold big inventories of fats runs a greater risk of loss than is involved in inventories of many other staples.

During the 1920's and 1930's substantial changes could be observed in world production as well as utilization. Unfortunately, international statistics on fats production and utilization up to the late 1920's were poor, particularly with reference to animal fats, and even today there are large parts of the world, particularly Asia, where production statistics are no more than rough guesses. Nevertheless, by closing the statistical gaps with some considered estimates, it is possible to get a relatively good picture of the proportions even for the period before World War I.

TABLE 1

World Production of Main Fats Commodities *
(Thousand metric tons fat equivalent)

Item	1909-13[a]	1934-36[a]	1934-38[b]	1949[c]
A. Vegetable fats	8,035	12,780	12,860	13,765
I. Annual crops	6,750	10,070	8,780	9,830
1. Special oil crops	4,255	6,925	6,195	7,385
a. Soybeans	620	1,710	1,275	1,600
b. Peanuts	1,150	2,370	2,240	2,565
c. Rape and mustard	1,625	1,340	1,030	1,220
d. Sunflower	275[d]	} 1,505 (d–f)	471[d]	} 2,000 (d–f)
e. Sesamum	} 585[d] (e–f)		485[d]	
f. Others			694[d]	
2. Fiber crops	2,495	3,145	2,585	2,445
a. Cotton	1,555	1,975	1,475	1,435
b. Flax	940	1,170	1,110	1,010
II. Tree crops	1,285	2,710	4,080	3,935
1. Palms	650[e]	1,740[e]	2,910	2,930
a. Coconut palms	385[e]	1,020[e]	1,870	1,910
b. Oil palms (Elaeis)	265[e]	720[e]	1,040	1,020
Kernels	(145)[e]	(310)[e]	(350)	(370)
Pericarp	(120)[e]	(410)[e]	(690)	(650)
2. Olive trees	590	840	1,000	820
3. Nut trees	45[f]	130[f]	170	185
B. Animal fats	8,620[g]	....	10,340	9,235
I. Butter	3.500[g]	....	4,150	3,370
II. Slaughter fats	5,000[g]	....	5,270	5,250
III. Whale oil	100	445	500	350
IV. Fish oil	20[g]	....	420	265
C. Grand total	16,655[g]	....	23,200	23,000

*Data from FAO, "Fats and Oils" (Commodity Series Bulletin No. 13, August, 1949), pp. 40, 44-47, except as otherwise indicated.
[a]Not comparable with data for later periods shown, as indicated in the source cited.
[b]Occasionally a somewhat different period.
[c]Forecast.
[d]Approximate subdivision of FAO total for "other oilseeds."
[e]Net exports.
[f]Net exports of tung nuts, plus production of other nuts.
[g]Roughly approximated by the author, or for totals including such approximations.

Table 1 shows the composition of the world's output of main fats commodities according to the different plants and animals which contribute to it, and the changes from pre-World-War-I to pre-World-War-II years and 1949. The time span covered is almost four decades.

The main changes in the world supply during the 25 to 30 years preceding World War II were varied. The total supply increased from roughly 16.6 to 23.2 million metric tons, or by 40%. The fat equivalent of annual crops increased from 7.0 to 10.2 million tons, or by 46%. The main expansion in volume of vegetable fats occurred in the production of peanuts (+ 1,370,000 tons), cottonseed (+ 543,000 tons), and sunflower seed (+ 424,000 tons). Minor expansion took place in the output of sesame seed (+ 363,000 tons), soybeans (+ 216,000 tons), linseed (+ 207,000 tons), and castor beans (+ 179,000 tons). At the same time the output of rapeseed and mustard declined slightly (— 170,000 tons).

The fat equivalent of the harvest of tree crops expanded from 1.4 to 3.1 million tons, or by 121%—or almost three times as much as did the fat harvest from annual crops. The most impressive expansion among the tree crops occurred in the palm-tree economy. Copra production expanded by 674,000 tons, and the combined production of palm oil and palm-kernel oil by 608,000 tons, or the output of all palm fats by 1.3 million tons. While olive oil production, which is almost exclusively a Mediterranean affair, also increased by 279,000 tons, it was nevertheless the palm-tree economy which contributed the main additional supply. A major part of the copra was not harvested on plantations but collected from wild stands or scattered trees owned by natives. This fact was responsible for the seemingly paradoxical phenomenon that declining prices had the effect of increasing supplies.

Of this expansion in the output of vegetable fats, the increase in the output of tropical palm fats was of particular importance. In contrast to all annual fat-bearing plants, palm trees utilize the sun energy all the year round. They grow in the tropical monsoon regions where sunlight, heat, and moisture are more than plentiful. While the development of large plantations involves long-term investment, as is the case of all sorts of orchards, and the plantations come into full production only five or six years after planting, the costs of production per unit of fat are lower than those of annual crops. Annual crops, on the other hand, yield the oilseeds immediately within the same year they are planted. Per acre of land, coconut palms yield up to four or six times as much, oil palms (Elaeis) up to 12 or 15 times as much fat as the highest-yielding annual oil crop.

