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CHAPTER V

AUTOMOBILES, GASOLINE AND RUBBER (Group III)

GENERAL CHARACTERISTICS

In cotton textiles we have considered a group of commodities that is subject to seasonality in respect of both the demand for its finished products and the supply of its necessary raw materials. The automobile, to which we now turn, has constituted, during the recent decade, the most important single commodity characterized, like textiles, by conspicuous seasonal variations in final demand; but, unlike textiles, the automobile has been practically undisturbed by climatic or conventional seasons in the supply of its raw materials—rubber, hardwood, steel, glass, leather. Consequently, the automobile industry is representative of all industries in Group III. In these, manufacturing may proceed at the even pace demanded by technical efficiency without encountering any problem as to the supply of raw materials. If, however, production is allowed to fluctuate in accordance with seasonal demand, raw materials must be stocked by someone to assure delivery to manufacturers at peak seasons. To illustrate how this seasonal variability of final demand affects the industries in Group III, this chapter is devoted to an examination of the seasonal swings observable in the production, sales and stocks of automobiles and goods associated with them, such as rubber and gasoline.

The detailed statistical analysis whose results are shown in Charts 19 through 25 and in Tables VII and VIII indicates clearly the conspicuous character of seasonal variations in purchases of automobiles by consumers. But interesting differences appear from one group of cars to another, depending upon the price of the car, the economic standing of prospective purchasers and the relative importance of pleasure and business demand. Among passenger cars the lower price

groups tend to show more marked seasonal swings than the higher price groups. In purchases of trucks seasonal variations are less appreciable than in passenger cars, but there is a distinct difference in respect of pattern and amplitude between heavy trucks, serving primarily construction, and light trucks, used by farmers, manufacturers and distributive trades.

Seasonal changes in purchases of cars by consumers have their source in the concentrated use of cars during limited seasons of the year. The purchase of gasoline, and to a lesser extent also of parts, reflect directly the use of cars, and the seasonal analysis of these series yields quantitative measures of the influence of original seasonal factors upon demand. These seasonal variations are shown to be of smaller amplitude than those in purchases of new cars. Since purchases are in the nature of additions to a large body of already existing equipment they tend to be concentrated in time and therefore to show large percentage variations from a smaller absolute base.

The seasonality in consumers' purchases of cars that derives from the greater use of cars during limited periods of the year makes, in its turn, for seasonal variations in the output of automobiles and of such components as rims, tires and original equipment. True, seasonal variations in automobile production are of lower amplitude than those in purchases by users. But the difference is not large, and the automobile industry remains a most important branch of manufacturing subject to violent seasonal disturbances.

These disturbances are passed on also to some of the raw materials. Those related closely to the automobile industry, rubber, upholstery leather, malleable iron, show variations that appear to be imposed by the seasonality of automobile production, although in none is the seasonal amplitude as great. The technical nature of the productive process of gasoline, one important material directly connected with the use of automobiles, renders adaptation to fluctuations in the use of cars difficult; consequently, variations in stock, not in production, take care of fluctuating demand. Total production of other materials, of which only a minor fraction is used in connection with automobiles, gives little evidence of the seasonality of automobile production.

Most of the raw materials used in automobiles are available in a fairly continuous supply, and if the industry remains one of the branches of production in this country most definitely affected by seasonal variations, the basic reason is the pronounced consumers' demand at the opening and during the early part of the outdoor season. In recent years the greater simultaneity in announcing new models and an increased emphasis on the style element have widened still more the seasonal swing in consumers' purchases. Production for stock would in consequence involve capital investment of large proportions. Such a production policy was discouraged in recent years by a downward trend in prices of cars, by the rapid rate of improvements and the correspondingly high rate of depreciation of old models, by the existence in later years of the post-War period of surplus equipment and the availability of cheap funds for extending equipment. Under these conditions the manufacturers found it advisable to attempt a more precise adaptation of the rate of production to the rate of demand. This served to increase seasonal instability in the rate of activity both of the automobile industry and of the industries closely related to it.

DETAILED COMMENTS

Constant seasonal indexes are used, as heretofore, but in view of the rapid changes in the industry during recent years, they afford, perhaps, a less characteristic and reliable description than they do for other, more stable industries.[1] For this reason many of the generalizations and inferences suggested below, especially in regard to the seasonality of production and registration of passenger cars, must be considered as

[1] Some of these important changes are suggested by Miss Aryness Joy of the Research Division of the Federal Reserve Board: (1) The January automobile show in New York City and the growing tendency, especially among medium and high price cars, to bring out new models just before that show, thus stepping up production for display purposes; and the recent attempts of the National Automobile Chamber of Commerce to secure agreement on the timing of the introduction of new models. (2) In the years 1927-30 any 'seasonal' is severely affected by the cyclical recession in the winter of 1927 and depression in the winter of 1929, accelerated again in 1930. This recurrence of depression at the end of the year exaggerated the winter decline, which is probably not entirely seasonal. (3) In the same period the introduction of a new model by Ford, although a non-recurring and therefore non-seasonal event, nevertheless accidentally accentuated the winter decline and the spring rise.

highly tentative. For the same reason, not only are average seasonal variations from link to link treated but also temporal changes are emphasized.

1. From Automobile Production to the Use of Cars by Their Owners

a. *Automobile Production*

The series called production of automobiles in the United States actually records ' factory sales'. But since it may be assumed that the final assembly of cars very closely precedes factory sales, the latter may be taken to represent the former, at least for the purpose of seasonal analysis.

An essential similarity characterizes the seasonal indexes for the two periods 1919-25 and 1925-31, that is, each has a peak in spring and a trough in December. But interesting changes take place in both pattern and amplitude. In the earlier period the seasonal peak occurs in May and June and there is a secondary high point in October. In the later period the peak shifts to April and May, the secondary peak in October disappears and the trough at the end of the year becomes much more prominent. The seasonal amplitude increases materially, as is shown in Table VII.

The spring shift may be attributed in part to improved roads, which make feasible earlier use and consequently earlier purchase of cars; to a larger sale of low price cars to buyers who wish to enjoy a long riding season, thereby creating an earlier concentration of demand for new cars; to a more extensive use of cars for business purposes; and to the stimulation of the January automobile shows. The increase in amplitude is probably due to the more widespread use of cars by masses of people whose demand is likely to be more influenced by the opening of a favorable driving season than was the demand of the relatively rich; to the greater synchronism in announcement of new models; and possibly during recent years to the growing over-equipment of the industry.

When total passenger car production is divided into groups according to make, the variety of movement underlying its seasonal pattern becomes clear. Seasonal production indexes, available for four makes for 1925-29,[2] separate manufacturers

[2] E. S. Smith, *Reducing Seasonal Unemployment* (New York 1931) p. 267.

