vinyl resins. These products impart excellent low temperature, low volatility, and low migration properties to the finished compounded resin. This same group of acids has in the form of esters also provided the backbone for the production of the synthetic lubricants which are so necessary for the operation of jet aircraft at high altitudes.

Sebacic acid has been used very extensively in the production of 6-10 nylon which is used for bristles and other monofilament applications. Pelargonic acid has been used in a wide range of industries including the fields of baking alkyds, ore flotation, pharmaceuticals, and perfumery. Undecylenic acid has been used to manufacture a polyamide called Rilsan and currently is used rather widely in the drug trade as a fungistat and in perfumery to form peach aldehyde, which is in reality undecalactone. Heptaldehyde is used primarily in the perfume industry.

Isomerization reactions, although occurring quite widely in chemical reactions of unsaturated fatty acid derivatives, have not led to a very large number of commercial products. Conjugated dienoic fatty acids have been used in the paint field to a certain extent especially where more rapid dry or reaction with styrene, cyclopentadiene, etc., are desired. Elaidinization of certain glycerides has produced substitutes for the very expensive cocoa butter. Other *trans*-isomers of fatty acids have been reported to impart unique and improved properties to soaps made from them. Skeletal rearrangement of unsaturated fatty acids having an 18-carbon atom straight-chain has produced a branched-chain unsaturated fatty acid (of the same carbon content) that, when hydrogenated, gives a liquid rather than a solid product.

Products from the reactions of unsaturated fatty derivatives that are induced by double bonds have not to date found extensive application. Polybasic acids or their anhydrides, produced from oleic or linoleic acids and maleic anhydride, may find use as epoxy resin curing-agents. The ester form of such products has been recommended as a vinyl resin plasticizer. Hydroperoxides of fatty acids or esters have been recommended as polymerization catalysts for certain resin systems.

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The Economics of Drying Oils

J. E. McHALE, Merrill Lynch, Pierce, Fenner, and Smith Inc., Chicago, Illinois

DURING THE COURSE of this series you have heard a great deal of expert information about factory and laboratory handling of drying oils. That is as it should be for this is a technical group, gathered for a technical purpose. Yet on reflection we must realize that at no stage, from planting of crop to consumption in end-use, can drying oils be divorced from economics. For economics dictates much of the pattern of production, distribution, and consumption and controls much of the research. Despite these profound effects the economics of this field has enjoyed remarkably little investigation. Applied economics, which concerns us here, involves the study of business alternatives, determinants, and decisions. It is always easier to study the last of these items as decisions, for better or worse, are matters of record. Past decisions are reflected in historical statistics so let us take a look at them.

The History. The most striking economic facts in connection with drying oils are, first, the failure of usage to expand in what we usually consider to be a dynamically growing economy, and second, the steady decline in the use of oils as a percentage of a gallon of paint (Tables I and II). The failure of paint and varnish sales to expand much despite the heavy housing construction of recent years and despite relative consumer prosperity can seemingly only be explained as a merchandising problem. The loss of position of drying oils is more familiar to all of you. The first big loss came during the oil-short days of World War II when many firms were forced to re-examine classical theories of pigment-to-binder ratios. The post-World War II period saw the introduction of styrene-butadiene-latex emulsion paints. New oil products and better methods of processing familiar oils were developed under pressure of latex emulsion competition. Some of these oil-type of products, notably alkyds, reduce oil consumption per gallon.

Consumers have demanded, and have gotten, products more suited to the do-it-yourself requirements of the average home-owner. In large measure these

TABLE I
Production of Paint and Varnish 1948–1958

Year	Total		Containing drying oils	
	Million gallons	Oil used per gallon	Million gallons	Oils used per gallon
1949	485	1.4	349	1.9
1950	599	1.3	432	1.8
1951	542	1.4	389	1.9
1952	536	1.3	374	1.8
1953	556	1.3	381	2.0
1954	545	1.3	375	1.8
1955	599	1.1	371	1.8
1956	587	1.2	371	1.9
1957	586	1.1	353	1.8
1958 (prel.)	598	1.0	367	1.6

Source: U.S.D.A. FOS 195, March 1959, p. 26.

TABLE II

Fats and Oils Used in Drying-Type Products, by Type of Product 1949–1958

Year	Paint and varnish	Floor covering and oilcloth	Resins	Other	Total
1949	655	148	82	89	974
1950	772	153	105	148	1,178
1951	743	134	156	118	1,151
1952	691	125	128	87	1,033
1953	750	117	128	93	1,086
1954	693	113	132	79	1,017
1955	677	111	178	158	1,125
1956	687	106	185	129	1,107
1957	622	102	187	122	1,032
1958 (prel.)	593	58	142	109	902

Source: U.S.D.A. FOS 195, March 1959, p. 26.
(It is generally thought, based on Tariff Commission figures, that 90 to 95% of resin production ends up back in coatings. New estimated usages can be obtained by applying these figures.)

new convenience products have contained little or no oil. The loss of position of oil in floor coverings and oilcloth (Table II) is the result of well-known shifts in consumer preference to vinyl and asphalt tile.

