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CHAPTER XI

TEMPORAL CHANGES IN SEASONAL AMPLITUDE

GENERAL CHARACTERISTICS

A study of changes in seasonal pattern is valuable in so far as it reveals the forces that determine their direction and magnitude. But in themselves shifts in seasonal pattern do not mitigate or increase the burden imposed by seasonal variability. So long as the size of the seasonal swing remains the same, varying seasonal patterns in production are possible with the same surplus equipment, surplus volume of labor and surplus raw material. This would not be true were the different industries so adjusted as to achieve relative stability in the utilization of the common productive factors by dovetailing their seasonal swings. In that case, a change in seasonal pattern in one industry would increase the seasonal burden on the common productive factors unless an offsetting shift occurred in the seasonal pattern of another industry. However, since such close interlocking of industries does not prevail in the economic system of today, changes in seasonal pattern alone have no direct implication for the economic burden of seasonal variations.

Changes in the magnitude of the seasonal swing, however, are of direct economic significance. If the amplitude expands, if the rate of activity declines to lower levels at the seasonal trough and rises to higher levels at the seasonal peak, if the large departures from the annual average become more continuous, it seems clear that, other conditions remaining the same, the strain on productive factors specifically associated with the given industry becomes greater. More surplus equipment, labor and materials are necessary to enable the industry to produce at seasonal peak. On the other hand, a contraction in seasonal amplitude, other conditions remaining the same, means that there is less need for surplus productive factors. Similarly, variations in the size of seasonal commodity stocks

spell changes in the stock burden associated with the solution of the seasonal problem.

For this reason especial importance is to be attached to the conclusions derived from the analysis of recent trends in the severity of seasonal variations. These conclusions may be summarized briefly as follows:

1. Changes in the size of the seasonal swing characterize almost all the series for which comparison from period to period was made.

2. Changes in the relative size of the seasonal swing appear to be unrelated to changes in the absolute volume of the series, although in many series declines in the seasonal swing accompanied a rising trend in absolute volume.

3. Seasonal swings became markedly smaller in commodities dealing with consumers' goods for which demand is seasonally stable. In industries handling semi-durable and durable consumers' goods for which final demand is seasonal there was a noticeable trend toward wider seasonal swings. The magnitude of seasonal variations of two basic agricultural raw materials, wheat and cotton, increased.

4. These differing trends in the size of the seasonal swing appear to be attributable to the general downward drift of prices, with its consequent worsening of the farmers' financial condition; the spread of a hand-to-mouth buying policy on the part of the distributive trades and consumers; the existing and growing plant over-equipment of manufacturing industries; increasing seasonality of consumers' demand in semi-durable and durable finished goods, and decreasing seasonality of demand for perishable goods.

5. At least some if not all of these factors influence changes in the magnitude of the seasonal swing from year to year. The measurement of these changes in selected series indicates that they are associated in most instances with actual or forecasted turns in the economic and business conditions of the industry in question. These annual changes in the size of the seasonal swing in durable consumers' goods correlate invertedly with the movements in absolute volume.

6. The increase in seasonal variations in industries producing seasonal commodities was accompanied not only by a larger surplus of capital equipment but also by greater seasonal instability in employment and payrolls.

DETAILED COMMENTS

A. Changes from Period to Period

1. Average Seasonal Indexes

Table XXXIII, which presented the indexes of similarity between seasonal patterns in two post-War periods, contains in columns *4* and *5* the measures of seasonal amplitude for the same two periods. These columns record the total deviations of the seasonal indexes from 100 (summated, without regard to sign), and a direct comparison is thus equivalent to a comparison of average deviations of the seasonal indexes. Since average deviations are much more sensitive measures of amplitude than ranges, the former are used throughout this chapter.

A comparison of columns *4* and *5* shows that seasonal swings have shrunk in some series and expanded in others. The grouping in Table XXXIX reveals the differences in behavior.

Most of the series appear to have undergone marked changes in the size of their seasonal swings, only six showing differences so small as to be of doubtful significance. Of the sixty-five series that show significant changes, twenty-one are characterized by rising seasonal amplitudes, forty-four by declining. This simple count is, however, misleading, for interesting differences appear in the movements of seasonal amplitude among the various economic groups. Thus, of the thirty-six series covering food products, only nine show a wider seasonal amplitude, and of these nine, two show merely an insignificant increase. Among the non-foods seasonal amplitudes rise much more frequently—in fifteen series out of thirty-five. Furthermore, the various groups of building contracts and the series of commodity stocks help to swell unduly the number of indexes showing declining amplitude. If only production or shipments of non-foods are considered, and all building contracts are treated as one group, it is found that out of sixteen series only six show a declining amplitude while as many as ten show a rising amplitude.

The seasonal indexes whose amplitudes we are measuring are in terms of percentages. Although it seems generally correct to assume that seasonal disturbances should be viewed in relation to the current volume of activity or of stocks, for some purposes it may be of interest to express the seasonal

TABLE XXXIX

GROUPING OF SERIES BY RISE AND DECLINE IN SEASONAL AMPLITUDE FROM THE WAR OR EARLY POST-WAR PERIOD TO THE MORE RECENT PERIOD

SERIES SHOWING RISING AMPLITUDE

Wheat, Marketing by Farmers
Wheat, Receipts at Primary Markets
Wheat, Shipments from Primary Markets
Wheat Exports
Beef and Veal, Cold Storage Holdings
Butter, Cold Storage Holdings
Evaporated Milk, Case Goods, Production
Cottonseed, Receipts at Mills [a]
Cottonseed Oil, Refined, Production [a]
Cotton, Receipts into Sight
Cotton, Visible Supply
Cotton, Stocks at Public Warehouses
Raw Wool Consumption
Shoe Production
Inner Tube Production
Fabric Consumed in Tires
Petroleum Output [a]
Steel Ingot Production
Passenger Car Production
Portland Cement Production
Portland Cement Shipments
Bath Shipments
Lavatory Shipments
Sink Shipments

SERIES SHOWING DECLINING AMPLITUDE

Wheat, Visible Supply
Wheat Flour Production
Cattle and Calves, Receipts at Primary Markets
Cattle Slaughtered
Calves Slaughtered
Beef and Veal, Apparent Consumption
Sheep and Lambs, Receipts at Primary Markets
Sheep and Lambs Slaughtered
Mutton and Lamb, Cold Storage Holdings
Mutton and Lamb, Apparent Consumption
Hogs, Receipts at Primary Markets
Hogs Slaughtered
Pork Products, Cold Storage Holdings
Pork Products, Apparent Consumption
Butter, Factory Production
Butter, Receipts at 5 Markets
Butter, Apparent Consumption
American Cheese Production
Cheese, Receipts at 5 Markets
Cheese, Cold Storage Holdings
Eggs, Receipts at 5 Markets
Eggs, Cold Storage Holdings [a]
Dressed Poultry, Receipts at 5 Markets
Dressed Poultry, Cold Storage Holdings [a]
Cottonseed Oil, Refined, Stocks
Raw Sugar Meltings
Raw Sugar Stocks
Cotton, Stocks at Mills
Crude Rubber Imports
Gasoline Production
Gasoline Consumption
Gasoline Stocks
Steel Sheet Production
Building Permits [a]
Building Contracts, Total
Building Contracts, Residential
Building Contracts, Commercial
Building Contracts, Educational
Building Contracts, Public and Semi-Public
Building Contracts, Public Works and Utilities
Portland Cement Stocks
Southern Yellow Pine Production
Western Pine Production
Structural Steel, New Orders
Bath Stocks
Lavatory Stocks
Sink Stocks

[a] Insignificant changes.

variation in absolute units. These would indicate whether from one period to the next the average absolute amount of goods involved in seasonal variations had shrunk or expanded.

Accordingly, the percentage changes in the absolute volume of each series and in the relative amplitude were compared for the two periods. Were seasonal amplitude more constant when measured in absolute than in relative units, the series with rising amplitude would have shown a contraction in absolute volume, while series with declining amplitudes would have shown expanding absolute volumes.

