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FINANCE • INDUSTRY • AGRICULTURE • TRADE
FOURTH FEDERAL RESERVE DISTRICT

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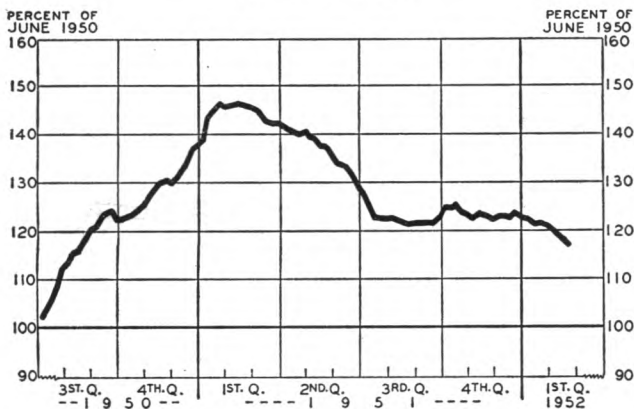
Federal Reserve Bank of Cleveland

Cleveland 1, Ohio

The Latest Sag in Commodity Prices

AFTER six months of comparative stability on a plateau some 20 to 25 percent above the immediately pre-Korean level, prices of basic raw materials have weakened again. The break-through on the downside, which occurred a few weeks ago, has carried the well-known index of 28 commodities down to the lowest point since the early days of the Korean conflict and has raised an interesting question as to why commodity prices should decline when the possibility of further credit and monetary inflation is still clearly visible.

INDEX OF 28 BASIC COMMODITIES
June 1950 = 100
(plotted weekly*)



... after a six-month plateau of some 20-25% above pre-Korean levels, basic raw material prices recently broke through into new low ground.

*Last date plotted is February 19, 1952.

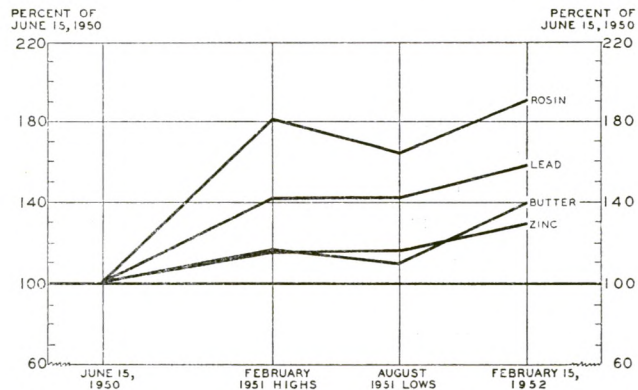
The latest downward movement has not been all-inclusive. In fact, several of the 28 commodities have risen substantially in recent months and are the highest on record: the metals generally have remained at ceiling prices. A number of others likewise recovered all of the loss incurred in the liquidation of last spring and early summer, and are once more quoted at or close to the peaks reached early in 1951.

On the other hand, at least eight commodities have encountered soft spots at various times in the past year or less, and are now available at prices comparable with those which prevailed before the Korean war broke out. This wide diversity of movement may provide some basis for conjecture as to whether the latest recession in prices signifies a fundamental change in the business outlook, or whether it is only a temporary phase without far-reaching implications.

Relatively Strong Commodities Commodity prices today would be the highest on record (instead of having retraced slightly more than one-half the Korean rise) if the majority of the components of the index had exhibited the strength of butter, rosin, lead, and zinc. Of the four, the two metals owe their preeminent position to world demand, while the other two are affected by somewhat special domestic situations.

Demand for nonferrous metals is currently absorbing all available supplies even though government control has limited or prohibited their use in certain cases. Imports were curtailed last year be-

FOUR STRONG COMMODITIES



... if all 28 commodities had conformed to the pattern set by butter, rosin, lead, and zinc, prices would be at or close to a new all-time high today.

cause domestic consumers were unable to pay world market prices which were almost double the domestic ceilings. During the past few months world prices began to soften as the wild scramble for metals came to an end. Effective early in February the American import duties on lead and zinc (roughly one cent per pound) were suspended for approximately one year. Several large offerings of foreign lead were then made in the American market at the ceiling price of 19 cents. In contrast to lead, the free world market price of zinc is still around 20 percent above the domestic price of 20 cents.