The Census Bureau in its Monthly and Annual Facts for Industry Series furnishes the analyst with data that are reasonably useful in the edible oil field. In the drying oil field, data are frustratingly sparse. This reflects a feeling on the part of the Bureau that disclosure of almost any figures would reveal some one's position. The usefulness was recently reduced even further. At any rate, perusal of the available figures for 1949–1957 reveals some interesting trends. In the paint field, raw linseed as a direct ingredient has about held its own, around the 110-million-lb. level, while refined has grown 28 million lbs. to about 141 million lbs. Crude soybean oil direct was up 1½ million lbs. to about 4½ million while refined soybean fell by 9 million lbs. to a total of 79 million. Coconut-refined increased from 3 million lbs. in 1949 to nearly 6 million in 1957. Crude castor direct about held its own. Dehydrated castor is very difficult to follow, but direct usage seems to have suffered rather badly. Fish oils held about steady around the 15-million-lb. level until 1957 when a 5-million-lb. drop took place apparently because of a poor catch. Direct use of vegetable oil fatty acids increased from some 10 million lbs. to perhaps 20–25 million.

Tall oil-direct (virtually all refined) has grown from a doubtful 18 million to certainly over 25 million. Indirect usage as vehicles and blown and bodied oils cannot be followed with any certainty, but other processing of linseed beside resins seems to show a slow down-trend, perhaps reflecting the decline in the percentage of painting done by professionals. There has been of course a big increase in resins. Linseed for resin use was up perhaps 9 million lbs. for the period, soybean up 22 million, tung up 1 million, castor up 40 million, vegetable oil fatty acids up perhaps 35 million. In the linoleum field linoil and soybean oil are down by percentage as well as absolutely, and tung oil has lost out almost completely. Tall oil has actually gained in absolute terms despite the over-all loss of ground of the industry. Presumably this reflects efforts to cut costs as well as increasing knowledge of how to work with tall. Linseed has also lost ground to tall in the field of core oils. This use of linseed oil soared from 5 million lbs. in 1949 to a high of 19 million lbs. in 1951 (presumably as the result of Korean rearmament). Since then it has fallen to only 2 million lbs. (1957). Tall oil came from 8 million lbs. in 1949 to more than 22 million in 1956, the best year of those for which figures are available. Refined linseed in printing inks has grown from around 11 million lbs. in 1949 to 18½ million in 1957. Refined linseed in paint and ink vehicles grew from 15 million in 1949 to 26 million in 1957. I have put all these figures in essay form rather than tabular form because the figures are so fragmentary and so much guessing is involved that they do not deserve the dignity that a table always seems to impart. So much for the history, or what pieces we can find. Now let us look at the individual oils.

Flax and Linoil. The flax industry in the United States was forced to move slowly but steadily westward until the discovery that "flax-sick" soil was really the effect of fusarium wilt. This led to the development of resistant strains, and the flax industry became stabilized. The history of domestic prices is one of extremely erratic moves. Depression lows of under $1 per bu. compare with post-World War II highs of more than $8.50 a bu. Recent years have witnessed a considerable calming down of the moves mostly because of operation of price supports which have produced a small but nagging over-production. The last five years have seen the United States become a substantial and persistent exporter of flax and also an intermittent exporter of linoil. Much of both have been cut-rate sales from CCC stocks. The other major shipper of flax as flax is Canada. Canada however produces flax for the world export market rather than exports as a residual, as is the case here. The other world-sellers (principally Argentina and India) move oil and discourage with imposts, or prohibit, the exportation of flax as grain. This is mostly to keep home mills working. Import-nations, on the other hand, have mills of their own to keep occupied, and as a result they may put a duty on the oil and/or subsidize the entry of flax. Obviously such actions on the part of either export- or import-nation change the price both to producer and to eventual user, and these factors alone can make prices move. There is a good futures market for flax in Winnipeg and fair futures market for linoil in Rotterdam, but both are concerned with world prices rather than U.S. so except for exporters they are not much of a hedge for short-term U.S.-price moves. United States domestic consumption has been in a slow but steady down-trend while production both at home and abroad has remained fairly stable. Economic recovery among European and Asiatic nations has enabled world markets to absorb surpluses as they have occurred. United States domestic prices of linoil are strongly affected by what CCC does with its flax accumulations as well as by price and demand level for linseed meal. Linseed meal enjoys a strong preference among cattle feeders because of the fine "finish" it imparts to the animals. This preference tends to keep linseed meal in fairly tight supply during the expansion phases of the cattle cycle, and this effect is accentuated when for one reason or another the flax crush is low.