CHART 19

SEASONAL MOVEMENT OF AUTOMOBILES: PRODUCTION AND SALES

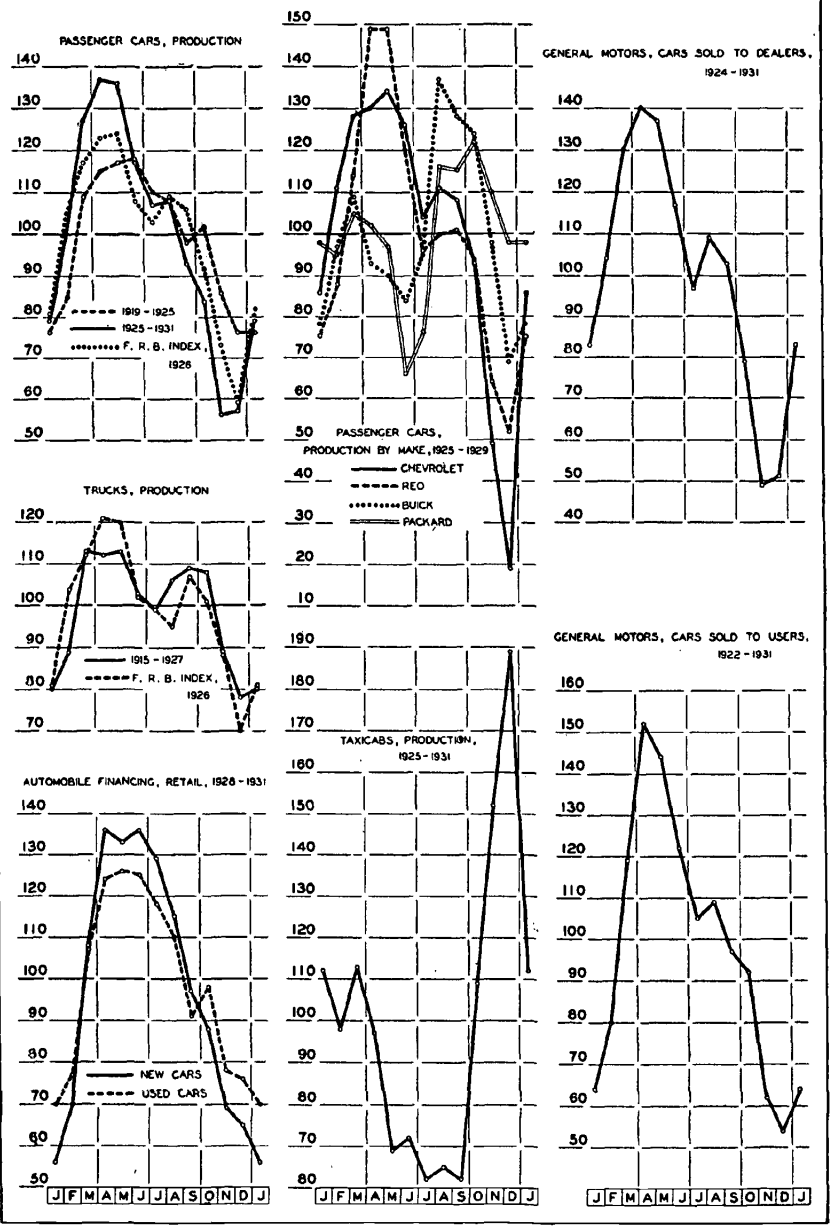


TABLE VII

Amplitude of Seasonal Variations

Production, Sales, Registration and Use of Automobiles

Series	Average Deviation	Range
PRODUCTION		
Passenger Cars, 1919-25	13.2	42
1925-31	21.9	81
1926, F. R. B. Index	15.8	65
Trucks, 1915-27	10.8	35
1926, F. R. B. Index	11.2	51
Taxicabs, 1925-31	29.2	127
Passenger Cars, by Make, 1925-29		
Chevrolet	25.4	115
Reo	22.0	97
Buick	16.2	68
Packard	11.7	56
SALES		
General Motors Sales		
Cars Sold to Dealers, 1924-31	23.4	91
Cars Sold to Users, 1922-31	25.2	98
Automobile Financing, Retail, 1928-31		
New Cars	26.0	80
Used Cars	18.3	56
REGISTRATION		
New Passenger Cars		
Total Registration, 1925-31	26.9	94
By Price Group, 1925-29		
First Highest	23.8	91
Second "	26.8	92
Third "	29.3	100
Lowest	26.4	94
By Make, 1926-31		
Highest Price Group		
Lincoln	22.0	97
Cadillac	21.0	84
Packard	24.5	91
Medium High Price Group		
Nash	27.5	97
Buick	24.3	102
Chrysler	27.3	104

TABLE VII (CONTINUED)

Series	Average Deviation	Range
Medium Price Group		
Hupmobile	27.7	99
Dodge	28.2	104
Hudson	28.0	101
Low Price Group		
Ford	26.8	98
Chevrolet	28.3	103
Essex	35.4	122
New Trucks		
Total Registration, 1925-30	18.8	74
By Make, 1926-31		
Mack	22.8	83
Chevrolet	21.2	81
EXPORTS		
Passenger Cars, 1923-31	17.2	58
Trucks, 1923-31	9.9	41
USE OF CARS		
Gasoline		
Domestic Consumption, 1918-25	15.8	58
1926-30	11.3	41
Retail Distribution, 41 States, 1922-31	12.2	44
Accessories, Shipments, 1925-31	9.4	34
Replacement Parts, Shipments, 1925-31	8.3	28

into two classes: those whose production is at peak in the spring and those whose production is at peak in the autumn. Chevrolet and Reo have very conspicuous spring peaks; production then declines markedly to deep troughs in the winter. For the more expensive makes, Buick and Packard, the autumn peak is much more conspicuous than the spring peak. Obviously, the seasonal swing in total passenger car production is a composite of the high spring pattern in a large group of cars and a relatively high autumn pattern in a small group of some of the more expensive makes. This combination served to produce the two-peak feature of the production curve.

The output of taxicabs was originally included in total passenger car production but has been reported separately since 1925. The new group is very small so that its omission

does not affect the comparability of the two indexes of total passenger car production. Taxicab output is at a high level from October through January with a peak in December; low levels prevail in summer. Its pattern is thus quite different from that in total automobile production, apparently because taxicabs, unlike privately owned automobiles, are used chiefly in winter. Most of them are made in plants engaged exclusively in their manufacture and are produced in quantity in the winter for prompt sale to franchise companies or independent taxicab owners. The increased winter demand is even reflected in a swelling of the ranks of taxi-drivers during that season.

The seasonal pattern in truck production is, on the whole, fairly similar to that in passenger car production but the secondary autumn peak is slightly more pronounced. The conspicuous difference between the two indexes is in the size of the seasonal swing. Both the much narrower amplitude and the more notable tendency towards a second peak in truck production are indicative of the business character of the demand for trucks as compared with the large element of pleasure demand for passenger cars. Although weather exercises a considerable influence on trucking and bus transportation, privately owned cars are much more appreciably affected. Truck production therefore has a narrower seasonal range and a greater tendency to reflect the spring and autumn peaks so characteristic of all business and farming.

b. *Automobile Sales*

The seasonal index of sales of General Motors Corporation cars to dealers bears close similarity to that in total passenger car production, showing, as does the latter, a peak in April and a trough in November. However, sales to dealers reveal a more prominent peak in August, probably because of the influence of autumn demand for Buicks and Cadillacs. The seasonal amplitude in sales to dealers is slightly wider than that in total passenger car production.