Table 2 shows the relative fat yields per acre for some of the major oil-bearing plants.

TABLE 2

Representative Yields of Seed and Fat of Selected Fat-Bearing Plants*
(Pounds per acre)

Kind of plant	Seed	Fat
1. Annual crops		
Cotton (United States)	440	68
Sesamum (India)	224	101
Rape (India)	393	138
Soybeans (United States)	1,104	166
Flax (United States)	511	174
Sunflowers (Argentina)	734	184
Peanuts (United States)	647	188
2. Palm trees		
Coconut palms (plantations)	1,270-1,900	800-1,200
Oil palms (plantations, pericarp, and kernels)	......	2,500-2,880

*Data for sesamum, rape, and sunflowers, 1943-46 average from Commonwealth Economic Committee, "Vegetable Oils and Oilseeds" (London, 1948); for cotton, soybeans, flax, and peanuts computed from U. S. Dept. Agr., "Agricultural Statistics, 1949"; for coconuts from U. S. Dept. Agr., Bur. Agr. Econ., P. L. Hansen, "World Trends in Major Oil Crops" (March, 1946), p. 19; for oil palms, from P. L. Hansen and R. L. Mighell, "Oil Crops in American Farming" (U. S. Dept. Agr. Tech. Bull. 940, 1947), pp. 6-7.

THE world output of butter and slaughter fats increased during the interwar period, as might have been expected, but there was also an unforeseen increase in the output of whale oil from the Antarctic. The output of whale oil rose from 100,000 tons to a pre-war average of 500,000 tons, with a peak of over

TABLE 3

World Production of Visible Fats by Major Areas*
(Thousand metric tons oil equivalent)

Area	1909-13 average[a]	As reported in 1949			As reported in 1950		
		1934-38 average	1949		1934-38 average	1949	
			Actual	As o/o of 1934-8		Actual	As o/o of 1934-8
Whaling	100	500	350	70	500	360	72
Europe	3,100	4,185	3,150	75	4,215	3,395	81
USSR and Baltic	1,400	2,135	1,630	76	........[b]	........[b]	....
Western Hemisphere	4,300	5,020	7,025	140	4,945	7,325	148
United States and Canada	....	(3,315)	(5,190)	157	....	....	....
Other	....	(1,705)	(1,835)	108	....	....	....
Africa	1,050	1,995	2,245	113	2,010	2,370	118
Asia	6,500	8,745	8,085	92	8,595	7,740	90
Oceania	250	620	515	83	635	530	83
World total	16,600	23,200	23,000	99	23,035[c]	23,350[c]	101
Ex. USSR and Baltic	15,200	21,065	21,370	101	20,900	21,720	104

*Data of the FAO (except 1909-13, see note [a]) as reported in 1949 from "Fats and Oils" (Commodity Series No. 13, August, 1949), p. 40. For comparison with production by main types, p. 5; and as reported in 1950, from Commodity Reports, "Fats and Oils, No. 1," May 31, 1950, Table A, which unfortunately does not give breakdown by types. In most cases the 1934-38 average refers to 3-5 years ending 1938. However for America the period is 1935-39, for China and Manchuria about 1931-37, and for India and Pakistan 1937-39.

[a]Rough distribution of the total shown on p. 5.

[b]Not included in the 1950 report.

[c]Including the estimate for USSR and the Baltic from the 1949 report.

600,000 tons in 1937-38. Butter production increased, particularly in Denmark and New Zealand. After World War I the production of nitrogen from the air began in many parts of the world, and as this vast new industry grew, the nitrogen fertilizer became available in ever-increasing volume at decreasing prices. Butterfat production benefited particularly from this development. Butterfat production increased also because the larger production of vegetable fats in exporting countries made available far greater supplies of protein concentrates as dairy-cow feed.

During the 30 years before World War II great progress was made in fats technology, which led to remarkable developments in the utilization of fats. Combined with improvements in the refining techniques, two outstanding developments in technology opened new avenues for the substitution of fats for other than their former uses: Hydrogenation is a process by which oils may be hardened to any desired degree and one that eliminates the tastes and odors of unsaturated fatty acids. Molecular distillation is a process which permits the fractional separation of various fat components. Hydrogenation, developed in 1906 by the German chemist Norman (who incidentally never made a penny out of it), was used by Unilever chemists in 1930 and lifted whale oil from low-grade industrial use to the position of a high-grade raw material for margarine. Great Britain, Germany, Norway, and Holland were the main beneficiaries. The technique of hydrogenation was so highly developed that the margarine manufacturers had an increasing freedom of choice in selecting the most priceworthy raw materials.