However, in the comparison of the twenty-four series in which the relative seasonal index rose in amplitude, only three (wheat exports, cold storage holdings of beef and veal, and raw wool consumption) show a decline in absolute volume. Thus, had seasonal variations been computed in absolute units, a still larger expansion in amplitude would have been shown in twenty-one out of these twenty-four series. In view of this showing it is of little significance that of the forty-seven series whose relative seasonal indexes declined in amplitude, all but five show mounting absolute volumes; even less, since the overwhelming number of industrial indexes in any growing country show rising trends. In most of these forty-seven series, it is true, the conversion of relative seasonal variations into absolute seasonal variations would have revealed a greater stability of amplitude from one period to the next. This would have been attributable, however, not to any greater inherent stability of absolute seasonal amplitudes, but rather to the fortuitous coincidence of a declining relative seasonal amplitude with rising trends in absolute volumes.

Another comparison will shed some light on the nature of the change in seasonal amplitude. In those series in which decline in seasonal amplitude of relative indexes is accompanied by an opposite movement in absolute volumes, which was the larger change? If the degree to which the amplitude of the relative seasonal index declined was appreciably greater than that to which the absolute volumes expanded, then obviously the milder seasonal variation was not only relative but also involved a smaller absolute amount of goods. If the degree of the contraction in relative seasonal amplitude was appreciably less than that of the expansion in absolute volumes, the seasonal variations, in spite of a milder percentage swing, involved a larger amount of goods.

TABLE XL

GROUPING OF SERIES BY DECLINE IN SEASONAL AMPLITUDE AND BY RISE IN ABSOLUTE VOLUME

Both Changes Are About Equal in	Decline in Amplitude is Greater Than Rise in Absolute Volume in	Decline in Amplitude is Smaller Than Rise in Absolute Volume in
Hogs Slaughtered	Wheat Flour Production	Wheat, Visible Supply
Pork, Apparent Consumption	Cattle Slaughtered	Butter, Factory Production
Butter, Apparent Consumption	Beef and Veal, Apparent Consumption	American Cheese Production
Eggs, Receipts	Sheep and Lambs, Receipts	Cheese, Cold Storage Holdings
Western Pine Production	Sheep and Lambs, Slaughtered	Eggs, Cold Storage Holdings
	Mutton and Lamb, Apparent Consumption	Poultry, Receipts
	Hogs, Receipts	Cottonseed Oil, Stocks
	Pork, Cold Storage Holdings	Raw Sugar Stocks
	Butter Receipts	Rubber Imports
	Cheese Receipts	Gasoline Production
	Raw Sugar Meltings	Gasoline Consumption
	Southern Yellow Pine Production	Gasoline Stocks
		Steel Sheet Production
		Building Permits
		Building Contracts, Total [a]
		Building Contracts, Residential [a]
		Building Contracts, Commercial [a]
		Building Contracts, Educational [a]
		Building Contracts, Public and Semi-Public [a]
		Building Contracts, Public Works and Utilities [a]
		Portland Cement Stocks
		Structural Steel, New Orders
		Bath Stocks
		Lavatory Stocks
		Sink Stocks

[a] Change in territory from one period to the next.

A comparison of percentage changes in the average deviation of the relative seasonal indexes with those in absolute volumes yields but an approximate answer to the question just formulated. However, the division in Table XL discloses interesting differences in the behavior of the various economic groups.

Of the twelve series in which the decline in relative seasonal amplitude appears larger than the expansion in absolute volumes, all but one relate to the movement or stocks of food products. On the other hand, of the twenty-five series in which the expansion in the absolute volume was relatively greater than the decline in seasonal amplitude, there are only eight series relating to food products, of which five cover stocks. All records of flow of non-foods seem to indicate an expansion in absolute volume much more sharp than the shrinkage in seasonal amplitude.

Thus, the consideration of the *absolute* size of seasonal swings only corroborates the difference that was manifest above between the relative seasonal movements of foods and non-foods from the War and early post-War years to the more recent period. This conclusion as to the decline in the former group and the increase in the latter is confirmed and extended by the study of the available moving seasonal indexes.

2. Moving Seasonal Indexes of Industrial Activity and Employment

Of the moving seasonal indexes computed by the Research Division of the Federal Reserve Board for thirty-one branches of industrial activity, twenty-three extend as far back as 1919, the others going back to 1921, 1922 or 1923. For all of these the years covered were subdivided into two equal periods and an average deviation computed for each. Table XLI assembles these average deviations and shows at a glance the trend in seasonal amplitude in the various branches of industrial activity.

Here again seasonal swings in branches of activity dealing with food products decline almost uniformly. Cigar production is the only exception and, for reasons pointed out below, it tends to confirm the rule. Seasonal swings in a few series

relating to the production of commodities other than foods also decline: goat and kid leather, lumber, woodpulp, both mechanical and chemical, wrapping paper and building contracts. It may be said that seasonal swings declined in industries whose activity is conditioned by climate (construction, lumber, mechanical woodpulp) and in industries that meet a

TABLE XLI

MEASURES OF SEASONAL AMPLITUDE FOR TWO SUCCESSIVE POST-WAR PERIODS

SELECTED SERIES ON INDUSTRIAL PRODUCTION

Series	Period 1	Period 2	Average Deviation in Period 1	Average Deviation in Period 2
Flour Production	1919-25	1925-31	12.3	8.5
Hogs Slaughtered	1919-25	1925-31	16.9	15.3
Cattle Slaughtered	1919-25	1925-31	10.0	8.3
Sheep Slaughtered	1919-25	1925-31	7.6	4.7
Calves Slaughtered	1919-25	1925-31	7.7	5.5
Cigar Production	1919-25	1925-31	7.5	11.7
Cotton Consumption	1919-25	1925-31	3.7	5.6
Wool Consumption	1919-25	1925-31	5.2	6.6
Calf and Kip Leather Production	1921-26	1926-31	7.1	10.3
Goat and Kid Leather Production	1921-26	1926-31	5.9	5.1
Shoe Production	1919-24	1925-30	5.5	8.4
Pneumatic Tire Production	1921-26	1926-31	6.4	10.3
Inner Tube Production	1921-26	1926-31	4.5	10.6
Polished Plate Glass Production	1923-27	1927-31	3.9	5.7
Steel Ingot Production	1919-25	1925-31	4.3	5.4
Passenger Car Production	1919-24	1925-30	10.9	17.9
Trucks, Production	1922-26	1926-30	10.5	12.0
Lumber Production	1919-25	1925-31	6.0	4.6
Cement Production	1919-25	1925-31	18.2	20.4
Building Contracts, Residential	1919-25	1925-31	8.8	7.4
Building Contracts, All Other	1919-25	1925-31	15.7	11.9
Shipbuilding	1919-25	1925-31	11.0	22.2
Mechanical Woodpulp Production	1919-25	1925-31	13.0	10.8
Chemical Woodpulp Production	1919-25	1925-31	3.7	2.2
Box Board Production	1919-25	1925-31	3.7	3.8
Wrapping Paper Production	1919-25	1925-31	3.4	1.9
Paper Box Production	1923-27	1927-31	5.3	5.4
Anthracite Coal Output	1919-25	1925-31	3.1	6.3
Bituminous Coal Output	1919-25	1925-31	6.1	8.3
Beehive Coke Production	1919-25	1925-31	11.3	13.9
Silver Production	1922-26	1926-31	2.6	3.5

seasonally stable consumers' demand (food products, paper). Cigars are subject to a seasonal final demand, and therefore, although in the group of foods, they show expanding seasonal swings.

Most of the series in which seasonal swings became wider, however, either describe an activity directly concerned with producing finished goods subject to intermittent demand by final consumers or record the production of a material for these groups of finished goods. Thus, series measuring cotton and wool consumption, output of shoes, tires and automobiles, shipbuilding, output of bituminous and anthracite coal all reflect production of consumers' goods for which final demand is seasonally variable. Calf and kip leather, polished plate glass and steel are materials for these consumers' goods.