The seasonal pattern in sales to users, also from data available only for General Motors cars, is very similar to that in sales to dealers but the seasonal amplitude is again wider. Since the seasonal amplitude of automobile production (and presumably also of sales) has expanded during recent years

the measures of variability in Table VII probably understate the difference in amplitude between the indexes for sales to users and sales to dealers. This greater seasonality of consumers' demand as compared with sales to dealers, that is, with factory sales or production, is further confirmed below by data on car registrations.

A comparison of the indexes of sales to dealers and sales by them makes clear the rise in their stocks from January through March and the decline from April to December, with the exception of August, when stocks are constant, and September, when they rise slightly. These movements correspond to our expectations based upon the practices of the industry. Stocks rise during the interval between the announcement of new models and the peak in consumers' demand. The first rise should come then between January, when most announcements of models are made, and April, the primary peak in consumers' demand. A second rise is to be expected between August, when some models are announced, and October, the secondary peak in consumers' demand.

The seasonal swing in the flow of cars to users is also reflected in the volume of loans advanced in order to finance cars sold at retail. The volumes of loans for both new and used cars have been reported since 1928. In spite of the brevity of the period, the resulting averages seem to present a reasonably accurate picture of the seasonal variations (Chart 19).[3]

[3] "The automobile finance companies reporting to the Bureau of the Census include all companies of any importance, and we believe the returns cover about 90% of all the financing business done by finance companies. This, of course, does not include instalment selling of cars which are financed by the automobile dealers themselves, nor does it include some financing done directly by banks. . . . .

I believe the new car financing covered by these reports is the best existing series reflecting the seasonal effect in the retail sale of new automobiles. Of course, the General Motors reports on sales to dealers show accurately the seasonal effect in sales of the cars of that company, but there is not available any similar series covering the industry as a whole. Reports of new car registrations do not closely follow actual sales, for the reason that in most states the registration fee which must be paid by a new purchaser decreases at every quarter. And people buying cars near the end of a quarter tend to postpone registration until after the new reduced rate goes into effect.

The Bureau of the Census reports include the financing of trucks as well as of passenger cars, whereas the most readily available series on new car registrations relate to passenger cars only. Of course, the seasonal effect in retail sales, and therefore in retail financing, is quite a bit different from the seasonal effect in the production of automobiles." (From a letter by Mr. Milan V. Ayres, Analyst for the National Association of Finance Companies.)

Peaks in financing of both new and used cars occur in April, May and June, while the trough is in January. The seasonal amplitude of both indexes is appreciable. The average deviation of the seasonal index for the financing of new cars is very close to that for General Motors car sales to users. The seasonal amplitude in financing used cars is much narrower than that for new cars, in spite of the fact that the volume of loans for new cars is still more than twice the size of that for used cars. The explanation may be twofold: (1) the opening of the outdoor season, especially the announcement of new models, may exercise a greater influence upon the demand for new cars; (2) the cheaper second-hand cars, the demand for which is affected more conspicuously by the opening of the outdoor season, are bought for cash or financed primarily by the dealers themselves, not by the finance companies.

c. *New Car Registrations*

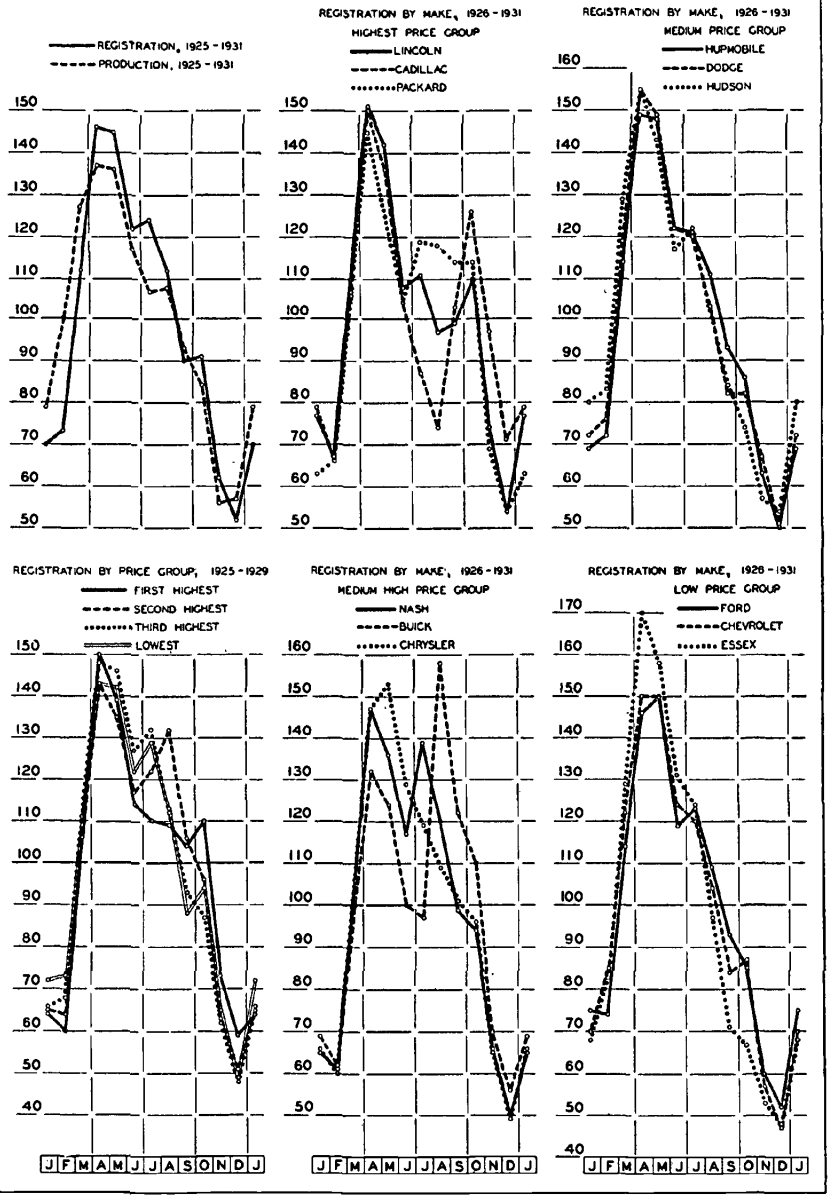
With the qualifications expressed by Mr. Ayres, a seasonal index of registrations of new cars is a reliable measure of the flow of automobiles to final domestic buyers. The index for registration of all new passenger cars (Chart 20) bears a striking similarity to that obtained for sales of General Motors cars to users, thus preserving in substantial identity the pattern that was first observed in passenger car production. The amplitude of the seasonal swing in registrations is, however, larger than that in production, although the difference is small as compared with the magnitude of both swings.