In the United States the 30 years before World War II brought also a remarkable change in the consumption of cooking, frying, and baking fats. Lard was the traditional fat for these purposes, but a mixture of vegetable and animal fats or hydrogenated vegetable fats only was developed, originally called lard compound, later on given the name of shortening. These substitutes for lard were so much improved that they sold more easily and at increasingly better prices than lard. In Europe hard fats, mostly made of coconut oil, were the equivalent of shortening.

Another technological advance was the improvement of the commercially obtained fat yield per unit of oilseed crushed. Broad-scale introduction of solvent extraction in Great Britain and particularly in Germany, Holland, and Denmark not only improved the yield from domestic and imported oilseeds but led even to the secondary extraction of imported expeller oilcake from overseas.

In Germany, next to Great Britain the world's largest importer of fats, strong efforts were made to manage with fewer imports. The solvent extraction of all the fat from hog carcasses proved too expensive because the meat was then useful only as scrap for feed. But research centered around the areas of a) finding raw materials other than fats for soap and paint; b) producing synthetic fats from domestic raw materials; and c) producing fats by biological processes. This research met with success in all areas although only the first yielded results of immediate and real economic importance.

TABLE 4

*Trend of World Net Exports in Fats by Major Fats Commodities**
(Thousand metric tons oil equivalent)

Type	1909-13 average	1934-38 average	1949
A. Vegetable fats	2,325	4,469	3,317
I. Annual crops	1,447	2,194	1,308
1. Special oil crops	716	1,382	958
Soybeans	175	396	242
Peanuts	261	834	554
Rape	112	43	
Sesamum	132	68	
Sunflowers	14	41	162
Others	22	....	
2. Fiber plants	731	812	350
Cotton	287	170	102
Flax	444	642	248
II. Tree crops	878	2,275	2,009
1. Palms	656	1,925	1,817
Coconut palms	390	1,107	993
Oil palms:			
Pericarp	120	495	485
Kernels	146	323	339
2. Olives	76	115	30
3. Tung	30	73	56
4. Others[a]	116	162	106
B. Animal fats	930	1,493	1,357
Butter	260	495	334
Slaughter fats:			
Tallow and grease	255	202	320
Lard	280	193	295
Whale oil and fish oil	135	603	408
Grand total	3,255	5,962	4,674

*Adapted from FAO, "Fats and Oils" (Commodity Series Bulletin No. 13, August, 1949), p. 86, and FAO, "Fats and Oils No. 1" (Commodity Reports No. 1, May 31, 1950), Appendix 3.

[a]Includes castor beans and oil, other technical oils, and margarine, *shortening, soap,* etc.

GEOGRAPHICALLY, world fat production during pre-World-War-II years was distributed among the major areas of the world approximately as follows:

Europe (18%) and Africa (9%), the Western Hemisphere (21%) and Oceania (2%), plus whaling (2%) were responsible for 52% of the world's fats output, Soviet Russia for 10%, and Asia for 36%. Since Europe and the United States actually absorb a substantial part of the fats production of Asia, it is obvious that the people of Asia and of the Soviet Union maintain a much lower per-capita fats consumption.

Table 3 gives the data in the geographical distribution of fats for the years 1909-13, 1934-39, and 1949.

The 40% increase from 1909-13 to 1935-39 was very unevenly distributed. The increase in whale-oil production was almost exclusively confined to the Antarctic Ocean and increased 400%. Oceania's fat output increased 150%, Africa's 90%, that of Russia and the Baltic States by 52%, Europe's by 35%, and the Western Hemisphere's by 16%.

The world export trade in all fats increased during the 30-year period ending with World War II from 3.3 to almost 6 million metric tons fat equivalent (Table 4). In other words, 26% of world fats production entered into international trade. Animal-fats exports increased from 900,000 tons to 1.5 million tons or by 66%; butter exports doubled, and whale-oil production and fish-oil exports increased 4.5 times. Net exports of vegetable fats rose from 2.3 to 4.5 million tons, or by 96%, with palm trees contributing nearly the entire increase.

According to areas, the gain in animal-fats exports was chiefly due to the increase in butter exports from Australia and New Zealand, which reached almost five times their former level, and to the increase in the whale-oil production in the Antarctic, which increased more than five times. Asia and Africa however were responsible for the major increase in the volume of trade in vegetable fats. Malaya and Indonesia boosted their exports by over 600,000 tons, the Philippines theirs by almost 300,000 tons, China and Manchuria theirs by 300,000 tons, and other Asiatic areas theirs by 130,000 tons. The West and East African net exports gained by almost 550,000 tons. Argentina and Uruguay boosted their linseed exports by 300,000 tons. The only other major change in the 30 years was the decline in United States and Canadian exports by almost 400,000 tons.