The pronounced firmness of butter prices throughout January and February, when many other commodities were declining, can be attributed to somewhat reduced supply and steady-to-rising demand. Current high personal incomes have increased the demand for both fluid milk and butter. But since fluid milk is the farmer's best dollar earner, and butter the poorest, butter production has been reduced and sales of milk in fluid form have increased. Consequently, the price of butter has advanced to within striking distance of the post-World War II peak of 89 cents per pound, but so far has been unable to pierce that earlier ceiling. A strong deterrent, however to further sharp advances is the competition offered by margarine, which is retailing at one-third to one-fourth the price of butter. Moreover, seasonally some decline should occur in the spring months.

Rosin prices have held up despite a reduction in apparent consumption below the unusually high rate attained in 1950. Production in the meantime has been maintained and the firmness in price is largely the result of large amounts of rosin being placed under Commodity Credit Corporation loans.

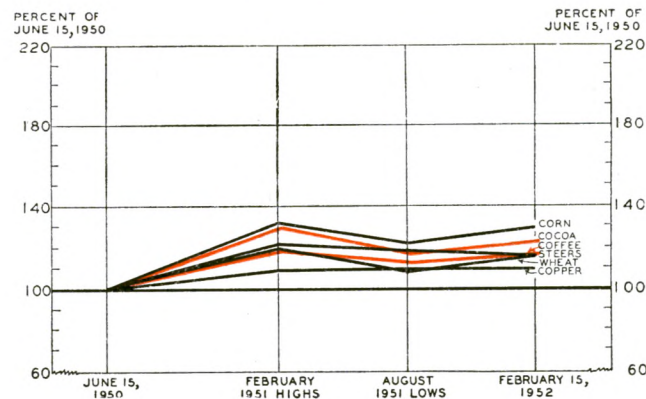
gain, near-record levels. If all 28 commodities had conformed to the pattern of these six, the aggregate index would be knocking at the door of the year-ago peak, instead of slipping into lower ground.

Four of the six, copper, cocoa, coffee, and wheat, are strongly influenced by world demand and supply conditions (like lead and zinc) rather than by purely domestic considerations. The other two, corn and steers, are commodities whose prices are determined almost exclusively by domestic conditions of supply, demand, weather, and other agricultural factors.

The price of copper has remained unchanged at the ceiling ever since the imposition of price controls in January 1951 whereas ceilings on lead and zinc were revised in October, allowing prices of those two metals to rise. Copper is probably in even greater demand than lead and zinc and in that sense actually belongs in the preceding group of relatively strong commodities. Copper sold as high as 55 cents per pound in free world markets last summer but recently it has been quoted at about 35 cents which is still about 40 percent above the ceiling price in this country. Further evidence of the easing demand for copper is found in Chile's recent offer to sell to the United States that portion of its supply which it has been reserving for sale in world markets at premium prices.

The price of cocoa headed downward late in 1951 and reached a low of 28 cents per pound or 10 cents below the O.P.S. ceiling. Early crop reports foretold a harvest which would satisfy all ordinary demand. As the season progressed it became clear that the crop would not be nearly as large as anticipated. A recent estimate places world production during the current season at 650,000 tons, almost a postwar low and 17 percent less than last year. Prices are quite sensitive to changes in the estimates

SIX STEADY COMMODITIES



... these six commodities have been relatively immune to the factors which pushed the combined index to a new low in recent weeks, and in fact are at or close to their post-Korean highs.

NOTE: Red lines indicate that more than half the country's needs are imported.

The Steady Commodities

Abetting the foregoing four strong commodities is another group of six which, while not showing spectacular strength, have nevertheless managed to hold, or re-

of world demand and supply and the U. S. is entirely dependent upon imports of this commodity, primarily from British West Africa and Brazil. At mid-February cocoa at New York was approximately two cents per pound below the ceiling price.

With respect to coffee prices, marketing controls and price support programs in Brazil have been instrumental in maintaining prices at the current level. Poor growing weather has prevented the building of surplus stocks which might cause price maintenance operations to collapse as they have in the past. Lower prices do not appear to be an early prospect.