The flow of passenger cars to final buyers is described in greater detail by the data on new passenger car registrations by price group, reported for the years 1925-29 by R. L. Polk and Company. All registrations are subdivided into four price groups, ranging from the highest to the lowest. The relative size of these groups is indicated by the following average monthly registrations during 1928: highest group, 10,700 cars; second highest, 54,100; third highest, 73,100; lowest, 122,100.

Chart 20 indicates the close similarity of seasonal pattern in all four groups, the most conspicuous difference being the secondary peak in August in the second highest price group. Otherwise, all the series show the typical movement of passenger car production and sales: a rise to April, then a de-

CHART 20

SEASONAL MOVEMENT OF NEW PASSENGER CARS: REGISTRATION



cline which becomes precipitous after July or August in the low price groups, after October in the higher price groups. This difference corresponds to what was noted above concerning the output of the various makes and is confirmed below by a more detailed analysis of registration figures.

Although all the groups show similar seasonal patterns, there are interesting variations in seasonal amplitude. The highest price group shows the mildest seasonal swing, a reflection of the fact that the demand of the well-to-do is not as concentrated in those seasons when favorable weather exerts the utmost pressure upon the buying desires of prospective purchasers. The next two price groups show an increasing seasonal swing, but surprisingly enough the lowest price group has a milder amplitude than the one next to it. In this group of cars the wide range and the great variety of purchasers, many of whom buy cars for business purposes, may help to flatten the peaks and the troughs.

The registration data available for diverse types of passenger cars throw even more light upon variations in consumer demand. Twelve makes of cars were chosen to represent the various price groups for 1926-31: Lincoln, Cadillac and Packard for the high price group; Nash, Buick and Chrysler for the medium high price group (although several Chrysler models belong to the medium and low price groups); Hupmobile, Dodge and Hudson for the medium price group; and Ford, Chevrolet and Essex for the low price group.

The similarity of seasonal pattern presented on Chart 20 is much more striking than are the differences. With the exception of Buick, all have the familiar peak in April or May, declining but high levels during the summer and a trough in December. There are minor variations from this pattern in the high price group. There is a marked autumn peak in Lincoln and Cadillac registrations, and Packard registrations continue on a high level through October, while registrations for all other cars, with the exception of Buick, fall below 100 as early as September. The peculiar pattern in Buick—the peak of registrations occurs in August—is largely due to the manufacturer's practice of announcing new models in the autumn.

In respect of amplitude the more expensive cars show the mildest seasonal swing. At the other extreme, the lowest price cars, such as Fords and Chevrolets, which commonly have a combined pleasure and business use, show a seasonal swing in registrations milder than that for their group. The widest swing is in the Essex, a low price car used primarily for pleasure purposes and enjoying only a limited patronage.

For three of the four makes for which indexes of production were presented on Chart 19, Packard, Buick and Chevrolet, registrations also have been analyzed. A comparison of the production and registration indexes reveals clearly how the peculiar pattern in Buick production is reflected fully in the seasonal swing in registrations and how similar are the pairs of patterns in the other two makes.

In each make registrations of new cars show a wider seasonal swing than does production. But in Chevrolet the difference is rather insignificant, while Packard output is subject to a seasonal swing only half the size of that in new Packard registrations. There seems to be evidence here of a difference in policy, since marked stability of productive activity characterizes the more expensive make. According to their own announcement, the manufacturers of the Packard car have made a conscious effort to stabilize production and employment.[4]

Registrations of new trucks show a seasonal pattern similar to that in production, that is, high levels during the summer and a precipitous decline to low levels after October. But their seasonal amplitude is much wider, reflecting partly the much shorter period covered by the index for registrations. It seems safe to assert, however, that registrations fluctuate seasonally more widely than does production (Chart 21).

The indexes for Chevrolet and Mack truck registrations reveal that the seasonal swing in total truck registrations is formed by the combination of two different seasonal patterns, in which light trucks, which preponderate in number, are the stronger influence. In heavy trucks (Mack), which are used chiefly in the construction industry, the peak is unmistakably in May and is followed by a rapid decline

[4] See statement of A. C. Bennett, Office Manager, Packard Motor Co., before the Senate Committee on Education and Labor, *Hearings on Unemployment in the United States, December 1928–January 1929* (Washington 1929) pp. 69-75.

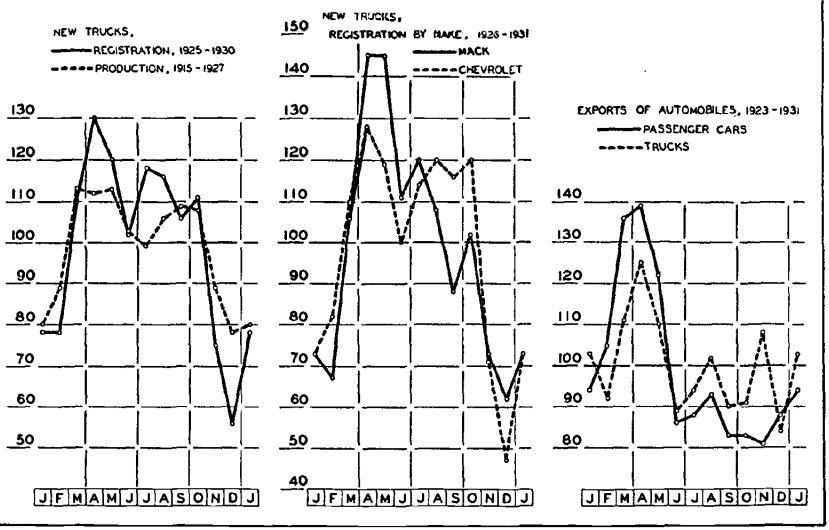
through the summer. The spring peak is attributable to the concentration in early summer of the initial phases of construction when heavy materials must be transported. In light trucks, which serve manufacturing industry, distributive trades and farmers, the continuing high level of registrations through the summer and early autumn is explained by the dispersion through the late summer and autumn of peak demand for trucking facilities by manufacturers and farmers and the autumn peak demand for such facilities by the distributive trades.

d. *Automobile Exports*

In some industries exports are planned in such a way as to offset the disturbing influences of domestic purchase and to make possible a more continuous rate of productive activity.