TABLE 5

Net Imports of Fats by Major Importing Areas*
(Thousand metric tons fat equivalent)

Country	1909-13 average	1934-38 average	1949
Europe			
Germany	715	1,130	319
United Kingdom	989	1,215	1,431
Others	838	1,680	1,533
Total	2,542	4,025	3,283
Non-European countries			
United States and Canada	202	937	582
All others	400	780	691
Total	602	1,717	1,273
Grand total	3,144	5,742	4,556

*Adapted from FAO, "Fats and Oils" (Commodity Series Bulletin No. 13, August, 1949), p. 88; FAO "Fats and Oils, No. 1" (Commodity Reports No. 1, May 31, 1950), Appendix 7.

The net imports of fats (Table 5) shifted only slightly during the 30-year period. Before World War I Europe absorbed 80% of all fats in international trade while the United States and Canada took 5%, and 15% was scattered throughout the world. Before World War II Europe's share in the imports fell to 70%, and the United States and Canada boosted theirs to 15%.

World War II had a profound impact upon the world's fats economy. Continental Europe lost its imports of feed grain and oilseeds. Dairy cattle had to get along on smaller protein-concentrate rations. In order to save grain for direct human consumption, hog numbers were cut drastically and cattle had to be slaughtered while still lean. Hence the output of butter and slaughter fats declined far below pre-war levels. Vegetable-oil production was boosted with high prices and bonus systems, but the increase in output could do no more than mitigate the shortage of fats.

The occupation of Manchuria, the Philippines, Indonesia, and Malaya by the Japanese cut those areas off from their fats markets in Europe and the United States. Soybean production in Manchuria dropped sharply, and that country never came back as a world supplier. On the large Asiatic islands the plantations as well as native production suffered severely. Many crushing mills were destroyed, particularly in the Philippines.

TABLE 6

United States Production of Fats From Domestic Materials*
(Thousand metric tons product weight)

Type	1937-41 average	1942	1943	1944	1945
Vegetable fats	1,180	1,680	1,630	1,540	1,500
Slaughter fats	1,770	2,180	2,540	1,950	1,900
Butter	1,000	950	820	820	640
Total	3,950	4,810	4,990	4,310	4,040

*Adapted from U. S. Dept. Agr., Bur. Agr. Econ., "Fats and Oils in World War II Production and Price Supporting Programs" (War Records Monograph No. 6, October, 1947), p. 22.

IN the United States fats production increased, reaching a peak in 1943 of 5 million metric tons (7.4 billion pounds) (Table 6). This peak was due to an increase of 470,000 tons of vegetable fats and an increase of 730,000 tons of slaughter fats (including the record output of 1.4 million tons of lard). Butter production, on the other hand, fell by 200,000 tons.

The higher vegetable-fats production consisted chiefly of a much higher output of soybeans and linseed. Toward the end of the war in 1945 our total domestic fats production fell back to the pre-war level of 4 million tons because the output of slaughter fats fell close to 107% and butter output to 67% of pre-war. High vegetable-fats production was maintained. Soybean production in the Corn Belt was completely mechanized, and with high-yielding varieties it will remain as a major crop yielding about 83% protein feed concentrates aside from 15 or 16% oil.

During the war the United States changed from the position of net importer of fats to that of net exporter. From 1940 to 1944 fats imports declined from 1.7 billion pounds to 117 million pounds while exports increased from 430 million pounds to 1.6 billion pounds.

Central and South America expanded their production slightly while Africa and Oceania kept theirs almost at pre-war levels.

Whaling ceased altogether during the war, and by international agreement the postwar Antarctic catch was limited to 16,000 blue-whale units so that a maximum annual output of 350,000 tons of whale oil could be expected in postwar years.

During the war the Allies as well as the Germans and the Japanese administered the fats supplies within the areas of their domains and allocated them to priority uses. The free Western Allies went through the war with a relative abundance of fats. Great Britain enjoyed a particularly favorable position, with a large available supply of vegetable fats. During 1934-38 the average annual supply was 580,000 tons, while during 1940-44 it rose to 820,000 tons. In 1943 the peak of 880,000 tons, 50% above pre-war, was reached. In 1945 the supply fell to the pre-war average of 582,000 tons and in 1946 rose to 642,000 tons. On the continent of Europe, on the other hand, shortages had to be made up by stretching supplies for edible purposes and by cutting rations for normal consumers. Soldiers and industrial workers were allotted particularly high rations of fats. In many countries these were three times the normal-consumer ration, in some instances even four or more times higher.