Corn and wheat typify the general firmness in grains. Adverse weather in some parts of the corn-belt last year reduced the output of this grain when livestock numbers were rising to a near-record level. Large carry-over stocks prevented an acute shortage this year, but prices firmed and have remained close to a four-year high.

Although extensive losses of wheat occurred in the Southwest last year there was no immediate alarm since the crop, totaling nearly one billion bushels, was adequate to meet expected demand after allowing for both anticipated exports and domestic consumption. Carry-over stocks of about 400,000,000 bushels (including C.C.C.-held wheat) gave added assurance of ample supplies. Later in the year it became apparent that crop failures in two of the four major wheat exporting nations, Argentina and Australia, were forcing reductions in exports by those countries. Argentina may even have to import some wheat this year. The importing nations which normally depend upon Argentina and Australia are now turning to the U. S. and Canada for their wheat requirements. While such sales will not exhaust all supplies in this country, they serve as a price stimulant and quotations recently reached a 4-year high of \$2.57 per bushel (No. 2 hard, Kansas City).

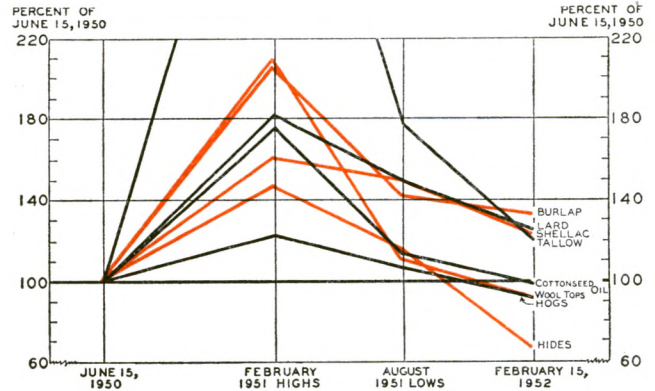
With regard to a possible recovery of cattle prices, high personal incomes have spurred the demand for beef as well as for other meats. Stockyard prices of steers may weaken somewhat during the next few months as the record number of cattle on feed begins to move to market.

The Weak Commodities

In contrast to the ten commodities enumerated above are at least eight which have experienced pronounced weakness over the past year and therefore have been primarily responsible for pushing the over-all index down toward the pre-Korean position. If all commodities had behaved as these eight did, the price level would be back down where it was when South Korea was attacked in June, 1950. The spectacular war-scare boom would have been completely canceled out.

Three major imports are found in this group.

EIGHT WEAK COMMODITIES



... it is these eight commodities which have been primarily responsible for the break-through on the downside. Four of them are quoted at prices lower than in June 1950.

NOTE: Red lines indicate that more than half the country's needs are imported.

Wool, which more than doubled in price following the outbreak of hostilities in Korea, subsequently had all of this gain wiped out when consumer and armed-forces demand failed to measure up to expectations and the textile industry depression was extended to include woolens. Unless consumption of wool increases this year the estimated world production is expected to exceed use by about 10 percent, the first surplus of the postwar period.

Production of shellac in India compares quite favorably with output in previous seasons. Prices usually tend to become firmer around this time of the year because of the normal increase in consumption with the coming of spring. Instead, quotations have continued to weaken. Consumers appear to be working off large inventories accumulated during late 1950 and early 1951 but synthetics are also replacing shellac in many of its former applications. Total industrial sales of paint, varnish, and lacquer last year exceeded 1950 by about eight percent, indicating no decline in over-all demand for such products.

Burlap quotations began to skid quite recently. One of the main factors in the price of burlap since November, 1950, has been the Indian export duty which amounted to 8.9 cents per yard on one key construction. Since that time the spot price at New York has varied from a high of 35 cents to a low of 22 cents. At the latter price, the tax amounted to well over one-third of the cost of burlap. On February 18, however, India cut the duty in half and some of the declines in the spot market may have represented dealers' discounting this anticipated reduction. Consumption of burlap had fallen by about fifty percent during 1951. Some action was deemed necessary to prevent permanent loss of markets. Out-

"Plant and Equipment" Expenditures by Agriculture

THE rate at which private enterprise spends money for new plant and equipment has long been recognized as an important factor in business fluctuations. It has been quite common practice, however, to think almost exclusively in terms of industrial expansion and construction when, as a matter of fact, one of the largest single elements in the picture is agricultural spending for such purposes. For many years farm investment has been greater than the total comparable expenditures by electric and gas utilities, mining, railroads, and all other transportation industries combined.