CHART 21

SEASONAL MOVEMENT OF AUTOMOBILES: REGISTRATION AND EXPORTS



Analysis of the series on exports of passenger cars and of trucks since 1923 (Chart 21), however, reveals that foreign demand follows domestic demand closely. The series combine completed cars, chassis and assembly parts for produc-

tion, expressed in car units, and to that extent are an inaccurate reflection of shipments abroad of finished units. But the light they throw on swings in exports seems to justify the conclusion that the industry is so geared in many of its practices (such as announcements of new models) to trade seasons on the domestic market that it cannot use exports as a counterbalance. Exports of passenger cars, like domestic production, are at peak in April and decline during the summer. The evidence afforded by exports of trucks is less conclusive. The seasonal index does not appear to be reliable in the light of the correction that its application introduces into the original series. Nevertheless it does seem to indicate greater exports in the spring.

e. *Gasoline Consumption and Replacement Parts*

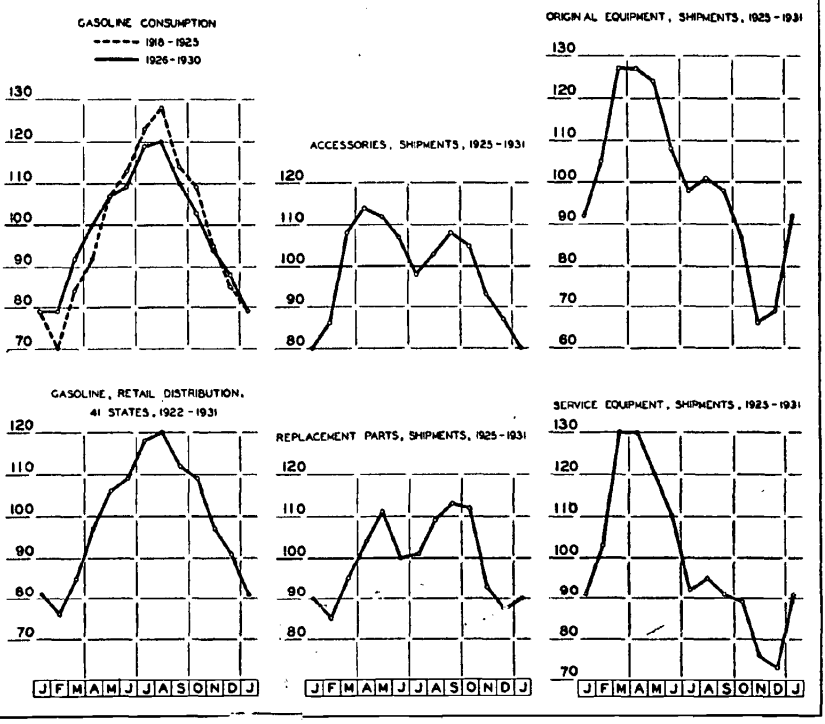
Following registration, consumption of gasoline is the next link in the chain of economic processes since it describes the use of the car by its final owner. Data are available on total consumption only, but since motorists use 85 per cent of total gasoline consumed,[5] the resulting index is a reliable indication of the seasonal movements in consumption by cars. This index shows a swing substantially similar to that in passenger car sales or new car registrations but with some significant differences (Chart 22). First, the peak of consumption is at the end of the summer while the peak in car sales and production is in April or May, at the beginning of warm weather. Second, the seasonal swing in gasoline consumption is appreciably narrower than that in car sales or registrations. The reason for both differences lies in the fact that sales or new car registrations reflect additions to equipment, while gasoline consumption reflects variations in the use of the total equipment. Consequently, the seasonal index of gasoline consumption can best be interpreted as a cumulation of the seasonal swing in automobile sales, added to the automobiles already used—the much larger quantity. In the light of this interpretation it is interesting to note that the use of automobiles (as reflected in gasoline consumption) is at peak in August, the last month during which the index of car sales (or registrations) is above 100. Also, that if the deviations of the seasonal index for new passenger car registrations are cumulated, we

[5] *Facts and Figures of the Automobile Industry, 1932*, p. 52.

obtain an average deviation of 55.8, about five times as large as that for gasoline consumption in the corresponding period. This would indicate that the base to which new cars are being added is about five times as large as that of the total annual

CHART 22

SEASONAL MOVEMENT OF AUTOMOBILE ACCESSORIES AND GASOLINE



volume of new cars purchased; this estimate of the average life of a car of about six years is not far from current approximations. This comparison of average deviations is, of course, subject to numerous qualifications and the example is cited not as proof but as an interesting illustration.

Shipments of replacement parts and of accessories by their manufacturers to the wholesale and retail trade for eventual sale to car users show two peaks: one in April or May, the other in September (Chart 22). This pattern seems to reflect

the increase of purchases by car users of spare parts and repairs at the beginning and at the end of the outdoor season when most overhauling of second-hand cars is done. As in gasoline consumption, and for the same reasons, the seasonal amplitude of shipments of these parts is relatively mild.

2. Seasonal Movement of Parts and of Raw Materials

So far the discussion has traced the seasonal variations from automobile production through sales and registration to eventual use by car owners. Now the direction of our analysis changes. We go back of automobile production in order to observe the seasonality characteristic of the movement of its parts and raw materials.

a. *Original and Service Equipment, Rims and Tires*

The contrast between the seasonality in shipments of replacement parts and accessories and that in movement of original and service equipment is the contrast between the use of the cars and the production or preparation for that use. Original equipment includes parts, accessories and other units shipped to car and truck manufacturers or distributed by vehicle makers to dealers. Service equipment includes machinery and tools used in automotive service stations and repair shops. Both show only one peak instead of the two observed in shipments of replacement parts. In both the peak is in March or April, close to the peak in automobile production. In both seasonal amplitude is rather wide.

The production of rims also shows seasonal variations closely similar to those in passenger car production (Chart 23). The peak is in April, an autumn peak is lacking, and the amplitude is wide, although below that for car production. The commodity obviously belongs to that category of finished parts which, although used by car owners for replacements and repairs, are chiefly consumed in assembly and therefore reflect closely the swing in car output.

The indexes for production, shipments and stocks of tires tell a different story (Chart 23). Inner tubes and pneumatic casings, the tires that are used primarily on passenger cars, are subject not only to original equipment demand but also to replacement demand. Also, while the demand for solid and cushion tires, which are used exclusively on trucks and buses,