It is interesting to see what the German food administration did in administering the supplies of fats because during World War I the fats shortage had contributed to the deterioration of civilian morale, and in World War II fats again were in critically short supply. German fats chemistry had solved the problem of producing synthetic fats by compounding synthetically produced glycerine with fatty acids produced from gatsch, a byproduct of the Fischer-Tropsch process of coal hydrolysis. During the war they produced up to 40,000 tons of gatsch a year, which they processed into 31,000 tons of fatty acids. Of this quantity 95% was used for soap manufacture and other industrial uses and only 5% for the production of edible fats. In 1943 and 1944 less than 2,000 tons of edible fats were produced.[2]

American estimates indicate that the production of synthetic fats from paraffin wax would cost $700 to $800 per ton. However such estimates involve so many assumptions that they must be considered as very rough approximations of a certain date. The usefulness of synthetic fatty acids and fats for industrial purposes is proven while the nutritional value of synthetic fats is still subject to controversy among nutritional scientists. Aside from this approach, the Germans tried to produce fats by biological processes and succeeded with the yeast fungus *torula utilis* in producing natural fats from wood sugar and other cheap carbohydrates. The Merck Corporation had an experimental plant in Darmstadt, which produced them in commercial volume.

However all this remained on an experimental level. Economically the most pertinent performance of the German war food administration was the preservation of adequate food fats rations in view of a progressive decline of fats supplies. This was done by cutting down the industrial use of natural fats almost to zero. Fatty soap was in the main replaced by synthetic detergents but partly also produced from synthetic fatty acids. Oil-base paints and other coatings were replaced by synthetic paints with a great variety of formulae.

Even before the war Germany used only 17% of its total fats consumption for industrial purposes. With an abundance of coal and an up-to-date chemical industry on the one side and a vast deficit of fats on the other, Germany will in the future also logically solve the problem by replacing imports of fats with the use of domestic hydrocarbons for those purposes where synthetic products give equal or even better service.

TODAY, five years after the end of the war, we can say that the world fats economy as a whole has in the main recovered from the war. By 1948-49 the total fats output had already reached the pre-war level of 23 million tons pure fat equivalent. Of course, there are quite a few changes in the geographical distribution of products and in the composition of various fats commodities. By comparison with the pre-war average, figures for 1949 show over 1 million tons more vegetable fats from annual crops. The gain is faily well scattered among soybeans, peanuts, rape and mustard, sunflowers, and sesamum. The output from tree crops in 1949 had not quite reached the pre-war level but came close to it. Animal-fats production stayed almost exactly as much below the pre-war level as vegetable-fats production rose above it—1.1 million tons. Since the output of slaughter fats was at pre-war par, the decline of the output of animal fats of 1.1 million tons was due to 780,000 tons less butter, 150,000 tons less whale oil, and 160,000 tons less fish oil.

Geographically, world fats production shows the following dislocations during the ten-year period from the pre-war average to 1949. Europe's total fats output in 1949 was 81% of pre-war, Soviet Russia's and the Baltic States' output 76% or slightly better. Asia's output was reported as being 90% and Oceania's 83% of pre-war. Africa reached 118% of pre-war and the Western Hemisphere 148%, with the lion's share of the increase contributed by the United States and Canada. Whaling was 72% of pre-war.

In the world fats export market the pre-war volume of trade in 1949 had not yet reached the pre-war level. Total indigenous exports amounted to 4.7 million tons while the pre-war average had been 6.0 million tons pure fat equivalent. The difference is composed of the following smaller quantities of exports:

roughly 350,000 tons less drying oils, mostly linseed and oil;
180,000 tons less butter;
300,000 tons less whale and fish oils;
120,000 tons less olive oil;
600,000 tons less soybean, peanut, and cottonseed oil; and
200,000 tons less coconut oil.

At the same time 120,000 tons more lard and 120,000 tons more tallow were exported.

The greatest change in the international trade in vegetable fats is the disappearance of Manchuria as the world's great source of soybeans and of India as the largest supplier of peanuts. Whatever soybeans are produced in Manchuria will go to the Soviet Union. India uses its peanut production to improve domestic fats consumption. The loss of the

[2] Cf. FAO Nutritional Studies No. 2, "Synthetic Fats, Their Potential Contribution to World Food Requirements" (March 1949).

soybeans hits Continental Europe and Britain; the loss of India's peanuts, primarily Great Britain.

Another of the great changes in the international fats trade during this last decade has been the shift in many of the major exporting areas to shipment of oil rather than oilseeds, thus becoming able to use the vegetable proteins domestically. In 1938, 14% of the vegetable fats were exported as oil, the rest as seed. In 1949 the proportion shipped as oil was 28%. This trend will probably continue, particularly when the Philippine copra crushing mills are restored. Argentina, the world's leading linseed exporter, used to ship most of it as seed; today all of it is shipped as oil. The world trade situation is improved by the continued high output of fats in the United States which in 1949 was, and for 1950 will be, 2.2 million tons above the 1935-37 level. The exports from the United States in 1949 were roughly 1 million tons.

In most of the importing countries fats consumption per capita has been restored to pre-war levels. The rates of consumption are still far below the pre-war level in Germany and Japan. If both countries continue their industrial recovery, it seems inevitable that they will improve the per capita fats supply by increasing domestic production as well as by increasing imports.