This somewhat more detailed and more significant formulation of the generalization concerning the trends in the size of

TABLE XLII

MEASURES OF SEASONAL AMPLITUDE FOR TWO SUCCESSIVE POST-WAR PERIODS

SELECTED SERIES ON INDUSTRIAL EMPLOYMENT

Series	Period		Average Deviation in Period	
	1	2	1	2
Flour	1919-24	1925-30	4.6	2.7
Baking	1919-24	1925-30	1.8	1.4
Slaughtering and Meat Packing	1919-24	1925-30	2.7	2.3
Sugar Refining, Cane	1919-24	1925-30	7.6	3.9
Cigars and Cigarettes	1923-26	1927-30	2.5	3.0
Chewing and Smoking Tobacco and Snuff	1923-26	1927-30	1.8	2.7
Cotton Goods	1919-24	1925-30	1.4	2.2
Dyeing and Finishing	1919-24	1925-30	1.6	2.0
Shirts and Collars	1919-24	1925-30	2.2	2.3
Millinery	1919-24	1925-30	6.6	9.0
Shoes, Leather	1919-24	1925-30	1.7	2.8
Shoes, Rubber	1923-26	1927-30	4.2	3.9
Automobiles	1919-24	1925-30	3.8	4.1
Glass	1919-24	1925-30	3.7	2.4
Hardware	1919-24	1925-30	1.0	1.0
Cement	1919-24	1925-30	5.2	4.8
Stoves	1923-26	1927-30	4.0	3.9
Furniture	1919-24	1925-30	1.6	3.1
Fertilizers	1923-26	1927-30	20.7	19.2

the seasonal swings in the various commodity and industrial groups is amplified and re-affirmed by the moving seasonal indexes of industrial employment. These are available for nineteen branches, most of them for the years 1919-30. The average deviations of the indexes for the first and second half of the period reveal at a glance the trend in seasonal swing in the various branches of employment.

Thus in Table XLII in industries supplying goods rather constantly in demand by consumers—flour, baking, slaughtering and meat packing, sugar refining, hardware—the seasonal swing again declined or was constant. Employment in industries concerned with the production of more durable and seasonal consumers' goods—cotton goods, dyeing and finishing, clothing, leather shoes, automobiles, furniture—shows rising seasonal swings.

B. Reasons for Change in Seasonal Amplitude

Why is the seasonal swing in industries producing for rather steady demand diminishing while that in industries producing for a demand subject to seasonal variations is increasing? What particular factors in the economic development of the last decade and a half have helped to reduce the seasonal disturbance in the former group of commodities and to increase it in the latter?

We can formulate a hypothesis more easily if we restate our conclusions with respect to changes in the size of the seasonal swing. Industrial activity and related aspects of commodity movements seem to be adjusting themselves more closely to final consumer demand. Where this demand was comparatively stable, more stable than the industrial activity serving it, the seasonal swing in industrial activity tended to diminish. Where demand by final consumers is seasonally intermittent, as is usually the case with semi-durable and durable consumers' goods, the seasonal swing in industrial activity increased. During the same period the movement of agricultural raw materials, both wheat and cotton, was characterized by mounting seasonal swings.

This process of closer adaptation of industrial activity to seasonality in demand, combined with a widening swing in the flow of agricultural raw materials, appears to be attribu-

table to several factors of which the most important seems to be a downward drift in prices, to a considerable degree anticipated by economic agents. Thus, the decline in the seasonal swing of flour production means that the mills are not ready, as they were previously, to produce at high rates immediately after the harvest months. Since flour mills usually do not carry large stocks of flour, the impetus toward such a change must have come from bakers and wholesalers who refused to stock up on flour during the post-crop months as heavily as they were accustomed to do. This probably reflects the familiar hand-to-mouth buying which, according to testimony, has become so widespread since the price decline of 1920-21, when many individuals were caught with large commodity stocks.[1] In respect of wheat, on the contrary, the decline in price, in so far as it affected the financial standing of the farmers and in so far as they might expect it to continue, would result in an increasing seasonal swing, since the farmers would be forced, and willing, to market the wheat as promptly as possible after the harvest.

Hand-to-mouth buying by the distributive trades of commodities in which final demand is seasonal meant that the task of supplying the variable demand of final consumers was thrown on the manufacturers, who had to choose between producing at a relatively even rate with the resultant accumulation of commodity stocks during the dull season in consumers' buying or having sufficient equipment to be able to produce at a seasonal peak rate during the months of heavy demand. The seasonal analysis whose results were summarized above tends to show that of the two alternatives the manufacturing industries of the country chose the latter. Faced with the failure on the part of the distributors to carry stocks and to order in advance, the industries producing semi-durable and durable goods chose to meet the seasonal fluctuations in consumers' demand by maintaining extensive equipment.

The reasons for such a choice may have been manifold. First, under conditions of a declining price level the accumulation of stocks of commodities, even for so short a period as is involved in seasonal adjustment, may have meant a heavy

[1] For an extensive discussion of this change in merchandising policy see *Hand-to-Mouth Buying* by Leverett S. Lyon (Washington, The Brookings Institution, 1929).

loss. Surplus equipment, while also implying heavier overhead charges, did not appear as immediately expensive; moreover, it was always valued as a weapon in the future expansion of the given enterprise. Second, in most semi-durable and durable commodities a marked fashion element is present which makes it inadvisable to stock up in advance, for no one can foresee with any degree of assurance what particular type of commodity will catch the public fancy. Since the wholesalers and retailers themselves refused to make forecasts and provide the manufacturers with orders, the manufacturers were indisposed to forecast and produce for stock. Third, the general movement towards reducing production costs, which has progressed so rapidly since 1920, resulted in a rapid development of the productive efficiency of the country's industrial system. This meant in many instances extensive over-equipment. And once surplus equipment existed, manufacturers faced with a seasonal problem were inclined to meet it by varying their productive activity. In some instances such a policy was facilitated by the existence of a surplus labor supply arising from technological unemployment.

This change in seasonality has been noted by other observers for some individual industries:

> The year 1923 for still another reason marked for many industries a period of transition. Excess plant capacity coupled with highly efficient transportation facilities, and the fear—still shared by many—that prices would shortly revert to pre-war levels made it possible, and at the same time desirable, for consumers to limit their commitments to the near term future. Thus, for the first time, the so-called 'hand-to-mouth' buying became really effective. These changed buying habits have had an immediate effect on the course of industrial output. In the first place, the normal seasonal fluctuations in production have been blurred—not so much by a change in the *direction* of movement as by a change in the *extent* of the seasonal movement. That is, the amount of the increase in the *seasonally* active months has tended to be enlarged and correspondingly the decline in the *seasonally* inactive months has been sharply accentuated.
>
> For example, in the steel industry: during the past six years, there has been no period of substantial duration when capacity of the industry was unable to supply *promptly* the peak demand. The full import of this statement is perhaps not at first apparent. The ideal month-to-month production schedule for a given industry is one in which the rate of activity remains constant, with plant and equipment fully in use, and with labor force fully and continuously employed. This might be possible were

there no large seasonal fluctuations in the total demand for its product. Actually, however, demand for a given product (as evidenced by shipments) is ordinarily subject to marked seasonal fluctuations during the year. Each industry must, therefore, lay its course somewhere between the two extremes: (1) it may accumulate large stocks to serve as a buffer or equalizer between the seasonal demand for its product and the 'constant' output or (2) it may choose not to maintain stocks at all but rather to build up plant capacity to the point where it can meet the seasonal peak of demand when and as it occurs. If it choose the latter course, however, it must stand ready to curtail its operations sharply when demand becomes seasonally inactive, and consequently a large part of its plant and equipment must then lie idle until demand once again expands seasonally.[2]

And having inspected and commented upon the seasonal behavior of the steel industry year by year, Maxwell says:

Apparently, there has been superimposed upon the 'normal' steel production seasonal—at least for the time being—a residual factor representing in a large measure the seasonal fluctuations in the demand of the chief consumers of steel as a raw material. Without the existence of a large over-capacity in the steel industry, such a 'blending' of seasonals would have been impossible. To state the matter somewhat differently, the ability of the steel industry to continue to supply promptly the peak demand will depend either upon the continued maintenance in the future of a very considerable excess capacity or upon a resumption to a greater or less degree of the practice of accumulating at least moderate stocks during the months of less active demand.

A somewhat similar phenomenon is observed in the output of the full-fashioned hosiery mills.[3]

Even 1926, which suffered no wide seasonal fluctuations, experienced a decrease at the beginning of the year and two summer declines, while the only 1925 decrease of note was in November. Full-fashioned production was higher but still more erratic in 1927, with big decreases in production in April and May and a sharp drop in July. In 1928 the fluctuations in production became even more violent than in 1927. We can say, therefore, that since 1925, when production increased without noticeable seasonal fluctuations, increased production of full-fashioned hosiery has been attained at the cost of seasonal variations becoming more and more noticeable. If production attains an index of 263.8 in January, 295 in March, and 215 in July, 259.2 in September and 323.7 in October, as was true in 1928, it must be inferred that the industry is either working its equipment over time in the busy months or under time

[2] W. Floyd Maxwell, The Revised Index of the Volume of Manufacture, *The Review of Economic Statistics*, May 1929, pp. 69-70.