Soybeans and Soybean Oil. Soybean oil usage in drying oils has come a long way from the time when lack of knowledge of how to use it resulted in poor experiences. Although research has been finding more uses for SBO, consumption other than in edible products has not expanded (Table III). This reflects a decline in nonfood uses of fats and oils both in total

TABLE III
Soybean Oil Utilization 1949–1958

Year	Food uses myn. lbs.	Nonfood uses myn. lbs.
1949	1,210	321
1950	1,446	323
1951	1,536	306
1952	1,911	388
1953	2,128	368
1954	2,002	331
1955	2,309	341
1956	2,155	351
1957	2,296	321
1958 (prel.)	2,875	328

Source: U.S.D.A. FOS 196, May 1959, p. 41.

and *per capita* (Table IV). It seems likely that the nonfood total will not fall much farther, but *per capita* consumption could continue to decline. Food use of SBO has been expanding along with our growing population, but *per capita* consumption may not grow much from now on. On the other hand, meal consumption still has room for expansion. Under pressure of severe competition, feeding practices have shown great improvement in recent years. This has resulted in better animals at lower costs. With the possible exception of poultry however there is still room for considerable improvement, and this means greater vegetable protein consumption. (Incidentally it also provides an expanding outlet for fats.)

Castor Beans and Oil. Including the Indian crop (harvested early in 1959), world castor-bean production last year was about at an all-time high, probably around 530,000 metric tons. Brazil, India, and Mainland China are the principal export nations. The United States takes about 20% of world trade in this item, substantially below the Korean War years when we took about one-third. The fall stems from lower demand for sebacic acid for jet engine lubrication as well as higher domestic production. United States 1958 turn-out of 22,000–23,000 metric tons was the largest of any year since 1953 when nearly 24,000 metric tons were produced. However in 1953 some 124,500 acres were required to produce not much more than was produced on only 24,000 acres in 1958. (The big 1953 acreage was the result of a form of support program.) The difference in yield reflects much better yielding and nonshattering strains plus better harvest equipment. Imports still provide four-fifths of our requirements and probably will always be substantial. However last year's yields make it plain that we could be self-sufficient if the need should arise. As was pointed out in a magazine article recently by one of the other short course speakers, the 1958 volume increase is the more significant in that it took place at prices which are reportedly disappointing to foreign producers.

TABLE IV
Utilization of All Fats and Oils 1949–58

Year	All food products		Drying oil products		All nonfood (incl. drying oils)	
	Mil. lbs.	Per cap.	Mil. lbs.	Per cap.	Mil. lbs.	Per cap.
1949	6,287	42.6	964	6.5	3,576	24.2
1950	6,890	45.9	1,182	7.9	4,140	27.6
1951	6,366	42.1	1,129	7.5	3,850	25.5
1952	6,765	44.1	1,010	6.6	3,593	23.4
1953	6,876	44.1	1,064	6.8	3,631	23.3
1954	7,239	45.5	998	6.3	3,517	22.1
1955	7,444	45.9	1,107	6.8	3,834	23.6
1956	7,484	45.3	1,089	6.6	3,962	24.0
1957	7,477	44.4	1,015	6.0	3,920	23.3
1958 (prel.)	7,884	46.0	890	5.2	3,796	22.1

Source: U.S.D.A. FOS 196, May 1959, p. 21.

Safflower. Safflower production is in the midst of a boom. This is partly on account of better strains, partly on account of better harvesting equipment, and partly on account of the constant efforts of a large West Coast oil-processing concern. This cousin of the thistle may answer the problems of many a Great Plains farmer although so far most of the production has been in California. Its nonyellowing properties have won for it many friends in the coating industry, and further expansion in demand is indicated. Production of seed has grown from 20 million lbs. in 1951 to an estimated 146 million in 1958. India is also a grower of safflower and has been an off-and-on exporter. However no estimates of production in that country have been made. The oil can also be used as an edible product, and recent cholesterol "scare" talk may help this use.

Oiticica Oil. Domestic disappearance of oiticica, all imported, has fallen from the 1941 high of 27 million (virtually all in paint and varnish) to a recent level of 10–11 million lbs. (6–7 million paint and varnish). The oil, a natural drying oil, is extracted from the seeds of a wild palm tree that grows in Northeast Brazil. In order to prevent seeding for growth in other countries Brazil does not permit exportation of the seed.