In the coming years after the expiration of the Marshall Plan certain adjustments will take place in international trade in general, including also international trade in fats. In 1949 of an amount of 5 million tons gross exports (pure fat equivalent), 1.8 million tons originated in hard-currency countries (including 1 million tons from the United States) while 3.2 million tons came from soft-currency areas. This was about 3 million tons less from soft-currency areas than in 1938. Unless the United States government initiates new programs of foreign aid of a scope similar to the Marshall Plan, it is to be expected that the importing countries will have no other choice than to shift their fats purchases back to the soft-currency areas, and the latter will have to expand their fats production for export. This will have its repercussion in a slackening demand for American lard, tallow, and vegetable oils. The latest German-Argentinian trade agreement already indicates this shift.

IN general, the forces of adjustment of the world fats situation are powerfully at work. In Europe the output of butter and slaughter fats is rising—in some important countries, rising rapidly. World exports of palm-tree fats promise to expand substantially during the coming years. British and Belgian oil-palm plantations in West Africa, Dutch, and British plantations in Indonesia and Malaya, and Philippine copra and coconut oil production show signs of promising a greatly increased volume. Our government is rapidly building up its stockpile of coconut oil. If Communist-led civil war should disrupt the domestic economy of the Philippines, the flow of copra might be cut off. French efforts to increase the peanut-oil production of French West Africa seem to encounter great difficulties with transportation, native labor, and food for labor; and the much discussed British government-financed groundnut scheme in Tanganyika, Northern Rhodesia, and Kenya is even more problematical. To sink the public investment of 23 million pounds sterling in the ground and in equipment was not too much of a problem, but so far the large oil production is still a matter of expectation for the distant future. The original plan to bring 2 million acres into cultivation has been cut to 600,000 acres, and several years hence, when the peanuts and the sunflower seed actually begin to flow in volume, it is highly probable that by that time there will be an abundance of palm and other fats in the world market.

All the discussion about a persistent and serious shortage of fats and oils in the world market seems exaggerated. From an economic point of view, supply and demand in 1950 are in balance at the prevailing prices and in view of the ability of importing countries to pay. If we had no Korean war and no preparation for the contingency of all-out war, it would be quite reasonable to expect a further recession of fats prices, particularly those of tropical palm fats.

Whaling cannot expand because it is up to the maximum catch under international regulation and lifting of the quota is improbable. But it seems likely that the Germans will be admitted to catching, as the Japanese already have been.

With a world population increase of 12-13% since 1938 the same production as in pre-war years allows for only 87-88% per capita consumption of fats throughout the world if the production guesses for Asia are not entirely off the mark. However if war or revolution do not prohibit the recovery of production in large areas, it seems likely that the increase in fats production will tend to restore the approximate pre-war consumption ratios, ultimately also in Germany and Japan.

Prices of fats are notorious for their extreme sensitivity to changes in the supply-demand situation, which expresses itself in the most erratic price fluctuations of any commodity. During the war prices of fats in the United Nations free part of the world were kept in check by relative abundance, an American-British purchasing agreement which was an international cartel arrangement, an international allocation system, and price ceilings or fixed prices in the consuming countries. Today there is no really free world market for fats because of the multitude of currency controls and import and export regulations in many countries, but international prices are no longer affected by cartel arrangements, ceilings, or allocations.

In the United States price ceilings kept price rises within narrow limits during the war and shortly after. Price index numbers for 26 fats, excluding butter (1935-39 = 100) rose to only 155, after having stayed at 72 in 1940 and at 116 in 1941. When in June 1946, after the war, the ceiling was removed, this price index began to jump to 204, and in July and August to 207. In September it fell to 170 and then resumed its ascent to the postwar peak of 371 in March 1947. From then on, prices fell until August 1947 to 209, climbed to 315 in January 1948, continuous slide down to 138 in November 1949 (Table 7).

From then on they have with vacillation come to 151 in June 1950 and from the Korean crisis on have been rising again. The Korean war has not directly affected the supplies of fats in the world market. The price rise has been the result of buying by manufacturers and wholesalers and retailers who have been increasing their inventories. For some commodities

TABLE 7
Wholesale Price Index Numbers of 26 Major Fats and Oils, Excluding Butter*
(1935-39 = 100)

Year	Index number	
1940	72	← end of price ceilings
1941	116	
1942	149	
1943	154	
1944	154	
1945	155	
1946	197	
1947	285	
1848	264	
1949	164	

	J	F	M	A	M	J	J	A	S	O	N	D
1946	155	155	155	155	155	155	204	207	170	223	323	302
1947	318	338	371	335	266	240	228	209	243	268	306	302
1948	315	261	265	282	293	298	266	245	243	237	240	224
1949	201	184	174	168	170	161	154	167	157	148	138	140
1950	144	146	151	152	157	151	165	182	......	......	......	......