The all-inclusive group of manufacturing industries consistently spends more than farmers, but no individual industry within the manufacturing category, however, even approaches farms in new capital outlay. The combined expenditures of the three largest manufacturing industries (petroleum, chemicals, and steel) currently account for considerably less than that of farms alone.

Farm capital expenditures⁽¹⁾ accounted for one-fourth of the total outlay in 1950 representing a ratio of one to three between farm and nonfarm. They probably amounted to about 22 percent of the total last year. At no time in more than three decades has it fallen below one-tenth of the total, and that low level occurred only in the midst of the Great Depression. This is in decided contrast to the railroad industry, for example, which represented less than 13 percent of the total during most of the prosperous 1920's.

Expenditures Linked to Cash Receipts

The important agricultural segment of business-generating expenditures depends in some minor degree upon agriculture's "parity" position, and perhaps upon actual or prospective net income. The major determining influence, however, seems to be gross cash receipts from marketings. The closeness of the relationship is illustrated in an accompanying chart which shows that for many years, out of each \$10,000 of cash receipts, farmers have tended to spend around \$1200 to \$1300 for buildings, machinery, and other capital improvements. The ratio was slightly higher during 1910-1920, and somewhat on the lower side during the "profitless" years of the 1920's and for some years thereafter. During World War II expenditures for capital goods were extremely small in relation to record high cash receipts for the simple reason that the desired products were available only in very limited amounts.

Since the end of the war, expenditures on agri-

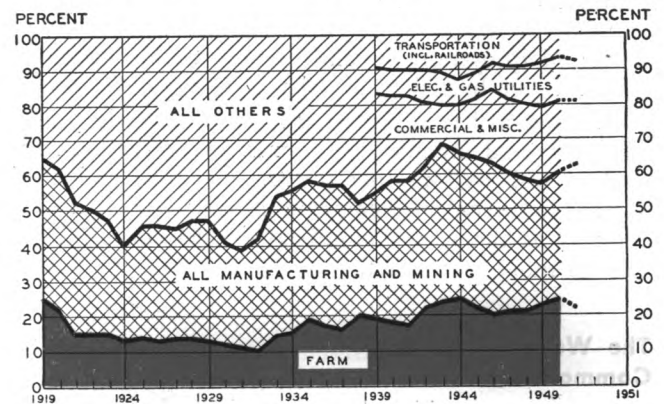
cultural plant and equipment (exclusive of land) have risen to record high levels, not only in actual dollar amount, but more significantly, in relation to cash receipts. In 1950, such expenditures represented more than 21 percent of cash income and last year the proportion was little, if any, smaller.

If current farm capital expenditures were cut back to reflect the usual relationship with cash receipts, it would have the same effect upon total aggregate capital expenditures (farm plus nonfarm) as would the complete elimination of railroads and mining or a reduction of over one-fifth in all manufacturing industry expenditures reported in 1951.

Perhaps the long run "normal" (12½ percent) ratio between the expenditures and receipts has become obsolete. Several developments may prove influential in keeping future farm expenditures at a proportionately high level, particularly for machinery and equipment. In the process of mechanization, farmers have, in effect, torn down the bridges behind them. There can be no return to self-sufficient "horse farming" as there are no longer enough draft animals to do the job. Also, animal power, even at its 1920 peak, would probably not enable farms to provide adequately the food and fiber needs of a sharply growing population.

The declining trend in farm population is also a significant factor in this respect. Labor is being re-

PLANT AND EQUIPMENT EXPENDITURES BY FARMS AND NONFARM INDUSTRIES (U. S.)



... during 1951, for each \$78,000,000 of plant and equipment expenditures, by nonagricultural enterprises, another \$22,000,000 was spent by farmers for buildings, machinery, and other capital improvements. Agriculture's role in this respect is greater than all railroads and utilities combined.

Source of data: "The Farm Income Situation", Bureau of Agricultural Economics (July-August, 1951), Table 14, page 28; and "Business Statistics, Statistical Supplement to the Survey of Current Business", Bureau of Foreign and Domestic Commerce (1951 edition), page 9. Non-Farm Expenditures previous to 1935 derived from data in the "Federal Reserve Bulletin", (September, 1939).