Perilla Oil. This seed was a casualty of the War. Most of the output was from Manchuria, with some also in China. Pre-war production was estimated at near 175,000 metric tons, but it is doubtful that present output is above 5,000–10,000 metric tons.

Tung Nuts and Tung Oil. Frost danger restricts United States tung-growing to a narrow belt along the Gulf Coast from Florida to Texas. Last year was the first year in five that the crop was not severely damaged by frost. The 1955 crop was a near failure, only 5,600 metric tons compared with a 1958 production of 122,000 metric tons. The 1955 failure did not have much effect on price as the CCC was feeding back into the market oil acquired in price support operations during the 1953–54 crop year. The 1955 failure took CCC "off the hook" for a year, but stocks in the hands of that agency have been climbing steadily ever since and 1958–59 could have been troublesome. CCC's 1958 problem was complicated by the setback in industrial activity both in the United States and around the world which resulted in poor demand. Oddly enough Mainland China, the major producer, did not put as much oil on the market last year as expected. This may result from the fact that since tung-nut gathering in China is a part-time "cottage" industry, the commune program may have reduced available labor for this task. It is also possible that stockpiling because of dissatisfaction with price may have been a factor. There seems to be little doubt that the 26-million-lb. oil import quota will be filled and that just about exactly that amount will go to the CCC. It is easy to say that obviously the quota was far more than adequate, but remember that the crop could just as easily have been a failure as a success. Like many tree crops, tung production cannot respond to short-term price moves since it takes five to seven years for a tree to start bearing in quantity and it bears for nearly 30 years thereafter.

Tall Oil. In 1940 only 30 million lbs. of tall oil were produced *versus* probably 700 million lbs. in 1958. From a waste product it has become one of the principal sources of vegetable fatty acids and one of the principal sources of rosin. A tremendous amount of research has gone into tall oil, and this plus low price are the reasons for its rise to prominence. The great amount of tall-oil research is sometimes contrasted to the lower amount of organized research on vegetable oils. It must be remembered that research expenditures are always more justified on finding uses for a waste product than for slightly upgrading currently acceptable products. Low prices have made it possible for some manufacturers to broaden lines on the low side and to compete better with products not made with oils. Tall oil occupies a peculiar economic position in that it is a product entirely derivative from a process that has nothing to do with oils. As a result, its supply is largely determined by the activity of the sulphate (kraft) paper industry. (This does not take into account the fact that high prices for the product will stimulate installation of systems for recovery of this oil in mills that do not have them now, and low prices will discourage such installation.)

Fish Oil. United States prices on fish oil are much more stable than in world markets where there is a substantial response to the size of catch as well as a fair seasonality. In some countries (mostly producing-countries like Canada and Norway) small quantities of refined fish oil are used for margarine, and it is used as a shortening ingredient in Western Europe. Most of it however goes into drying products and soap. Not considered an especially desirable oil except in certain applications such as rustproofing paints or in cases where flexibility is desired, the principal attraction of fish oil seems to be low price. The United States, Norway, and Iceland are the principal producers. West Germany and the Netherlands are the chief customers for United States fish oil. Exports have been declining because of a tendency in Europe to use all-vegetable oil shortening.

General Economic Notes. The first decisions are whether to plant and whether to harvest, and, if so, what items? These decisions are functions of current market prices (or projections of future prices) as well as of the availability of labor and seed, the presence or absence of soil moisture, and investments in facilities. For domestic producers their decisions may also be controlled by the support price for the item, or more exactly, by the support price of one item *vis-a-vis* support and/or market prices for alternative uses of the land. Crops compete with each other for the land just as surely as corporations compete in the market place. Drying oil materials currently enjoying direct-support operations are soybeans, flax, and tung nuts. In addition to direct-support operations, other methods are taken to keep domestic prices up. These include import quotas,

TABLE V

Hindrances to Importation of Drying Oil Items

Item	Quota	Base duty	*Ad valorem*
Tung nuts	None	None	None
Tung oil	26 myn. lbs.[a]	None	None
Castor beans	None	¼ ¢/lb.	None
Castor oil	None	1½ ¢/lb.	None
Flaxseed	None	.50/bu.	50%
Linseed oil	None	4½ ¢/lb.	50%
Oiticica	None	None	None
Fish oils	None	Wide range depending upon the oil	

[a] Imports from Mainland China are prohibited.