*Source: "The Fats and Oils Situation" (U. S. Dept. Agr.), for annual figures, FOS 115 and 139, p. 12; FOS 139, p. 9; and monthly data, FOS 106 to 143.

like tallow the price has almost doubled under the impact of a sudden spurt of demand from processors. As the American economy is being geared to an enormous further increase in productivity and an expanding military force, an increase in fats consumption may be expected, which may result in prices for fats substantially higher than those in the first six months of 1950. However much depends on the flow of exports of lard, tallow, soybeans, and soybean oil. In 1949 and the first half of 1950 these exports ran at an annual rate of over 1 million metric tons fat equivalent. High prices of fats in this country will impede exports, particularly of tallow and lard, and make them dependent upon foreign loans and subsidies. With the prospect of an almost record output of lard, a very large amount of tallow, and a slightly smaller total output of vegetable oils than in 1949-50, much depends on the strength of domestic demand plus exports. No one can forecast what is going to happen in the fats markets because the political and military events in foreign affairs overshadow everything else. If total war precipitates soon, it is possible that Western Europe will be over-run once more and the islands in the Pacific may remain accessible. Thus the Western Hemisphere might increase its output. This might repeat the World War II situation of relative abundance of fats for the Western Allies, price controls, allocations, and all the rest of the features of planned economy. However events could take place that would entirely demolish that comparison.

If, to go to the other extreme, the international tension should unexpectedly ease suddenly, the fats market might also ease, with a resulting resumption of price declines toward a new lower level—one lower than that of the first six months of 1950—and this in spite of high employment in the United States.

If however we are in for continued high tension between the empire of Soviet Russia and the United Nations under the leadership of the United States, with a continuation of the Korean treatment in other areas, an accelerating armaments race in Europe and the United States, the fats situation may soon be affected by all sorts of governmental controls. There would probably be a high military and civilian demand but enough supplies to satisfy that without returning to the extreme prices of 1947. However the international situation has never been so much of an enigma as it is today, and, as a result, the veil that covers the future is more impenetrable than ever. As an economist I can only warn you against trusting any forecast, no matter what its scientific trimmings. Alertness to and preparedness for sudden changes seems more advisable than ever. Once the stockpiling program comes to an end and the war scare subsides, a sudden slump in the fats market may occur at any moment.

Among the major shifts in consumption within the fats economy of the United States are these:

1. The total consumption of butter declined during the war and following years. Domestic butter disappearance measured in terms of fat equivalent fell from a pre-war average of 1.8 billion pounds to a level of 1.5 billion pounds in 1946, and to 1.3 billion pounds in 1949, or to 70% of pre-war. Margarine consumption increased from a pre-war annual of 367 million pounds of fat equivalent to almost 700 million pounds in 1949. The removal of the federal excise taxes and license fees on the sale of colored margarine on July 1, 1950, will probably boost the consumption of margarine some more. One can buy three pounds of colored margarine for the price of one pound of butter. However 16 states still outlaw the sale of yellow margarine. Six states have excise taxes ranging from 5 to 20c a pound, and 14 states require license fees from margarine wholesalers and retailers.[3]

Gradually increasing margarine consumption will assist in the absorption of very large soybean crops, but what supports the bean producers must be the demand for soybean meal as a protein feed. If it is strong, the oil will sell at low prices and will be exported as well as consumed in greater quantities at home.

Consumption per capita in terms of fat equivalent in 1949 was 8.5 pounds of butter and 4.6 pounds of margarine, or a ratio of less than two to one. In 1931-34 this ratio was roughly 10 to 1. The dairy industry has made the necessary adjustments in selling its output in the form of products other than butter, which are yielding a better aggregate return per pound of milk than does butter. The consumption of all dairy products per capita was 11% higher in 1949 than it was in 1935-39, but consumption of dairy products excluding butter was 23% higher. The following tabulation indicates the changes in income of the U. S. dairy industry from 1935-39 to 1945-49:[4]

	1935-39 average	1940-44 average	1945-49 average
Milk production (billion pounds)........	103.6	115.9	119.0
Farmers' cash receipts from milk and dairy products (million dollars).....	1,409.3	2,299.9	3,813.5
Farmers' cash receipts (dollars per 100 lbs. of milk produced)....................	1.36	1.98	3.20
Farmers' cash receipts (dollars per 100 lbs. of milk produced, deflated by the index for prices paid by farmers, interest, taxes, and wages).....	1.36	1.63	1.75

Per capita lard consumption stood up very well, and at 13.0 pounds in 1949 was about 19% above pre-war while shortening consumption, at 9.6 pounds, was 18% lower than pre-war. Improvement in the quality of lard by the use of antioxidants, better refining, hydrogenation, and other methods of treatment by some companies, and, most of all, the fact that the

[3] Cf. "Recent Trends in Margarine," Fats and Oils Situation (U. S. Dept. Agr., Bur. Agr. Econ., FOS 140, Feb.-Mar.-Apr. 1950), pp. 14-21 and table 18.