(1) Including operators' dwellings, which generally account for 1/10 of farm total.

placed by mechanization which requires greater expenditures of capital. A large scale population movement back to the farm could temper this situation but it is not likely to occur on a significant scale.

While it seems highly unlikely that expenditures will soon, if ever, shrink to the former ratio of 12½ percent of receipts, there are several indicators which suggest that the postwar peak in farm capital expenditures may not hold indefinitely. During the war years new tractors, combines, cornpickers, balers and other prominent farm machinery, equipment, and building materials were difficult or impossible to obtain in desired quantities. Farmers, therefore, spent a much lower proportion of their higher cash incomes on capital improvement during those years. The "cash receipts-capital expenditures ratio" actually dropped very nearly to the record low levels which prevailed during the depression years.

It was the combined effect of wartime shortages together with the development of new and improved equipment which produced a great boom in plant and equipment expenditures which began in 1946 and was still under way at the end of 1951.

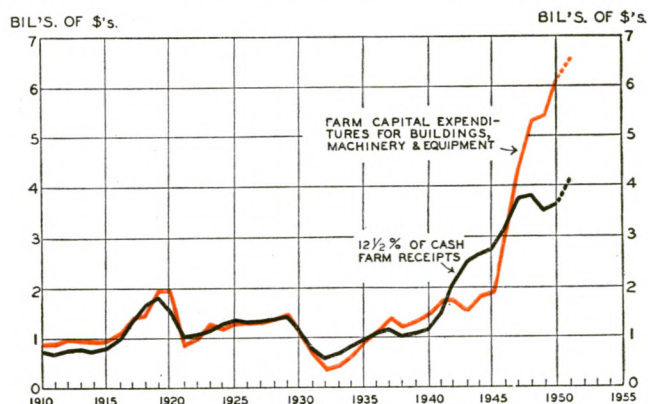
Part of the postwar farm demand has been due to replacement of worn out conventional types of production goods, and part has been due to the advent of larger scale mechanization and the introduction of completely different types of machines such as the self-propelled corn pickers, field choppers, speed sprayers, hydraulically controlled tools, and more recently the cotton picker.

The five years of war-depressed expenditures have now been followed by five years of above-normal expenditures which suggests that at least a substantial part of the deferred demand has been met. Unless a new "normal" receipts-capital expenditure ratio is going to be established at a level nearly two-thirds higher than that of the past, it would appear that the gap between the two might tend to close sometime during the next few years. This could come about by sharply increasing receipts (without a corresponding increase in capital expenditures), or sharply decreasing expenditures, or a combination of the two.

A not uncommon assumption is that farm receipts will not remain at current high levels indefinitely. If so, equipment expenditures will not necessarily shrink immediately. In the past it has taken more than one year of declining receipts to bring about a reduction in capital expenditures partly because of the fact that much of the spending occurs early in the year before receipts are ascertained. However, when cuts in capital outlay eventually did occur, they were much sharper than the drop in receipts.

Several examples of this behavior are evident during periods of rising receipts and expenditures between the two World Wars. For instance, receipts started to level off in 1919 and fell a total of 44

FARM CAPITAL EXPENDITURES COMPARED WITH CASH RECEIPTS* (U. S.)



for many years, out of each \$10,000 of cash receipts, farmers tended to spend roughly \$1,250 on machinery, buildings, and other capital improvements. In postwar 1950, however, such expenditures reached an all-time high of over \$2,100 per \$10,000 of cash income.

* Including government payments.

Source of data: "The Farm Income Situation", Bureau of Agricultural Economics, (July-August, 1951), Table 7, page 21, and Table 14, page 28.

percent in 1920 and 1921. In this same sequence expenditures rose sharply the first year, continued at this high level the second year, and dropped 50 percent the third year. As another example, in 1926 receipts dropped and then leveled off in 1927, whereas, expenditures increased one additional year before leveling. A review of the situation immediately before the Great Depression shows that receipts increased in 1928, remained the same in 1929, and dropped 58 percent in the next three years; whereas, expenditures increased both in 1928 and 1929 and then fell 79 percent in the following three years. In still another period receipts failed to gain in 1937 and declined 11 percent in 1938, but expenditures showed a 24 percent gain in 1937 and then dropped 14 percent in 1938.