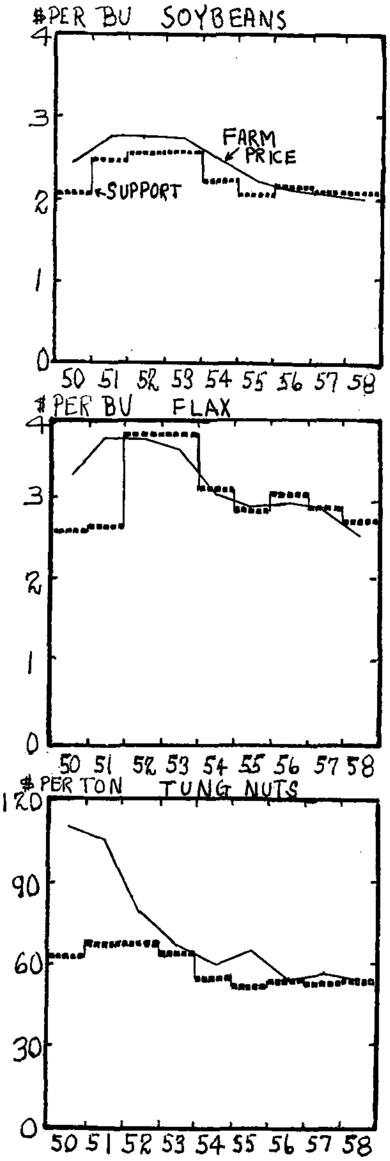

FIG. 1. Support prices *vs.* prices received by farmers.

processing taxes, and import duties. All have the effect of not permitting production from lower-cost areas to compete (Table V).

Declaring an item surplus, then granting foreign countries funds with which to buy that item is actually a form of support as it creates a demand that otherwise would not appear. A decision as to whether to support, how to support, and the precise level at which to support is not usually an exercise in applied economics. These things are more in the realm of applied sociology, applied political science, or governmental budgeting, or a combination of the three. As a result, support prices do not bear any necessary relationship to value. This is not to say that support prices do not set the price area at which that portion of the crop which moves into consumption does move. They frequently do just that and thus are extremely important in the economics of this field (Figures 1a, 1b, and 1c). However this effect is often only a symptom of willingness to allow surpluses to accumulate and/or to prohibit or tax the entry of foreign growths. Direct supports are usually set on a pounds-of-raw-material-produced basis, and this results in further ignoring of value.

The farmer, who is an economic being just like the rest of us, does not have enough incentive to produce a high-oil-content crop. It is of little concern to him whether his beans yield 17% oil or 22% oil especially if they are only going into loan. However this is obviously of great concern to the crusher when meal is selling at 2½¢ per lb. and oil is selling at 10¢ a lb. To crushers, who are almost always forced to work on tight margins, the difference of $8 per ton is very important and frequently is more than their profit. This situation is the result of several factors. First, no quick oil-content testing-device that is usable at the country-elevator level has gained general acceptance. This is the level that counts as the farmer individually must be encouraged to grow for quality. Second, beans and flax are grown mostly in grain areas where end-product out-turns are traditionally of little concern. Third, since support programs have been set up along bushel lines, the emphasis in genetic research has concentrated along yields, with quality considerations secondary. Much of the experimentation has been done by groups whose first concern must be helping the farmer.

Support programs in the oil and oilseed fields have been much more varied than supports in other fields. For one thing, the economics of these items is more complicated than that of food grains or fiber. For another, soymeal returns to the farm as mixed feed and there is a reluctance to keep meal prices too high; that is just what will happen if oilseeds are kept away from crushers. The domestic balance between supply and demand in high-protein feeds is substantially closer than in oils. Edible oils, as a matter of fact, are in reasonably constant danger of moving into a serious over-supply situation. So far the over-supply has been averted by massive doses of government aid. As the world becomes more protein-conscious, and there is every indication that this is taking place, it may go the same way this country has toward an over-supply of oil. This will mean that our oil will require even greater subsidization to move it out.

Prices. The controversy over the desirability of market movements is perhaps sharper in the inedible field than in the edible for the latter group has largely come to terms with the problem. We all know that the job of the buyer and the job of the formulator would be easier if prices did not swing up and down. On the surface at least, this makes stable prices desirable. However it may be considered for a moment that whether prices move or do not move is not necessarily a reliable indicator of whether price-making forces are at work. The actual fact may well be that a portion of the time the buyer of a stable price item is paying too much and other times he is paying too little. But sellers and human nature being what they are, the former is probably true much more often than the latter. So the net result may well be that an actual price is being paid for a stability that does not exist. It is certainly true however that certain items have more factors tugging on them than others. It will be noted from Figures 2, 3, and 4 that price swings in edible are sharper than in inedible and that the larger production items tend to swing farther than small items.