[4] Data from U. S. Dept. Agr., Bur. Agr. Econ., *The Dairy Situation*, May 1950, p. 17, and from *ibid.*, *Agricultural Prices*, January 1950, p. 43. Milk production excludes milk sucked by calves and milk produced by cows not on farms.

price of lard is about a third lower than the price of shortening, are responsible for the increased per capita consumption of lard.

OF late, the meat-cattle producers, the meat packers, and the tallow renderers have become alarmed over a decline in the prices of inedible tallow and grease. According to time-honored tradition, those who hate socialism and highly prize the competitive economy at least in theory, have promptly called for Congressional investigation and protection against such supposedly unbearable conditions. To those who know the whole saga of the 70-years' holy war that the butter producers waged against oleomargarine, it is amusing to see how the producers of tallow are tempted to start a crusade of their own along similar lines, just at the time when the butter lobby lost its war to maintain a legal monopoly.

What has happened is this. Starting with research that dates back to the years before World War I and continuing with the use of the results of German industrial chemistry, the production of so-called wetting agents or detergents has grown by leaps and bounds in this country.

The following tabulation shows the development in the volume and value of soaps and detergents sales from pre-war years to the present as reported by the American Association of Soap and Glycerine Manufacturers:

Soap			Detergents		
Date	Million pounds	Million dollars	Date	Million pounds	Million dollars
1935-39 average	2,522	242	1946	250	
1940-44 average	2,975	354	1948	402	111
1945-49 average	2,569	493	1949	712	145
1950	2,234	404 [a]	1950	1,044	202 [a]

[a] Estimated annual rate according to actual sales during first 6 months.

Total sales of all manufacturers may have been considerably larger. With the brisk business that has developed since the Korean war it seems possible that soap sales for 1950 may end up higher than the 1945-49 average and that detergent sales will continue to soar.

Detergents entered the picture many years ago at prices of 70c a pound wholesale. In 1950 some of the best-selling detergents had a retail price of 24c a pound in early September. The average wholesale prices reported by the American Association of Soap and Glycerine Manufacturers show that in the first quarter of 1948 detergents prices were 25% above soap prices, in the first quarter of 1949 were 12% above soap prices, and in the first quarter of 1950 were only 5% above soap prices.

The qualities of detergents have been so much improved that today they are better for many purposes than fatty soaps, particularly in all hard-water areas. The absence of scum and their power to dissolve fat, grease, and even mineral lubricants, their wetting capacity that leaves self-drying washed surfaces without spots, are all elements that give the detergents their large and expanding market.

Detergents can be made from many raw materials following many formulae. Today they are made chiefly of hydrocarbons, such as benzene derived from the coking of coal or from petroleum. If benzene is not available, numerous other hydrocarbons serve the same purpose. However a smaller proportion (estimated to range between 25 and 30%) is said to be produced from sulfonated fatty acids split from natural fats, such as coconut oil and tallow, for example. The decline of the price of tallow and greases from 27 to 4½c a pound, combined with the phenomenal rise in detergent production and the fact that the major part of the detergents is in any case made from mineral materials, led the tallow producers and renderers to the conclusion that the soap industry was responsible for the low price and that something ought to be done to prevent it from using petroleum derivatives. However the amazing fact is that while the soap industry in pre-war years used between 7 and 800 million pounds of tallow and grease, it used 1.4 billion pounds in 1948, or 90% more. There is about one-third more tallow and grease in soap today than there was in pre-war years. Yet per-capita production of soap in 1949 was the lowest since 1921.

Thus detergent consumption has been largely additional to the consumption of soap, and the soap industry has expanded immensely by becoming a soap and detergent industry. It seems desirable that more tallow and grease be used also in detergents. This is a question of intensive chemical research. Such research has an immense incentive if the price of tallow is low. Methods of boosting tallow prices by governmental restrictions on other products or by other price supports promise to discourage such efforts. Indeed it is the economic purpose of high prices to turn processors away from such materials. The same is true of exports. Low prices create the slope on which tallow and grease will flow into the world market. High prices back up supplies for domestic use only. Tallow and grease, like all fats, yield glycerine in fat-splitting or in soap making. The demand and price for glycerine is also a factor to be considered. Since fats contain 12 to 18% glycerine and glycerine prices sway between 8 and 45c or more a pound, the soap manufacturer is keenly interested in this by-product, too. With 2.1 billion pounds of tallow to be expected in this country in 1950, prices may come down in spite of the armaments boom and price inflation. Domestic demand for tallow and grease will continue to shrink unless methods are found to use these commodities generally as raw materials for detergents.

Let me conclude my review by saying that we may look forward to great progress in the world's fats economy, and that means lower costs of production, better quality in the finished product, lower costs to the consumer, and a great many adjustments as chemistry marches on.