A sequence of this kind may have been about to emerge prior to the Korean hostilities. Cash receipts failed to show a substantial gain in 1948 and actually dropped sharply in 1949. Expenditures were not reduced the first year but had started to level off by 1949. But following the Korean War, receipts rose rapidly and in 1951 both receipts and expenditures reached the highest level on record.

Other Expenditure "Guides" Another element has entered farm management plans which may deter some capital improvement spending.

Short run cash production costs are gradually consuming more of the cash receipts⁽²⁾, thus tending to limit net income despite a record high

(2) Cash farm production expenses are now three and one-half times larger than capital expenditures and consume two-thirds of the cash receipts.

volume of cash sales. In an effort to maintain net returns, farmers may pay more careful attention to care and maintenance, as well as to means of attaining more full and efficient use, of existing capital resources. The need for new capital per unit of produce marketed could be lowered by these practices. The appearance of more tool sheds and farm work shops equipped with welders and similar repair tools probably indicates that farmers are launching a better maintenance program, whereas, sharp increases in average farm acreage are indicative of the desire for more complete utilization of capital.

Capital expenditures do not appear to be as closely related to net income as they are to cash receipts. A recent striking example of short range disparity is illustrated in the period from 1947 to 1950, when net income of agriculture declined for three consecutive years for a total of 26 percent, while capital spending rose for three consecutive years, for a total of 41 percent. Presumably the slow expansion of cash receipts was more influential in determining capital expenditures than was the slow decline in net income.

Allowing capital equipment to depreciate or be liquidated would be a frustrating alternative to declining net incomes in present day mechanized agriculture. It has posed a real problem to many high cost producers during the postwar years and carries the potential for more extensive difficulty.

Until recent years, the parity ratio has also been a fair indicator of the direction of farm capital expenditures. It does not serve as a guide to magnitude, however, and has been generally unreliable for this purpose in the postwar period. For example, between 1947 and 1950 the parity ratio declined from 115 to 100, while over the same interval capital expenditures rose 40 percent, reaching \$6 billion for the first time. This was still due partly to unfilled war shortages. A reliable forecast of the parity ratio during that period could not have been relied upon as an indicator of the amount of capital expenditures to be expected.

The physical magnitude of the postwar agricultural capital expansion program is somewhat over-

stated in the accompanying chart because of sharply increased prices. For example, tractors are about 90 percent higher in price than before World War II and the cost of materials needed to construct a typical 200-hen poultry house is well over two and one-half times greater. Physical inventories of durable production capital goods, however, have shown substantial increases. Tractor numbers on farms are more than double that of prewar and the physical volume of other machinery and equipment is probably rapidly approaching three times the prewar level. New expenditures on buildings have also been much greater than that shown simply by higher prices. Building material prices in 1950, as an example, were about 120 percent above prewar, whereas new farm investment in buildings was 483 percent greater.

Farm capital expenditure data used herein were published by the Bureau of Agricultural Economics in a recent issue of "The Farm Income Situation". Business plant and equipment expenditure data are contained in the 1951 edition of "Business Statistics" published by the Bureau of Foreign and Domestic Commerce.

ANNOUNCEMENT

The Board of Governors of the Federal Reserve System has published a technical study, *The Development of Bank Debits and Clearings and Their Use in Economic Analysis*, by George Garvy of the Federal Reserve Bank of New York. The purpose of the study is to provide a foundation for better understanding of debits and the velocity of deposits and consequently to furnish a basis for evaluating the usefulness of these series for different types of economic analysis.

Single copies of the pamphlet may be purchased for 25 cents. Group purchases of 10 or more for single shipment are available at the rate of 15 cents each. Orders should be sent to the Division of Administrative Services, Board of Governors of the Federal Reserve System, Washington 25, D. C.

COMMODITY PRICES

(CONTINUED FROM PAGE 3)

put in India is now increasing and order appears to be returning to the important dollar-earning Indian burlap market.

The decline in hide prices to the lowest since 1946 is accounted for only in part by lagging shoe sales. During 1951 for the first time in history the proportion of soles made of synthetic materials exceeded the use of leather. Demand and prices were easing last year even though production of hides was curtailed. The increase in the slaughter of cattle this year will result in a significant increase in supplies. Government controls over the distribution of hides were removed late in February when it became apparent that they were no longer necessary.