In general, the more uses that an item can be put

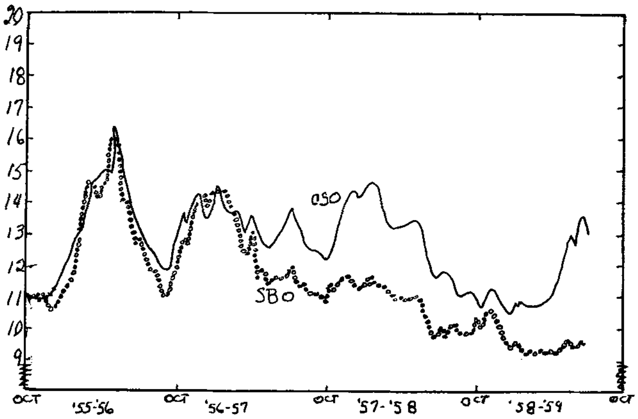

FIG. 2. CSO valley *vs.* SBO, Decatur.

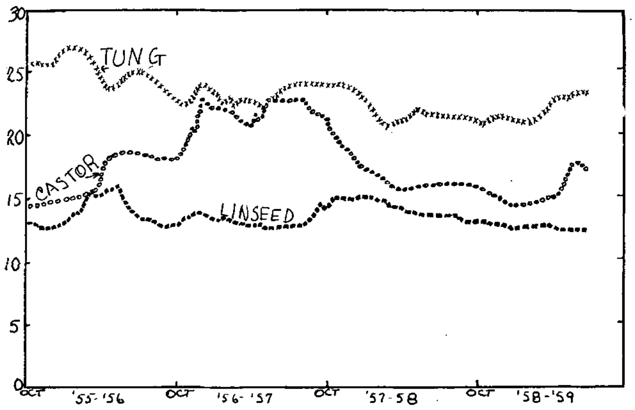

FIG. 3. Tung (N.Y.) *vs.* castor (N.Y.) *vs.* linseed (Mpls.).

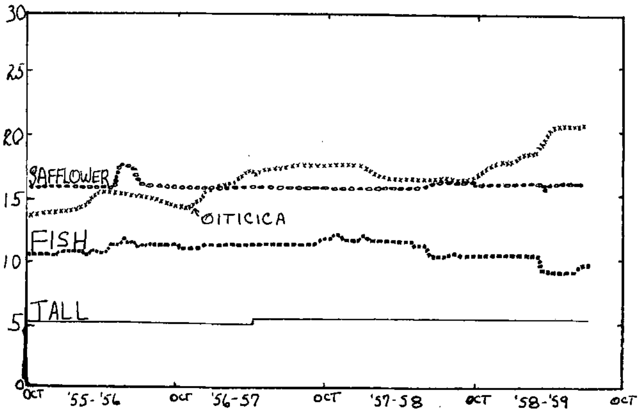

FIG. 4. Safflower (N.Y.) *vs.* fish (N.Y.) *vs.* oiticica (N.Y.) *vs.* tall (ex-works).

to and the greater number of items that can be freely interchanged for it, the greater will be the possible components of price moves. For soybean oil the number of possible factors is simply enormous. This greatly complicates the life of the analyst for the better informed he is, the greater are his chances of being right. For example, the following are just some of the factors that had to be given at least passing consideration in recent months: the animal population and animal-feeding ratios, flood losses to Argentine and Chinese oilseed crops, the peanut crops of India and Africa, the oil and oilseed positions of European dealers and manufacturers, the amount of rain in the Philippines, weather (state by state) in the bean and cotton belts, proposal for liquidation of government coconut oil stocks, CCC cotton oil inventory, grants of U. S. funds to other nations to buy oils and the status of the purchases thereon, and the profitability (conversion) in bean crushing.

A full detailing of both the possible short- and long-term factors would take a lot more space than we have. To all this talk-rumor-gossip-information must be added the reaction to any or all of these by traders, both the speculators on the floor of the exchanges and in brokerage offices and the traders for the big oil firms. And no two people will react exactly the same to the same piece of information. Actually the remarkable thing is that prices do not move up and down more than they do.

Some Notes on the Paint Industry. There is a substantial seasonality to paint production (Figure 5a) and a similar seasonality to use of linseed oil as a percentage of all oils used (Figure 5b). This indicates that higher summer production leans heavily toward exterior paints. The timing of these two bulges indicates that production must move fairly rapidly into user-hands as it coincides reasonably well with what is the exterior painting season in many parts of the country. Linoil prices do not exhibit any similar seasonal pattern (Figure 5c) except that there is a tendency for firmness in late spring. This may be partly the result of the operation of the support program although it is conceivable that some of the bigger factors are contracting for summer needs at this time. However flax processors are frequently reluctant to sell very far in advance. For one thing, they are not able to sell cash meal anywhere near this far forward nor are they able to contract for the cash flax. The absence of futures markets for either of the products and lack of a utilizable futures market for flax means that by selling oil the crusher is long in meal and short in flax. (An unhedged three-way position is, I assure you, an extremely uncomfortable one.)