[3] G. W. Taylor, *Significant Post-War Changes in the Full-Fashioned Hosiery Industry*, Publication No. IV in the Research Studies of the Industrial Research Department, Wharton School of Finance and Commerce, University of Pennsylvania, 1929. Quotations from pp. 29, 37 and 43.

in the dull ones. Either situation is undesirable from the point of view of management which desires an even flow of production.

In attempting to explain this enhanced seasonality of production Taylor refers to the greater emphasis on the style element, which renders demand more seasonal, and to overcapacity, which enables manufacturers to supply demand promptly in the months of seasonal peak.

> Truly, the women's hosiery industry is being placed upon a millinery basis with style changes occurring seasonally. . . . . We have already noted that the increases in production after 1925 were accompanied by increasing seasonality which, in the face of increasing demand, indicates a capacity that is increasing faster than demand.

The contraction of seasonal swing in food industries, in contrast to its expansion in other industries, lies in the extension of the source of supply of raw materials and in the changed balance of competitive position between the purchaser and the seller of these raw materials. Thus, in flour, the growing extension of milling in the Southwest tapped a different source of wheat supply for domestic consumption and served to dampen the seasonal swing in milling for the country as a whole. Furthermore, the disappearance after 1920 of the extraordinarily large foreign and War demand for raw materials meant an abundant supply for domestic consumption. The industries consuming these raw materials thus felt no spur to purchase and manufacture them promptly after the harvest, as would have been the case were a failure to purchase promptly to endanger the chances of adequate supply in later months.[4] Such a tendency could not be effective

[4] Federal Reserve Board analysts suggest the following explanations of their moving seasonal indexes:

"In the food industries the heightened demand of the war and postwar period resulted in a greater degree of seasonal fluctuations. . . . . Because most of the available supplies of animals were slaughtered as soon as possible, the importance of the peak months in slaughtering was accentuated . . . . and the slack months became even less active, relative to the other months, than before the war. The high prices both of feed and of animals made early marketing more profitable than feeding. But with the break in prices in 1920 and 1921, the seasonal movement became less marked. In the case of sheep slaughtering, for example, the peak months in the fall have grown progressively less important, while in the spring months, which once were relatively unimportant in that industry, slaughtering has increased. . . . . This is probably due to the changing policies of farmers in feeding lambs for the market, whereby lambs heretofore slaughtered in the fall are purchased and fed during the winter, and sold in the late winter and early spring months. The extent of these feeding

in industries producing durable and semi-durable consumers' goods, for their main seasonal problem is on the side of consumers' demand, not on the side of the supply of raw materials.

Finally, there are the changes in consumers' demand itself. So far we have discussed the seasonality of consumers' demand as though its size were constant through the period studied. This assumption now has to be abandoned. It is quite clear from the few indexes dealing with consumers' purchases and from other, non-quantitative, evidence, that the seasonality of consumers' demand has itself changed from the War and early post-War years to the more recent period.

Generally speaking, consumers' demand tended towards higher levels of consumption, and for certain commodities, towards a greater diffusion among the masses of the population.[5] On the whole, the effect on basic foods, namely cereals, dairy products and meat, was to dampen the seasonal variations in them. A higher standard of living meant the use of dairy products during the winter, while improved methods of transportation facilitated the supply of seasonal products throughout the country. In addition, modern methods of refrigeration tended to increase the consumption of meat during the summer.

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operations varies from year to year with the relation between feed costs and the selling price of lambs.

Among other food industries, the relative decrease in the number of cattle slaughtered in the fall and the proportionate increase in the spring months may, perhaps, be attributed to two factors—the gradually diminishing importance of range cattle, which were customarily sold as beef in the fall months, and changes in feed practices of farmers similar to those which have taken place in the case of sheep. . . . . The increase in flour milling in the late summer at the expense of the late fall and winter months reflects, in part, the growing importance of milling in the southwest, where wheat is ready as early as July.

. . . . Lumber illustrates, as does flour, the effect of the spread of an industry over a wider, and climatically more varied, area. Southern pine and Douglas fir, coming from regions in which all-year-round logging is possible, form an ever-larger share of the lumber output. With the decline in lumbering in the northeast and west, north-central States, the proportion of production in the summer and early fall months is declining, although more lumber is still cut then than in the winter."

(*Seasonal Variations in Production,* Memorandum by Woodlief Thomas and Aryness Joy, 1926, pp. 5-6.)

[5] See *Recent Economic Changes,* Vol. I, Chapter I, Consumption and the Standard of Living. (National Bureau of Economic Research 1929.)

The effect of the same factors upon the seasonality of demand for semi-durable and durable goods appears to have been quite the opposite. In the discussion of seasonal swings in sales and registrations of passenger cars it was pointed out how the reduction in prices and the more extensive and diffused use contributed to amplify the seasonality of purchasing. But similar trends have characterized the demand for shoes, clothing and furniture. In all of these the increase in the number of purchasers, especially the spread to the lower income classes, has served to widen seasonal swings.

In the case of some commodities, a better standard of living implied more emphasis on fashion and style. This emphasis, which has become marked during the post-War years in the demand for textiles and shoes, is noted by Victor S. Clark.[6] Having discussed the recent concentration of the production of woven cotton goods and of yarns in the South, he writes:

> Under these conditions of sectional competition it is not strange that styles and fashions should assume new importance in the eyes of northern manufacturers. Some important establishments in New England employ style directors, who make frequent trips to the centers of fashion abroad, keep in touch with the leaders of trade in New York, and virtually dictate the designs and patterns turned out by their mills. . . . . These changes in production involve more than a mere shifting from one class of fabrics to another. Fashion is fickle and highly styled goods must be placed on the market quickly and sold out before their run of popularity comes to an end. This requires speeding up not only the manufacturing process but also sales procedure. These new conditions also help to explain the hand-to-mouth buying by jobbers, retailers, and garment makers, which has become the bane of all textile industries. This aversion of purchasers to making long-time commitments has been reenforced by unhappy memories of losses on stocks in hand during the price slump shortly after the war. (pp. 340-41)

The same changes in the character of consumers' demand with consequent hand-to-mouth buying on the part of the distributive trades was true of the other textiles.

> Many of the conditions affecting the wool manufacture were identical with those embarrassing the cotton industry. Long-time contracts were giving way to hand-to-mouth buying as caprices of fashion became the determining factor in the consuming market. The vogue of woolens for men's wear, following the long ascendancy of worsteds, hung on from season to season despite the refusal of manufacturers to believe it more

[6] *History of Manufacturers in the United States,* Vol. III (New York 1929).

than a passing fancy. . . . . Finally, woolens fitted in with the quick-delivery system of buying better than worsteds. . . . . The change in trading practice from buying a season in advance to buying for immediate consumption prevented mass production and shifted the financial burden of carrying stocks largely to the holder of raw materials. As a result of this revolution in the character of their output and of their system of production, many mills, both cotton and woolen, had to be remodeled. (p. 344)

And in regard to silk manufacturers:

Fashion changes, and the adaptation of fabrics to them are too ephemeral to detain us here. Novel yarn combinations of spun and thrown silk and mixtures of silk and rayon added to the variety of new products. . . . . Consumers kept calling for higher grades and qualities of goods. The growing importance of style increased managerial costs. . . . . (p. 345)

A similar situation prevailed in the markets for shoes and leather:

Manufacturers of leather, and of boots and shoes, have been forced since the war to adjust themselves to changing market conditions similar to those encountered by textile manufacturers. . . . . Fashion has incessantly demanded new shades and varieties of leather both for footwear, which consumes four-fifths of the country's product, and for most of the varied uses that employ the remainder, with the natural concomitant of hand-to-mouth buying. . . . . Machinery has been perfected until leather can be split to extreme thinness, thus multiplying its service in display if not in wear. (pp. 349-50)

This change in the character of the demand for shoes is corroborated by the statement submitted by Mr. Jackson Johnson, former chairman of the Board, International Shoe Company, St. Louis, Missouri, to the United States Senate Committee on Education and Labor.[7]

Until a few years ago, our operations and employment were almost constantly continuous throughout the year. That was possible because our production consisted in the main of shoes of staple character. There was very little change in styles and patterns from season to season or from year to year, and while there were dull seasons for selling and heavy seasons for selling, the fact that our product was staple enabled us to estimate our requirements for the year and employ the dull seasons as well as the heavy seasons in manufacturing and storing the shoes that would be required.