CHART 23

SEASONAL MOVEMENT OF AUTOMOBILE PARTS AND TIRES

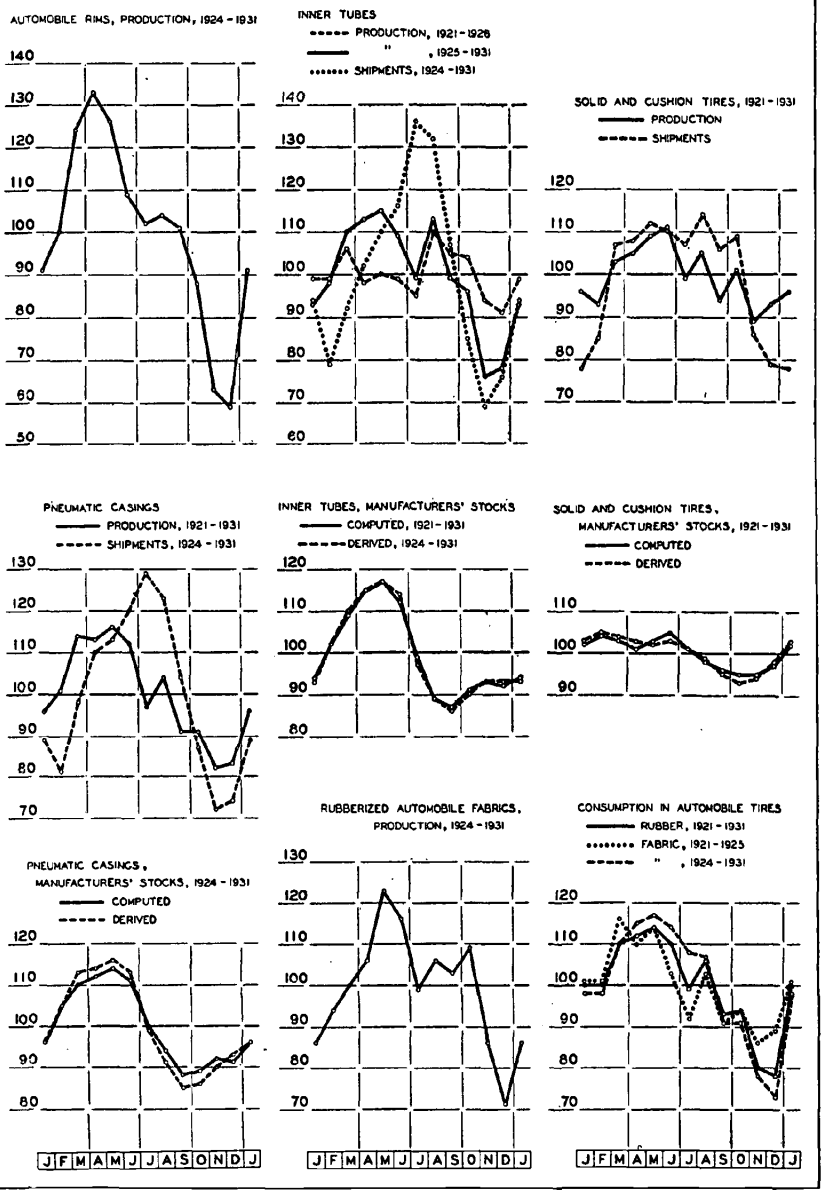


TABLE VIII

Amplitude of Seasonal Variations

Automobile Parts, Tires and Raw Materials

Series	Average Deviation	Range
AUTOMOBILE EQUIPMENT AND PARTS		
Equipment Shipments, 1925-31		
Original Equipment	15.2	61
Service Equipment	15.5	57
Rims, Production, 1924-31	16.5	74
TIRES		
Pneumatic Casings		
Production, 1921-31	10.0	34
Shipments, 1924-31	16.5	57
Manufacturers' Stocks, 1924-31		
Computed	8.5	26
Derived	10.1	31
Inner Tubes		
Production, 1921-26	4.2	19
1925-31	10.1	39
Shipments, 1924-31	17.3	67
Manufacturers' Stocks		
Computed, 1921-31	9.2	30
Derived, 1924-31	9.8	31
Solid and Cushion Tires, 1921-31		
Production	5.8	22
Shipments	12.1	36
Manufacturers' Stocks		
Computed	3.2	10
Derived	3.5	12
Fabric Consumed in Auto Tires, 1921-25	8.0	30
1924-31	11.8	44
RAW MATERIALS		
Crude Rubber		
Imports, 1919-24	10.8	45
1925-31	6.7	26
Consumption		
Total, 1925-30	8.4	33
In Tires, 1921-31	9.0	36
Domestic Stocks, 1925-30		
Total Domestic		
Computed	7.7	24
Derived	7.2	22

TABLE VIII (CONTINUED)

Series	Average Deviation	Range
Domestic Stocks, 1925-30		
Afloat	4.2	20
Dealers'	11.3	43
Manufacturers'	8.4	30
Petroleum and Gasoline		
Crude Petroleum Production (Output) 1913-22	2.3	14
1923-30	2.4	11
Gasoline		
Production, 1917-23	3.3	17
1924-30	2.2	12
Stocks at Refineries		
Computed, 1919-24	16.9	55
1924-28	11.2	35
Derived, 1918-24	13.5	41
1924-30	10.7	31
Other Materials		
Rubberized Automobile Fabrics, Production, 1924-31	10.6	52
Steel Ingots, Production, Daily Average, 1926-31	7.5	31
Steel Sheets, Production, 1919-28	7.1	31
Steel Sheets, Shipments, 1919-28	6.1	31
Malleable Castings, Production, 1923-31	8.8	35
Malleable Castings, Shipments, 1923-31	10.5	39
Upholstery Leather, Splits, Production, 1922-30	5.8	26
Upholstery Leather, Splits, Shipments, 1922-30	8.5	37
All Hardwood, Production, 1925-31	2.8	13
All Hardwood, Shipments, 1925-31	4.8	22
Plate Glass, Production, 1927, F. R. B. Index	5.2	23
Copper Smelted, 1919-31	2.5	11
Lead Production, 1919-31	2.7	9

is more preponderantly that of manufacturers, there is some influence of replacement purchases.

Consequently, comparison of shipments of casings and inner tubes shows a pattern and amplitude midway between the seasonal characteristics of passenger car production and of car use (the latter as shown by gasoline consumption). In both groups of tires the peak in shipments is in July, but the trough is reached as early as November, while in gasoline consumption during recent years the trough has been in January and February. In casings high levels of shipments are attained already in April, indicating the influence of demand by auto-

mobile manufacturers. The average deviations of the seasonal indexes for shipments (Table VIII) are lower than those for passenger car production but distinctly higher than those for gasoline consumption. This, however, may be partly due to the steadying influence on gasoline consumption of the use of buses and trucks.

Shipments of solid and cushion tires have a materially lower seasonal amplitude than shipments of other tires and a pattern with a more uniformly high level throughout the spring, summer and autumn. This is undoubtedly a reflection of the seasonal characteristics of truck production and use, both different from the production and use of passenger cars. The amplitude of solid tire shipments is no lower than that of truck production.

While shipments of tires, which is the stage nearest their sales, show a marked seasonal swing and reflect closely the seasonality of purchases, production of tires exhibits rather different seasonal characteristics. The amplitude is lower than in shipments, the greatest relative damping occurring in the output of solid and cushion tires. The patterns show earlier peaks than in shipments. Obviously, tires are produced for stock in advance of the peak selling seasons.

Stocks of tires held by producers exhibit seasonal variations that are clearly a cumulation of the seasonal disparities in production and shipments (see computed and derived indexes for stocks on Chart 23). The significance of these variations is gauged when the average volume of stocks is compared with monthly production or shipments. The ratios for recent years covered by the seasonal indexes are: 2.3 for inner tubes, 2.0 for casings and 3.8 for solid and cushion tires. Multiplying these ratios by the average deviations of the respective seasonal indexes we obtain: 21.2, 17.0 and 12.2. Thus, the seasonal burden of stocks is heaviest for inner tubes, the group for which demand (as reflected in shipments) is seasonally most variable; and is lightest for solid and cushion tires, a group for which demand is seasonally most stable.