The failure of paint production to level out over the year means that manufacturers are giving up the obvious economies of year-around level production. We can probably discount the possibility that there is an unpredictable fashion element involved in color choice although there have been some efforts to promote this. It is more likely an indication that, first, economies of levelling are not equal to warehousing costs and, second, that there is a reluctance to stockpile inventories that may not move. This, in turn, indicates a lack of confidence in ability to forecast sales confidently.

Interchangeability. Edible oil users interchange fairly readily, and as a result a sharp move in one item will frequently force moves in others (Figure 2). There is less tendency for this to occur in drying oil (Figures 3 and 4). Lack of interchangeability is also indicated by relative stability in month-to-month usage, at least on a short-term basis. There are apparently a number of reasons for this.

1. At the risk of repeating something that is quite frequently stated, not enough is known of the basic mechanism and chemistry of drying to enable formulators to shift from one oil to another with confidence.

2. A formula feed-manufacturer or an edible oil producer has a much shorter in-progress time for testing of changed formulations. A growth ration for a broiler chick can be tested from start to finish in six months; a shortening formulation that produces bad results can be discarded after a few dozen cakes are baked.

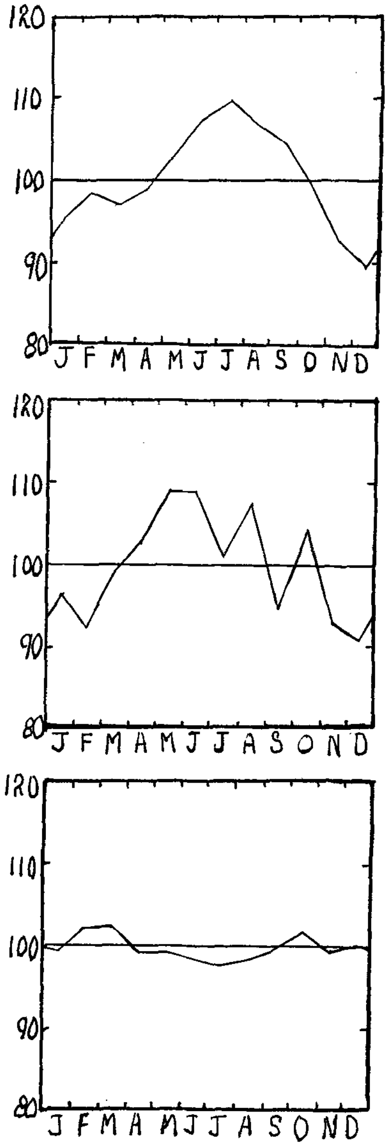

FIG. 5. Top—seasonal index of paint production in gallons; middle—seasonal index or usage of linoil in paint as percentage of all oils used; bottom—linoil seasonal price pattern.

3. An edible oil manufacturer is concerned about the stability and performance of his product only for the maximum time that it is likely to be in distributive channels and in the users' kitchens, a few months at most. A drying oil manufacturer must be concerned with performance over a period of many years, even to the point of concern over how it will take the subsequent finish. So by the time the research is finished, the price shift that called for the research may long since have passed.

4. There is a general recognition of the fact that protective coatings are frequently applied to things whose value is out of all proportion to the cost of the coating. About the most serious thing that could happen from a poor edible oil formulation would be a ruined dinner. This may seem like a tragedy to a housewife, but in terms of dollars it is nothing to the damage that could be done by a coating that did not protect. All of the above point to the reasons why there is a general reluctance on the part of manufacturers to change formulations. Reportedly for "first-line" products this reluctance approaches complete refusal.

The Future. There seems to be little doubt that some day the chemistry and mechanism of drying oils will be understood much better. There certainly has been an enormous advance in recent years because of such aids as ultraviolet and infrared spectroscopy. When these factors are better understood, interchangeability will be much simpler. This would give the industry a chance to apply an enormously important recent formulation break-through known as linear programming. The principles of this were not discovered until 1947 and were not published until 1951. It represents a method of wading through the trillions of alternatives possible from a small series of specifications and ingredients. In actual practice, the number of possibilities actually investigated will not run that high since many can be thrown out early. However the number is still beyond feasibility without something similar to this system plus a computer. Other possibilities for the future include the possibility of detoxifying castor meal and/or tung meal which would enable the oils to move to market much cheaper without changing the price of the seed to the producer. To go even deeper into the fanciful, there has been for years an effort to develop an efficient way of separating babassu kernels from the hulls. Some day some enterprising inventor will find the way, and the impact on the world oilseed and protein picture could be enormous. But we must wait on all these things.