While these conditions existed we were able to induce our customers to anticipate their needs, and through special dating we were able to secure their orders in advance of their actual requirements.

[7] *Hearings on Unemployment in the United States,* December 1928-January 1929 (Washington 1929) p. 133.

However, there has been a radical change in these conditions in the last few years. Our industry now is subject to the same rapid changes of styles that have affected other industries. Our factories which formerly concentrated season after season on staple shoes, must now accommodate their operations to making smaller quantities of shoes that are dictated by style and fashion from time to time. Our retail merchants, because of these changes in style, can not and will not anticipate their needs. We no longer have any assurance as to future requirements.

The fundamental cause for this change in conditions is, of course, beyond our control. . . . .

Thus the consumer's motives are likely to be modified considerably as his budget admits of the purchase of clothing only as a necessity or as he may be able to consider style and fashion. In the latter event a greater seasonality in demand may well develop as purchasers are prone to await the announcement of new modes. This tendency was intensified by efforts on the part of some industries to expand the market for their product by stressing style and vogue. Such a shift in emphasis introduces greater economic perishability, and as obsolescence of commodities becomes more rapid, the potential market for the industry grows.[8] The buyers' market that existed after 1921 in most consumers' goods gave rise to this attempt by industries producing semi-durable and durable goods to render them more perishable through greater fashion and style appeal; this, in its turn could not help but render consumers' demand more seasonal in character.

Thus the trends in the supply of raw materials and seasonality of consumers' demand in the two groups of goods reenforced the influence of declining price levels on the adaptation of industrial activity to consumers' demand, resulting in a marked decline in the seasonal swing in the production and flow of finished food products and a marked increase in that of the production and flow of semi-durable and durable consumers' goods.

In so far as an increasing seasonal swing in production means a larger volume of over-equipment and idle labor, the significance of the conclusions just reached becomes clearer

[8] For an interesting discussion of this tendency in automobiles see C. E. Frazer and G. F. Doriot, *Analyzing Our Industries* (New York 1932) Chapter III, p. 33. The authors refer to a reported instance of a decision to manufacture an eight instead of a six cylinder car made at the insistence of the sales department over the veto of the engineering department.

if we consider it together with the generalization arrived at by Leverett S. Lyon concerning changes in stock burden during the post-War years.

The general conclusions that can be drawn as to stock burden vary somewhat with the nature of the industry considered. American production as a whole may be divided into two classes so far as stock burden is concerned. In agriculture, in many industries definitely related to agriculture, and in some others the economies of seasonal production make large stocks unavoidable. In many lines of manufacture, stocks can be reduced by improved practice in manufacturing, selling, and in purchasing. Obviously in wholesaling and retailing the buying policy of the merchant may be a dominant factor.

There is evidence showing that a larger burden of the stocks of agricultural products has been carried by the farmer since 1921 than for the period between the outbreak of the war in Europe and that date. Of canned foods, sugar, and cheese, all immediately dependent upon seasonal production, the manufacturer or storer has in recent years been carrying a heavier stock burden than formerly. In such products where the burden must be borne by someone, there has been, in other words, a tendency to keep an increased part of it at the point of first or early incidence.

The other industries studied, however, give no reason for concluding that in general manufacturers are, compared with those to whom they sell, worse off in the matter of stock burden than they were a number of years ago. A fully satisfactory opinion on this point would require a more complete comparison of the present and the past division of burden among successive participants in many industries than has been made. Yet it is significant that the evidence shows only a slight lessening in the stock burden of retailers and somewhat more lightening of the burden carried by wholesalers, and omitting the building trades, more cases of decreased than increased burden among manufacturers. From such observations it seems a reasonably safe conclusion that where the conditions of production make it possible to control stocks, current buying methods have shifted no new load to manufacturers or wholesalers generally, and that, on the contrary, either by adjusting their production to these methods or by revising their own purchasing practices, or both, they have in many cases decreased the stock burden carried.[9]

Thus, in the industries in which the seasonal problem lay on the side of the supply of raw materials, larger seasonal stocks were kept while production was allowed to become more even. In goods that are subject to seasonal demand, on the contrary, production was allowed to become more seasonal and inventories of finished commodities were reduced.

Whether from the viewpoint of society as a whole the reduction of stock holdings as a consequence of hand-to-mouth

[9] *Hand-to-Mouth Buying* (The Brookings Institution, Washington, 1929), pp. 274-5.

buying and of hand-to-mouth production was beneficial remains highly problematical. It is true that stocks in the form of goods declined in volume. But stocks in the form of equipment and labor must have increased, for only such an increase would make possible a seasonal expansion in productive activity. This expansion has not been the only factor that served to give rise to over-equipment and idle labor. Changes and readjustment of a wider sweep than is involved in shifts in the seasonal burden may have occurred, but in so far as changes in the apportionment of the seasonal burden contributed to the formation or retention of excess equipment and idle labor, the waste involved in them must be set over against whatever benefits society may have derived from the reduction of the volume of goods held in the form of commodity stocks.

Finally, the reduction of commodity stocks helped to stimulate over-equipment in so far as the credit funds that were released by cutting down inventories became available for long-time investment in industry. The speculative expansion of 1924-29, which, according to observers, was fed partly by funds released as a result of hand-to-mouth buying, meant that the industrial system could avail itself of cheap money for purposes of plant expansion; and this plant expansion and reorganization in its own turn meant, in many instances, over-equipment and technological unemployment. Thus, the interrelation is close and manifold between declining price levels, changes in stock holding at the various stages from the derivation of raw materials to the finished products, cheap money and plant expansion, a rising standard of living and modifications in buying habits of consumers, and seasonality of productive activity. It is clear that shifts in seasonal swing constitute only one facet of the integrated process of post-War changes in the economic life of the country.

C. Changes from Year to Year

1. The Method of Measurement

The factors just suggested as determining changes in the size of seasonal variations—the financial condition of farmers and their price expectations for the movement of agricultural commodities; changes in purchasing policy on the

part of the distributive trades and price prospects, equipment conditions and the element of fashion on industrial activity; modifications in seasonality of consumers' demand—all these, but especially the first two groups of factors, are likely to affect seasonal amplitude not only from period to period but also from year to year. Price prospects, promptness of purchasing, extent of over-equipment, consumers' affluence, may be expected to vary from year to year with the business cycle. It therefore becomes important to measure changes in the size of the seasonal swing over intervals shorter than those covered by constant seasonal indexes. Such measures would throw further light upon the forces which determine the changes as well as upon their economic implications. Also, like the measures of persistence of seasonal pattern, they may be of value as possible technical guides in the statistical methodology of measuring seasonal variations.

The comparison involved in the measurement of annual changes of seasonal amplitude is, as in that of persistence of pattern, one between deviations of original data from the moving average and deviations of the average seasonal index from 100. The simplest way of making this comparison for amplitude is to compute the average deviation of the original data from the moving average for a year, and compare this average deviation with the average deviation of the constant seasonal index for the period which includes that year. As the former average deviation is smaller or larger than the latter, the seasonal amplitude in the given year may be considered narrower or wider than the amplitude for the period as a whole.

This comparison of average deviations would yield a measure of the degree to which the seasonal swing remained the same from year to year similar to that of an index of similarity for the persistence of seasonal pattern. But the reasons that prevented us from using the indexes of similarity to test persistence of pattern from year to year bar the use of average deviations to measure annual changes in seasonal amplitude: the deviations of the original data from the moving average include not only the seasonal but also some non-seasonal elements. In the arithmetical addition involved in obtaining the average deviation, these non-seasonal elements will swell the measure, thereby causing an over-estimate of

the seasonal amplitude by a varying amount from year to year.