The seasonal behavior of the production and flow of tires is reflected in the consumption of rubber and fabrics in tire manufacturing (Chart 23). Rubber is, of course, the important raw material. The seasonal swing described in this index shows, as might be expected, a high level in summer and a

low level in winter. The amplitude is rather substantial. But it may be inferred that in respect of both pattern and amplitude the seasonal index for rubber consumption in tires corresponds well to the indexes for tire production.

The seasonal pattern of fabric consumed in automobile tires is very similar, except that in the early period the spring peak is higher and the decline during the summer more precipitous than in rubber consumption. Also, the seasonal amplitude is somewhat wider. The explanation for these differences in pattern and amplitude may lie in the fact that fabrics are not used in the production of inner tubes or solid tires. Since it is chiefly for inner tubes that replacement demand is very important, the consumption of fabrics rather tends to reflect production for use in new cars and has a more conspicuous spring peak and a wider seasonal amplitude.

b. *Rubber*

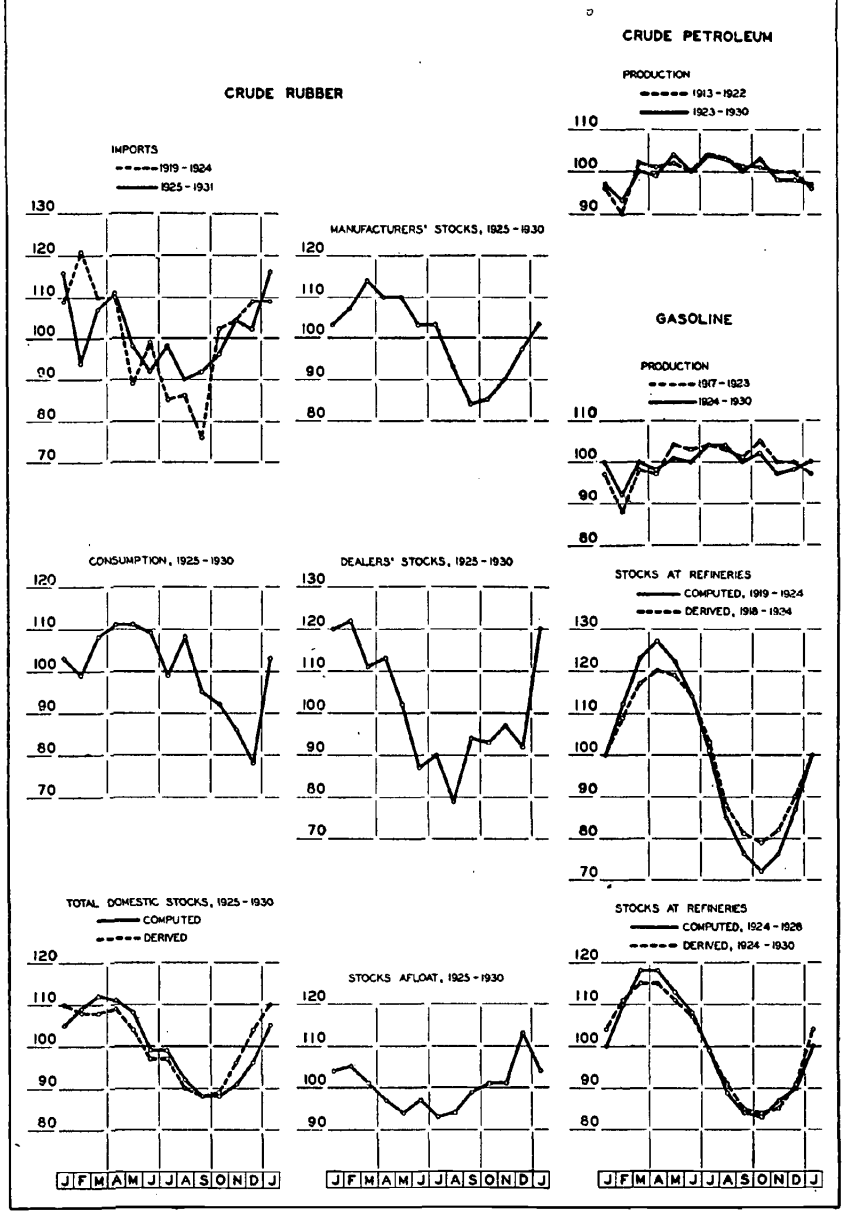
Of total rubber consumed in this country, of which all but a negligible fraction is imported, at least 80 per cent goes directly into tires and some additional fraction into rubberized automobile fabrics. Rubber imports, therefore, reflect almost the entire inflow of an important material directly related to the production and use of automobiles.

The seasonal variation in rubber imports is of about the same magnitude as that in consumption; during recent years it was only slightly lower. But though similar in amplitude, the seasonal swings in imports and in consumption differ in direction. Imports of crude rubber are large from November to April and small during July, August and September (Chart 24). Consumption is rather uniformly high from March to August and low at the end of the calendar year. Thus the movement of rubber imports precedes that of consumption by about three months. The time discrepancy between the two should be reflected in the movement of crude rubber stocks which ought to be high throughout the first five months of the year and low from August to November.

Total stocks of crude rubber do reveal high levels from December through May. Chart 24, which presents both the computed and the derived indexes for rubber stocks, shows that the seasonal movements in stocks may well be interpreted as cumulative discrepancies between the seasonal swings in

CHART 24

SEASONAL MOVEMENT OF RUBBER, PETROLEUM AND GASOLINE



imports and consumption. Both computed and derived indexes show the same general pattern, although their peaks do not occur in the same month. Both show troughs in September and October. The seasonal swing in stocks is substantial, and the ratio of domestic stocks to monthly consumption averages 2.8 during recent years.

An interesting picture is revealed by the seasonal indexes for the various groups of stocks. Stocks afloat are, of course, closely similar in seasonal behavior to rubber imports, preceding them by a month or two. Thus, stocks afloat are lowest by the end of July while imports are at trough in August or September. Stocks afloat are highest at the end of December while imports are at peak in January or February. The seasonal amplitude of stocks afloat is measured by an average deviation smaller than that for imports. But the difference may arise because stocks afloat average one and a half times monthly imports.

Domestic stocks are divided unequally between manufacturers and rubber dealers in the proportion of four to one. Incoming shipments lag behind dealers' stocks at the peak and coincide with them at the trough. The seasonal swing is rather wide but that may reasonably be attributed to the small absolute volume of this particular group of stocks.

The seasonal pattern in dealers' stocks precedes by about a month that in stocks held by manufacturers. Thus, dealers' stocks are at peak in February, manufacturers' stocks in March. Again, dealers' stocks are lowest in August, manufacturers' stocks in September or October. The anticipatory character of dealers' activity appears clearly in this comparison of their timing. Manufacturers' stocks are also subject to a narrower seasonal swing, probably because they are much larger in absolute volume.