Impact of Outside Factors. Figure 6 in an indication of how closely prices of drying oils in the United States are tied to international prices. This relationship is apparent despite a heavy weight given to domestic linseed oil in the United States whereas the heavy weight in the international index is given to Argentine linoil. The wider swings in the international prices result from the effect of freight rates (it is a CIF index) plus the stabilizing effects of flax and tung supports in the United States. So, in the drying oil field, one cannot afford to ignore international developments. Attention must be paid to such things as currency developments in Argentina, sales policies of the Indian government, stocks in Rotterdam, and Rotterdam linoil futures prices.

Paint raw-material prices have not advanced as much as paint prices (Figure 7). This is a reflection of severe competition between oil and the availability of low-price substitutes for oils. Comparing the action of the paint raw-material index with the domestic drying oil index, it is obvious that raw materials other than oils have advanced in price.

It will be noted from Figure 8 that the total utilization of oils for drying purposes displays an obvious tendency to follow the ups and downs in the level of business activity. (This is not a parallel tendency as far as we have noted before for fats and oils for paint purposes face great competition.) This relationship forces those who must analyze demand-forces and possible price-movements to pay close attention to financial developments all the way from housing starts to steel strikes. This brings us back once more to the brief summary of possible price factors in edible oils mentioned earlier and to all the forces on the individual oils that we have mentioned in passing. So often there is a tendency for people outside the economic field to feel that brokers, dealers, and traders have a formal little language that is understandable only to the initiate. This simply is not so. Perhaps far more than in the technical part of the field, the information is simple and available to all. There are far fewer really original pieces of research in my field than in yours. Going back to college economics, we will recall that one of the requisites for classically perfect competition was a large number of equally well-informed buyers and a large number of equally well-informed sellers. "Well-informed" is a necessity. The point I would like to make is that the more you delve, the more attention you pay to available information, the better chance you have to be as well-informed as the people with whom you deal. This may not make you a better trader than the other man, but at least you may start out with him on an equal basis. No man can ask for more.

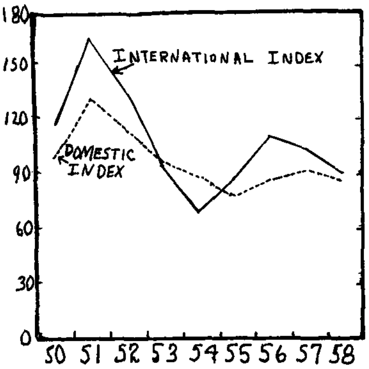

FIG. 6. International (FAO) index of drying oil prices: 1952–54 equals 100 *vs.* domestic prices; 1952–54 equals 100 as reconstructed from U.S.D.A.

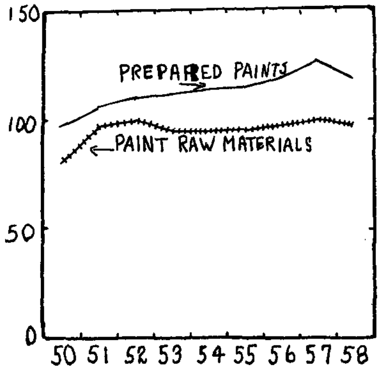

FIG. 7. Indexes of prepared paints *vs.* paint raw materials (BLS); 1947–49 equals 100.

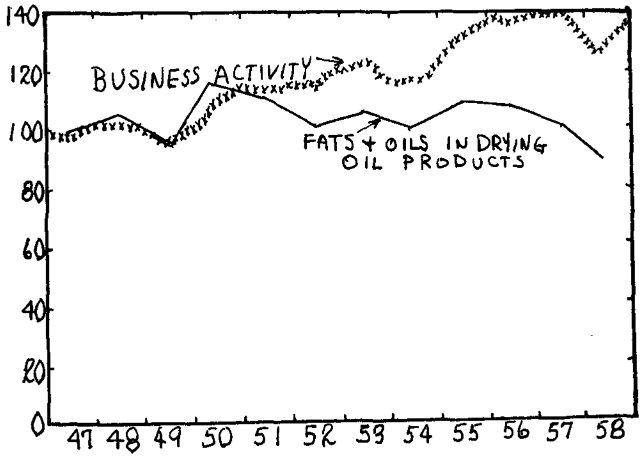

FIG. 8. Business activity index (Morgan-Guaranty), 1947–49 equals 100 *vs.* index of fats and oils in drying oil products (U.S.D.A.); 1947–49 equals 100.