Consequently, second moment comparisons are again utilized in the expectation that in the product-moments the non-seasonal elements, not being associated with the average seasonal pattern, will be cancelled. The measure of seasonal amplitude is, then, the coefficient of linear regression of the deviations of the original data from the moving average on the deviations of the average seasonal index from 100. This coefficient, which is referred to in the discussion below as the amplitude ratio, is given by the following formula:

$$\text{Amplitude Ratio} = \frac{\Sigma ds}{\Sigma s^2}$$

in which:

d = percentage deviations of original data from moving average

s = deviations of the average seasonal index from 100

If the amplitude ratio is larger than 1.0, the seasonal amplitude in the year which is being compared with the average seasonal index is higher than the amplitude of the latter. If the ratio is less than 1.0, the seasonal amplitude in the given year is lower than that of the average seasonal index. If seasonal indexes are computed for two periods, a continuous series of amplitude ratios is built by first computing amplitude ratios for each of the indexes separately and then rendering them comparable by reducing them to the mean standard deviation of the two seasonal indexes. The amplitude ratios may be computed for any period of twelve months, but in the discussion below they have been utilized primarily for calendar years.

2. The Movement of Amplitude Ratios

a. *Wheat and Flour*

Table XLIII presents the amplitude ratios for four selected series dealing with the flow of wheat and wheat flour.

The wide range of variations in the amplitude ratios is apparent. In wheat marketing the lowest is 0.63, the highest 1.31, and slightly greater spreads characterize wheat receipts at primary markets (from 0.71 to 1.46), wheat flour pro-

duction (from 0.63 to 1.54), and wheat flour consumption (from 0.69 to 1.41).

When the year to year changes in amplitude ratios are studied wheat marketings by farmers and wheat receipts at primary markets, and wheat flour production and wheat flour consumption are found to be similar. Thus, counting just the signs that indicate direction of change we find that wheat

TABLE XLIII

SEASONAL AMPLITUDE RATIOS BY YEARS

SELECTED SERIES ON WHEAT AND FLOUR

Year	Wheat Marketing by Farmers [a]	Wheat Receipts at Primary Markets	Wheat Flour Production	Wheat Flour Consumption
1919	1.15		1.54	
1920	0.63		1.02	
1921	1.02	0.78	1.37	1.19
1922	0.84	0.71	1.36	1.41
1923	0.92	0.87	1.00	1.02
1924	1.05	1.26	0.97	0.97
1925	1.00	0.76	1.10	1.27
1926	1.07	1.22	1.04	0.94
1927	1.08	1.00	0.64	0.85
1928	1.05	0.99	0.78	0.95
1929	1.31	1.37	0.65	0.75
1930		1.46	0.63	0.69
1930–31		1.28	0.75	0.76

[a] Crop years 1919-1920, 1920-1921 and so on.

marketings and receipts show the same signs in seven out of eight changes, flour production and flour consumption in nine out of ten.

The factors that determine the variations in amplitude ratios in such a pair of series as wheat marketings and wheat receipts at primary markets could be ascertained with assurance only from a close study of the annals of the industry. However, by comparing changes in amplitude ratios with those in the ratio of spring to winter wheat we found that whenever the ratio of spring to winter wheat increases, the seasonal amplitude of marketing tends to decline (for the period 1919-29 this was true seven times out of ten). Since spring wheat is the less important fraction of the crop, an

increase in the ratio of spring to winter wheat means a more even division between the two in the total harvest and consequently a milder seasonal in marketings. Another factor of possible importance in determining changes in the seasonal amplitude of wheat flow are the various combinations of prospective prices with the financial standing of farmers. Whenever the latter happens to be good at the same time that prices are expected to improve, marketing will not be prompt and the seasonal swing will be relatively mild. Whenever financial pressure is great and prices may be expected to decline, wheat will be marketed promptly following the harvest and the seasonal amplitude is likely to be high. This hypothesis finds substantiation in the low amplitudes of 1920-21, when the farmers were in rather good financial position and expected that prices, which had broken very badly, would improve.

It is highly significant that changes in the amplitude ratios of wheat receipts and of wheat flour production move in opposite directions. The signs of the change are unlike eight times out of ten, and in one of the exceptional two instances of coincidence small changes are involved. Thus, the factors that make for a wider seasonal swing in the flow of wheat seem to have an opposite effect upon the intensity of seasonal variations in the production of flour. Brief reflection will indicate that such results should have been expected. If we envisage the carriers of wheat and the producers of flour as two distinct business groups, it becomes obvious that the causes that induce the former to move the wheat promptly after the crop season (high current prices and expectation of lower prices) are exactly the factors that would induce the latter to delay the purchase of wheat. Even when flour mills are the movers of wheat, that is, when they are themselves the buyers and consumers, competition between the grain division and the milling division is set up within the mill. And if because of anticipated price improvement, the grain division spreads out the moving of wheat and thus dampens its seasonal, the milling division has all the more reason to hasten the stocking of wheat in terms of flour. Thus, a milder seasonal in wheat flow will tend to be accompanied by a more conspicuous seasonal in flour production, and vice versa. This tendency

was noted above to hold true not only from year to year but from one longer period to another.

As wheat flour consumption is really disappearance of flour into trade, the fact that the change in the size of the seasonal swing from year to year is the same as that in wheat flour production is not surprising. The factors that impel bakers and distributors not to keep seasonal stocks of flour also have a marked effect upon its producers.

Just as we compared changes in the size of the seasonal swing from period to period with changes in absolute volumes, so it is interesting to compare annual changes. For the three series for which comparison is possible there is a mild negative association. In wheat receipts, wheat flour production and flour consumption, changes in the size of the seasonal swing and in the volume of the series are unlike in some years and similar in others. For all three series the number of agreements in direction of change is 12, of disagreements, 18. There is thus a slight tendency for the seasonal swing of all three series to decline when a good crop succeeds a poorer one or the volume of production rises. This negative association will be found more marked in most series dealing with industrial activity.

b. *Livestock and Meat*

Table XLIV presents the amplitude ratios for series recording the movement of livestock and meat. For each of the three groups, receipts at primary markets, production and apparent consumption of meat are analyzed. Chart 50 presents the amplitude ratios as well as other measures that either explain the movement of the ratios or serve as a check upon their validity.

In general, variations in the size of the seasonal swing appear considerable but there are interesting differences among the series. The changes in seasonal amplitude in cattle and calves appear on the whole to be less conspicuous than in the other two groups of livestock; the same is true of beef and veal as compared with mutton, lamb and pork products. The difference may be attributable to the much longer cycles characteristic of the supply of bovine livestock.

The size of the seasonal swing in receipts of cattle and calves at primary markets has undergone changes roughly