The decline in cottonseed oil, lard, and tallow is representative of the weakness that has been apparent in fats and oils for several months. This general easiness is the result of ample supplies and some competition with substitute materials. Tallow, an important ingredient of soap, must compete with the new popular chemical detergents. Cottonseed oil production increased markedly last year and for many of its uses, soybean oil is a nearly perfect substitute. Lard supplies are fully adequate as a result of the current near-record hog slaughter.

Hog price movements are generally of a seasonal nature. The marketing of the second largest pig crop on record, however, has kept prices only moderately above the seasonal low long past the time when quotations could ordinarily be expected to be moving upward.

Other Areas of Potential Weakness

The price of one commodity (not charted) also weakened during February after a considerable period of stability. During the first two weeks of February rubber prices declined sharply in foreign markets from 48 cents per pound to 37 cents compared with a relatively small decline in domestic prices from 52 cents to 50½ cents. Changes overseas have been reflected belatedly in U. S. markets because of the General Services Administration's role as sole importer of rubber to the U. S. The agency was reluctant to lower its selling prices until stocks obtained earlier at the higher prices had been disposed of, hence there was a lag in the adjustment in domestic prices. The current G.S.A. quotation will remain unchanged until April 1, at which time a reduction is expected. The attainment of the stockpile goal is now within sight, according to official sources, so demand from that source will drop. Production of natural rubber is expected to exceed consumption by about twenty percent this year. With quotations approaching more reasonable levels, rub-

ber procurement was turned back to private industry late in February with the provision that the government will continue to be the sole supplier of natural rubber until the end of May. Private interests may contract now for rubber to be delivered in June and the G.S.A. will be out of the picture by July 1.

Other domestic commodities (not charted) such as raw cotton and cotton print cloth as well as flaxseed also have shown visible tendencies of weakness. Sugar also has receded again to a point only nominally above the post-Korean low to date. In short, the renewed decline of basic commodity prices in general seems to stem largely from lack of demand for agricultural products used in industry, ranging all the way from rubber to hides, wool, and tallow. Unless some revival is destined to occur soon in the production of nondurable consumer goods (or an international scramble for materials recurs), no early recovery in the price of these 28 basic commodities is in sight.

Position in July, 1951 In this connection, reference may be made to an article in the July, 1951, issue of this *Review* in which a number of commodities were classified in accordance with relative scarcity or abundance as implied by price behavior up to that time.

Of the five "scarcest" commodities so designated in July, 1951, only one—coffee—still warrants that description today. But of the six described as "moderately scarce", at least four—copper, zinc, steel scrap, and steers—continue to qualify as such in the current description.

Of the eight classified as "moderately abundant" in July, 1951, the following four—lead, wheat, butter, and cocoa—have strengthened in demand (or fallen relatively shorter in supply) in the intervening months.

But of the five commodities described as "most abundant" last July, only corn subsequently reversed the field and proceeded to rise to a point not far below the high of a year ago, because of adverse weather conditions at harvest time. The remaining four continued to be "most abundant".

These various shifts in position reaffirm the principle that "scarcities" can be remedied more quickly than the obverse condition of "over-abundance" can be alleviated. When a commodity can be described as scarce, because of its price behavior in relation to other commodities, it becomes vulnerable and susceptible to substitution, to increased production and other factors which have bearish implications. On the other hand, a commodity which has become abundant—in a relative sense—seems to require a longer period of time in which recovery may take place.

Lightweight Aggregates for Concrete

by CLYDE WILLIAMS, *Director, Battelle Memorial Institute*



There seems to be practically no limit to the products that are being made, or will be made, to order by modern technology. Consider anti-knock gasoline, the many synthetic fibres, and possible ceramic linings for rocket motors, to mention only a few examples.

Another "tailor-made" product is receiving wide acceptance in the construction industry. This time it is concrete made from lightweight aggregate materials such as expanded clay or shale, instead of from the conventional gravel or crushed rock materials, commonly termed heavy aggregates. More extensive nationwide use of these relatively new building materials is expected as the benefits to be derived from their use become better known and appreciated.