Seasonal movements in the flow of rubber are evidently imposed by variations in industrial demand, which in its turn is a response to the original seasonal variation in demand by final consumers. The patterns in rubber imports and stocks are definitely preparatory for seasonal swings in the consumption of rubber by tire manufacturers. And the continuous character of rubber production, when considered on a world scale, suggests that there are no factors on the side of supply that would account for the seasonal swings that

may be observed in the imports of the commodity into the United States and its movement here.

The seasonal variations imposed by the tire and automobile producers are passed on to crude rubber without any appreciable damping. The swing in rubber imports is nearly as great as in consumption of rubber by tire manufacturers and in the production of tires. This is not the case with the other important raw material closely connected with automobiles, petroleum, and its product, gasoline.

c. *Petroleum*

Data on production and stocks of petroleum, and of gasoline, cover almost the entire country and there is little doubt concerning the representative character of the series (Chart 24). Furthermore the data are available for a fairly long period. Nevertheless, the resulting seasonal indexes for petroleum and gasoline production are so inconsistent from one period to the next that no trust may be placed in them. This conclusion is confirmed by the lack of similarity between the index for gasoline production derived from the series on petroleum production and stocks (from which we can compute disappearance of petroleum) and that computed from the series itself. In petroleum stocks the seasonal disappears entirely. The line of the seasonal index, even in petroleum and gasoline production, the two instances in which measurement was possible, clings closely to normal, and the safest conclusion to be drawn is that there is no persistent and appreciable seasonal variation in the processes described.

The reasons for this absence of a persistent seasonal swing in petroleum and gasoline production and petroleum stocks are not far to seek. Petroleum wells must be kept at work continuously to offset pumping by competing wells or seepage of crude oil into the ground. Hence, unless there is a definite seasonal swing in the number of new wells opened, there will be no seasonal variation in crude oil production. The gasoline industry has then the alternative of absorbing crude oil steadily and letting gasoline stocks fluctuate or of adapting the rate of production to the variable demand. The indexes show that the refineries prefer to operate at an even rate and let their stocks fluctuate with demand.

The indexes yielded by the series of gasoline stocks differ entirely in character from those obtained for production; they indicate a clear-cut and persistent seasonal swing. Stocks rise to a peak in April, that is, just prior to the opening of seasonal demand, and decline to a trough in October, just before the season closes. The pattern persists from one period to the next, but the amplitude diminishes significantly during recent years. This decline in seasonal amplitude in gasoline stocks is in line with the similar change in gasoline consumption noted above and is obviously due to the same factor of a more extensive use of vehicles during the winter.

The reliability of the seasonal indexes for gasoline stocks is indicated by a comparison of the measure derived from the discrepancies between production and consumption with that computed from the data. The close correspondence of the two lines on Chart 24 is a clear indication that the seasonal movement in stocks may be interpreted as a cumulative discrepancy between the seasonal patterns of production and consumption, or, in other words, that variable consumption is made possible under conditions of stable production by the existence of seasonally variable stocks. Thus, in contrast with the type of adjustment made in the supply of rubber, in the case of petroleum and gasoline the inflow of the raw material is kept seasonally constant and the seasonally variable demand is satisfied with the help of variable stocks.

d. *Materials other than Rubber and Petroleum*

A large part of several other commodities is also absorbed in the production or operation of automobiles. Thus the industry used 29 per cent of total domestic production of steel sheets, 54 per cent of malleable iron, 32 per cent of nickel, 36 per cent of lead, 60 per cent of polished plate glass, 17 per cent of hardwood lumber, 51 per cent of upholstery leather, 14 per cent of copper, 13 per cent of tin.[6] Chart 25 assembles the readily available indexes that describe the seasonal variations in the supply of all these raw materials.

The three commodities of which large percentages are absorbed by the automobile industry show seasonal movements very similar to those in the production of cars. Malleable castings, plate glass and upholstery leather have the familiar

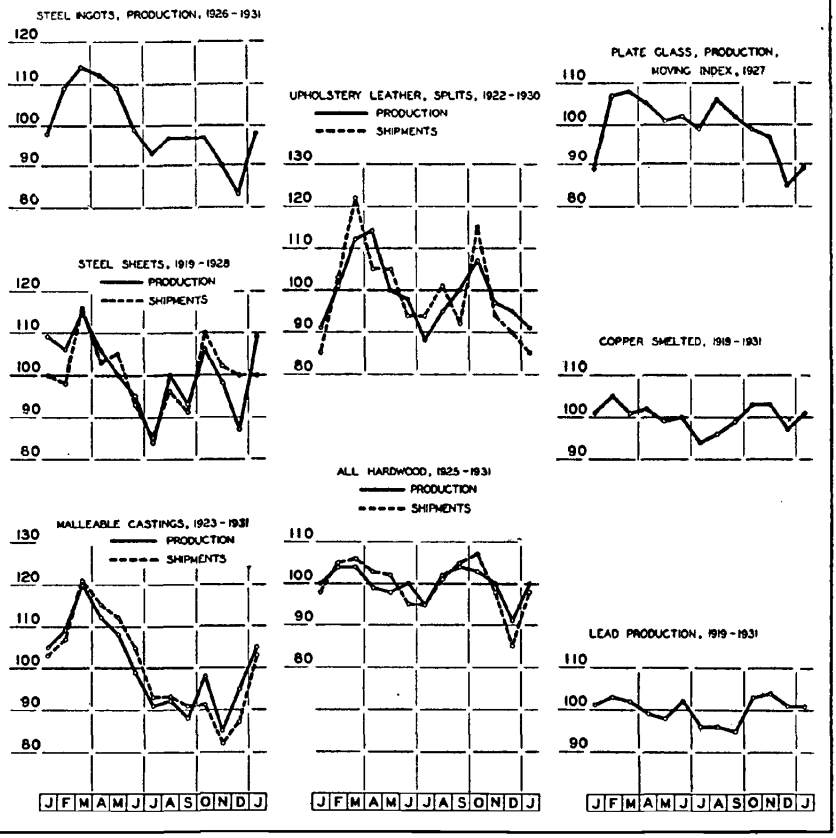
[6] *Facts and Figures of the Automobile Industry 1932,* pp. 50-1.

spring peak, summer decline, autumn peak and low winter levels that are characteristic of the automobile industry.

Of the other commodities, steel ingots, steel sheets, and to some extent, hardwood, tend to follow the same pattern. Tin

CHART 25

SEASONAL MOVEMENT OF SUNDRY AUTOMOBILE MATERIALS



deliveries, for which the seasonal index is not very reliable, copper and lead production seem to reflect in their pattern little adaptation to the seasonality of demand by the automobile industry. This is only natural since relatively small percentages of the total volume of those commodities are absorbed in the production and use of automobiles.

Tables VII and VIII show that the seasonal swing in each series is considerably less than that in automobile production. In those commodities that are most largely absorbed by the automobile industry, such as malleable castings and upholstery leather, the seasonal amplitude of shipments is not far below that of automobile production, while output is subject to much milder seasonal swings. In other commodities, especially those which have little connection with the automobile industry, the seasonal swing tends to be narrower, as shown by the indexes for hardwood, copper and lead.