TABLE XLIV

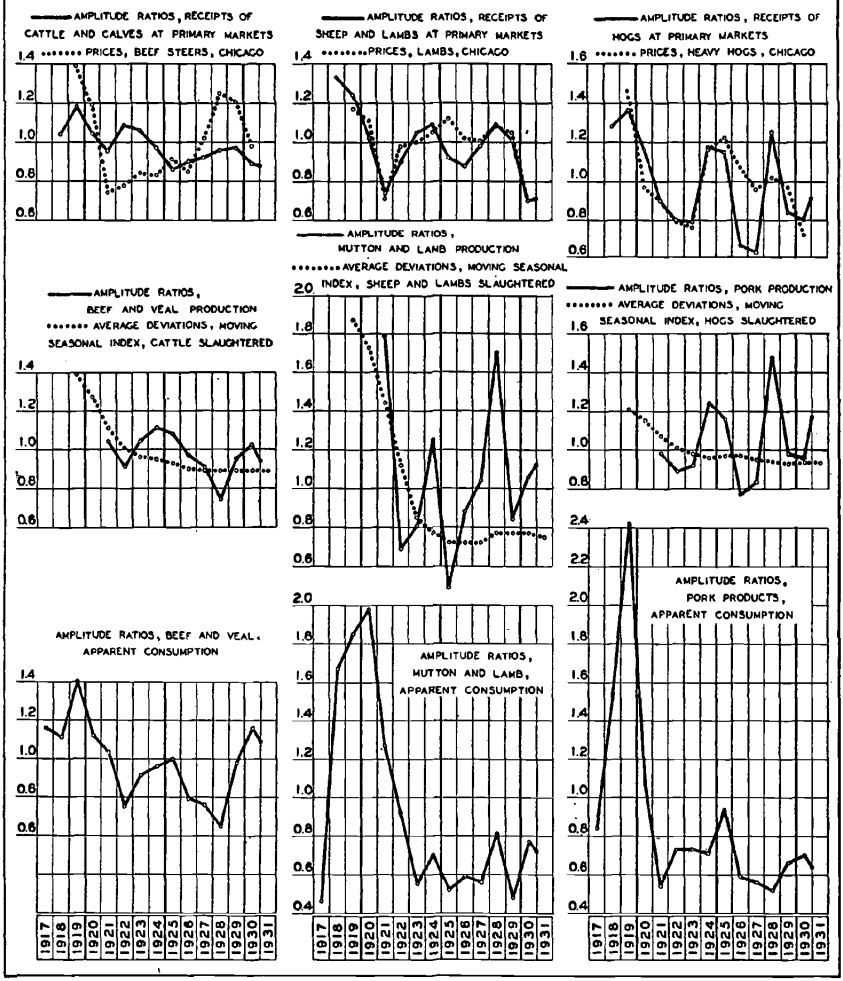
SEASONAL AMPLITUDE RATIOS BY YEARS

SELECTED SERIES ON LIVESTOCK AND MEAT

Years	Cattle and Calves Receipts	Beef Production	Beef Consumption	Sheep and Lambs Receipts	Mutton and Lamb Production	Mutton and Lamb Consumption	Hog Receipts	Pork Production	Pork Consumption
1917.....			1.16			0.46			0.84
1918.....	1.04		1.11	1.33		1.67	1.28		1.54
1919.....	1.18		1.40	1.24		1.85	1.36		2.42
1920.....	1.04		1.12	1.02		1.98	1.16		1.07
1921.....	0.95	1.04	1.03	0.73	1.79	1.27	0.90	0.98	0.54
1922.....	1.09	0.91	0.75	0.90	0.69	0.92	0.80	0.90	0.73
1923.....	1.06	1.04	0.91	1.05	0.81	0.55	0.79	0.92	0.73
1924.....	0.97	1.11	0.96	1.09	1.25	0.70	1.17	1.24	0.71
1925.....	0.86	1.08	1.00	0.92	0.49	0.52	1.15	1.16	0.94
1926.....	0.90	0.97	0.79	0.88	0.88	0.59	0.66	0.77	0.59
1927.....	0.92	0.91	0.76	0.98	1.04	0.56	0.62	0.83	0.56
1928.....	0.96	0.74	0.65	1.09	1.70	0.81	1.25	1.48	0.52
1929.....	0.97	0.95	0.98	1.01	0.84	0.48	0.84	0.98	0.66
1930.....	0.89	1.02	1.16	0.70	1.06	0.77	0.80	0.96	0.71
1930–31.....	0.88	0.94	1.09	0.71	1.12	0.72	0.91	1.17	0.64

CHART 50

ANNUAL CHANGES IN THE AMPLITUDE OF SEASONAL VARIATIONS: LIVESTOCK AND MEAT



NOTE.—On Charts 50 and 51 series other than those of amplitude ratios are converted into relatives, the arithmetic mean for the period being taken as 1.0.

described by two wave-like movements, one reaching a maximum in 1922, the other in 1929. An attempt to relate these variations in amplitude with changes in wholesale prices of steers discloses some association. Thus both prices and amplitude declined from 1919 to 1921; furthermore, each rose to a maximum in 1928-29. But from 1922 through 1926 no correlation appears.

The reason for this attempt to associate changes in price with those in the size of the seasonal swing has been suggested above. If livestock growers consider prices high, they tend to market their stock rather promptly when it reaches maturity for slaughtering purposes. If prices are low and are expected to rise, the growers tend to delay marketing and continue feeding, especially if the price of fodder is reasonable. Hence in periods of mounting prices there is a tendency for more seasonal marketing, while in periods of falling prices there is a tendency towards more even marketing.

Receipts at primary markets cover cattle shipped both for slaughtering purposes and for outshipments as stockers and feeders. The latter constituted between 18 and 20 per cent of total shipments during post-War years. Their seasonal fluctuations are large and undoubtedly affect the seasonal swing in the flow of cattle to the slaughter houses. They probably also account for the opposite direction of the changes in the amplitude ratios in the production of beef and veal and in receipts. Of the ten possible comparisons seven are unlike in sign. The indication is strong that when the seasonal swing in receipts expands, that of outshipments of stockers and feeders expands still further and that of slaughtering contracts. With an increase in the price of cattle, there is thus a tendency to carry heavier seasonal stocks in the form of live animals rather than to have the production of meat fluctuate seasonally.

For comparison with the amplitude ratios in beef and veal production we have drawn on Chart 50 the changes in the average deviation of the moving seasonal index (Federal Reserve Board) for cattle slaughter. It may be seen that the latter describes very well the long-time movement in the amplitude ratios and sometimes reflects even their up and down changes.

The close similarity of changes in the size of the seasonal

swing in beef and veal production and of apparent consumption tends to suggest that as in the case of flour production and consumption, the factors that determine variations in seasonality in processing and in purchase by the trade are the same.

For the second group of livestock the movement of amplitude ratios suggests somewhat different conclusions. The influence of price changes on variations in the size of the seasonal swing in receipts is much clearer in the case of sheep and lambs. The changes in prices and in the amplitude ratios of receipts are very similar. Prices lag behind amplitude ratios somewhat at the peak in 1924 and at the trough in 1926, but that might have been expected, for prospective rather than actual prices influence the seasonality of livestock marketing and the decision whether a lamb should be retained for further feeding or shipped immediately to the terminal market.

The changes in the amplitude ratios of sheep and lamb receipts at markets and mutton and lamb production are also similar: the direction is the same seven times out of ten. This agreement is surprising because the percentage of sheep and lambs shipped back as stockers and feeders is at least as large as in the case of cattle and calves. Inspection of Chart 50 shows that while the swings in amplitude ratios are much more sharply outlined in mutton and lamb production than in sheep and lamb receipts, the two lines move very similarly. The reasons for this similarity are not clear.

Between production and apparent consumption of mutton and lamb agreement is also marked, the direction of changes in the amplitude ratios being the same in seven instances out of ten. There is, however, a much more marked drop in the size of the seasonal swing in consumption.

Passing on to the third group of livestock, we find again that the association between changes in the prices of hogs and in the size of the seasonal swing in receipts at primary markets is marked. Since the year covered by prices runs from October to September, they may be expected to lag somewhat behind receipts. The marked agreement exhibited justifies the conclusion that as prices rise the magnitude of the sea-

sonal swing in receipts increases, but when prices decline, there is a greater tendency not to market as heavily in the seasonal months.

In hogs, as in sheep and lambs, changes in the size of the seasonal swing in receipts at primary markets and in production of the meat correspond, the direction of change of amplitude ratios being the same in the two series eight times out of ten. But in hogs the agreement is expected, for outshipments of hogs as stockers and feeders are quite negligible compared with total receipts. Since the major portion of receipts at primary markets is either slaughtered there or shipped out for prompt slaughtering at other markets, changes in the seasonal swing of receipts ought to be reflected in similar changes in that of pork production. In contrast to the other two groups of meats, however, changes in the size of the seasonal swing in production and in apparent consumption of pork show little agreement. As in the consumption of mutton and lamb, the seasonal decline in the consumption of pork is rapid. But eight times out of ten the amplitude ratios in pork consumption move in a direction opposite to that of the ratios for pork production. Two reasons may be suggested for this different showing of pork: larger exports and large cold storage holdings. Exports of pork products amounted during the post-War years to about 18 per cent of total domestic production, and average cold storage holdings were equivalent to about a month and a quarter of production—both ratios much higher than in lamb or beef and veal.

The factors that determined the size of the seasonal swing in pork consumption may only be guessed at. Its movements agree very well with those in beef and veal consumption, the direction of change being the same in ten instances out of fourteen. Summer demand for these two groups of meat declines more than for lamb. It is possible, therefore, that the year-to-year changes in the size of their seasonal swings were influenced by variations in summer temperature. Years with rather warm summers may be characterized by wide seasonal swings and years with cool summers by narrower seasonal swings.

In livestock and meat there seems to be little association between changes in the size of the seasonal swing and in the

absolute volume of activity. It might be suspected that since variations in the seasonal swing, as they are reflected in the amplitude ratios, are relative, they would really be determined by changes in absolute volume; and that since the absolute rather than the relative size of the seasonal swing is stable, especially over short intervals, our measures would vary inversely with changes in absolute volume. If this were true, amplitude ratios would rise when absolute volumes declined, and vice versa. Or, at least, amplitude ratios would be high (above 1.0) when absolute volumes declined, and vice versa. But comparisons of both the size of the amplitude ratio and the change in amplitude ratios with changes in absolute volume show that in the livestock series such a negative association does not exist.