Lightweight aggregate concretes can be "tailor-made" so that economic and design advantages can be realized from their properties, without losing necessary strength. In addition to lighter weight, these properties include "nailability", ease of cutting or channeling, and capacity to absorb sound, reflect heat, and resist fire.

"Tailor-made" aggregates can be made from a variety of materials. The most frequently used materials are clay or shale, wastes from coal mines, and perlite, pumice, and vermiculite. Concretes made from these materials vary in weight from one-fifth to three-fourths the weight of gravel or crushed rock aggregate concrete, which averages about 150 pounds per cubic foot.

It must be realized that lightweight aggregate concretes are not going to replace heavy aggregate concretes. Their increasing importance, for the present at least, is based on use for structural framing, where there are limitations in weight as in bridges and multistory buildings. They are also finding wider acceptance for applications where sound-proofing, fireproofing, and heat insulation is particularly vital, and for floor and wall fillings where the extra expense and weight of heavy concrete is unnecessary to do the job.

Outstanding among recent successful uses of lightweight concretes is the office building of a large life insurance company in Los Angeles, California. This building was specially designed to resist earthquake forces. Another example is the San Francisco-Oakland Bay Bridge. Incidentally, it was reported that use of lightweight concrete for the bridge saved the builders an estimated three million dollars in reinforcing steel.

Lightweight concretes have not yet been used extensively as a general purpose building material for home dwellings. Wood, brick, and stucco still have a firm grip on this market. Some expansion in the use of lightweight concrete materials for special purposes, however, is in prospect. A New Jersey manufacturer, for example, is making a pre-cast vermiculite plank that has been approved for roof construction use in all five boroughs of New York City. The use of perlite instead of sand in plaster ground coats is becoming increasingly popular with plasterers. They find

the new material "works" well, and is easier to handle because of its light weight.

The expression "it's not what you do but the way that you do it" is particularly true in the making of lightweight aggregates. Clay or shale, for example, is put through a furnace. The heat causes expansion or "bloating" to a cell-like structure. Chilling this expanded material at the proper point is necessary to preserve the cell-like structure. If the heating is overdone, or if chilling is not done at the right moment, strength and other desirable properties will be lost.

Clay and shale seem to offer the most promising potentialities for more extensive development of the lightweight aggregate concrete industry on a nationwide scale. They are available in sizeable quantities in every state of the Union. Consequently, processing plants can be set up close to both raw materials and consuming markets. Transportation costs can thereby be minimized.

Where plants processing clay or shale for brick, pottery, or tile are already established, the addition of a lightweight aggregate unit can create new uses for already available raw materials. According to a recent study made by Battelle, the Ohillco region of southeastern Ohio, famous for its clay products, falls into this category.

Although the number of expanded clay aggregate plants has jumped in recent years, many states are still without them. According to a recent count, there are 23 plants in the nation located as follows: Texas, 6; Illinois, 3; Missouri, California, Ohio, and Louisiana, 2 each; and New York, Oregon, Tennessee, Utah, Virginia, and Washington, each 1. Our best estimate of the use distribution of expanded clay or shale shows that 70 per cent goes into concrete block, 25 per cent to structural concrete (roof, pier, floor, and foundation fills), and 5 per cent into pre-cast concrete shapes.

Perlite and vermiculite do not share the advantage of wide distribution enjoyed by clay or shale. The main concentration of perlite is in the western states. Vermiculite is mined principally in Montana and South Carolina. Perlite and vermiculite, furthermore, are not generally considered to be competitive with other lightweight aggregates whose principal use is in making concrete. Perlite and vermiculite have had their growth in such uses as plaster, ground coats, floor filling, and heat insulation.

For many years, ceramic scientists, architects, and building engineers have been searching for lighter building materials than those conventionally in use. By resorting to unconventional raw materials, they have come up with lighter weight concretes that can do certain jobs as well as, or better than, concrete made from gravel or crushed rock aggregates. They have also developed more efficient materials for special applications such as heat insulation, and sound absorption. More extensive nationwide use of these relatively new materials is in the offing as their advantages are more generally realized.

Editor's Note—While the views expressed on this page are not necessarily those of this bank, the *Monthly Business Review* is pleased to make this space available for the discussion of significant developments in industrial research.