Table XLV shows clearly that except for sheep and lamb receipts, in which there is a definite preponderance of negative association between changes in volume and in amplitude ra-

TABLE XLV

COMPARISON OF CHANGES IN THE ABSOLUTE VOLUME OF THE SERIES WITH THE STANDING OF AND CHANGES IN AMPLITUDE RATIOS

SELECTED SERIES ON LIVESTOCK AND MEAT

Series	Changes in Volume and Standing of Amplitude Ratios			Changes in Volume and Changes in Amplitude Ratios		
	Number of Times the Two			Number of Times the Two		
	Agree	Disagree	Indeterminate	Agree	Disagree	Indeterminate
	In Sign			In Sign		
Cattle and Calves, Receipts.	8	5	0	6	7	0
Beef and Veal Production.	6	4	0	4	6	0
Beef and Veal Consumption	5	8	1	7	6	1
Sheep and Lambs, Receipts	4	6	3	3	7	3
Mutton and Lamb Production	6	4	0	8	2	0
Mutton and Lamb Consumption	4	10	0	7	7	0
Hogs, Receipts	6	7	0	7	6	0
Pork Production	3	7	0	6	4	0
Pork Consumption	7	7	0	6	8	0
Total of 9 Series.....	49	58	4	54	53	4

tios, and one or two series in which there is similar association between changes in volume and standing of amplitude ratios, the series lack the expected correlation. The totals for the nine series are especially revealing in their negative evidence. Thus, the changes in the size of the seasonal swing as measured by our ratios would have led us to the same conclusion even if we had used absolute instead of relative amplitudes.

c. *Industrial Activity*

The two groups for which annual changes in the size of the seasonal swing have been studied were composed principally of series whose seasonal swing is determined by seasonality in the supply of raw materials. Since these factors are primarily climatic and organic in character, it was quite illuminating to discover that changes in the amplitude ratios seem to have been determined chiefly by such purely economic factors as price expectations. In the present group of series the play of these economic forces, which were outlined above in explaining the reasons for changes in the size of the seasonal swing from period to period, appears still more prominently in determining year to year changes.

Table XLVI presents the measures for eight selected

TABLE XLVI

SEASONAL AMPLITUDE RATIOS BY YEARS

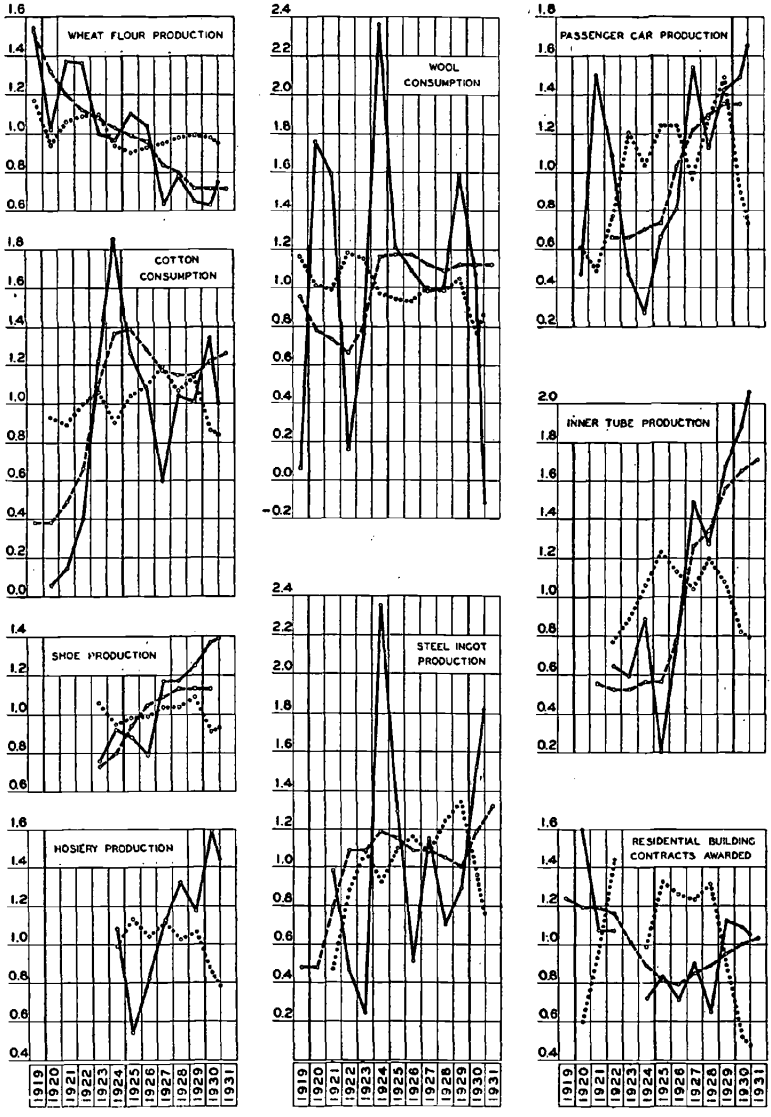
SELECTED SERIES OF INDUSTRIAL PRODUCTION

Year	Cotton Consumption	Wool Consumption	Shoes	Hosiery	Passenger Cars	Inner Tubes	Steel Ingots	Contracts Awarded, Residential
1919		0.06						
1920	0.06	1.76			0.47			1.02
1921	0.14	1.59			1.50		0.98	1.13
1922	0.40	0.16			1.09	0.64	0.46	1.38
1923	1.22	0.76	0.76		0.47	0.59	0.24	
1924	1.85	2.36	0.92	1.08	0.27	0.89	2.35	0.72
1925	1.26	1.21	0.88	0.54	0.56	0.29	1.29	0.80
1926	1.08	1.09	0.82	0.82	0.81	0.76	0.51	0.49
1927	0.60	0.98	1.17	1.12	1.54	1.49	1.15	0.85
1928	1.04	1.00	1.17	1.32	1.13	1.27	0.70	0.78
1929	1.01	1.59	1.25	1.17	1.42	1.67	0.89	0.98
1930	1.34	1.07	1.37	1.59	1.49	1.88	1.52	1.26
1930–31 ...	1.00	— 0.11	1.39	1.44	1.65	2.06	1.82	0.97

CHART 51

ANNUAL CHANGES IN THE AMPLITUDE OF SEASONAL VARIATIONS: SELECTED INDUSTRIES

——— AMPLITUDE RATIOS
------ AVERAGE DEVIATIONS OF MOVING SEASONAL INDEX
..... VOLUME OF ACTIVITY



branches of industrial activity. These eight series of amplitude ratios and the ratios for wheat flour production are given graphically on Chart 51, for purposes of comparison, together with the annual absolute volumes of activity and the average deviations of the moving seasonal indexes computed by the Federal Reserve Board for the same series. The first of these comparative measures throws light on the factors that determine changes from year to year in the size of the seasonal swing; the second serves as a general check upon the validity of the amplitude ratios.

The average deviations of the moving seasonal indexes for each year were expressed in terms of the average deviation for the period as 100. Comparison of the curves on Chart 51 shows clearly that the moving seasonal indexes reflect the same secular movements in the size of the seasonal swing as are indicated by the amplitude ratios, and also bear faint traces of the fluctuations in amplitude that are brought out so conspicuously by the amplitude ratios. It is apparent that the latter throw into relief variations in the size of the seasonal swing which the moving indexes present in a smoother and hence much milder fashion.

In this group we find the negative association of amplitude ratios and absolute volumes so conspicuously absent in the livestock and meat series. Table XLVII shows this inverted relation.

Why does the seasonal swing increase when absolute volume of activity declines? And why does the inverted association occur only in the series on industrial activity? Why can it not be found in such series as meat production?

The explanation seems to be that fluctuations in absolute volume in series measuring industrial activity indicate changes in business conditions, with the implied modifications in purchasing policy on the part of the distributive trades, variations in the amount of surplus equipment at the disposal of the industry, and changes in the business prospects for the immediate future. Decline in the volume of activity of the industries producing passenger cars, cotton or steel ingots usually indicates the presence of a cyclical contraction. During the declining phase of the business cycle hand-to-mouth buying by the distributive trades (and consumers) becomes more prominent. Manufacturers are then faced with the ne-

cessity of supplying a more variable demand. Although the decline in volume of activity makes surplus equipment available, the possibility of a further price decline discourages production for stock. Hence, manufacturing activity itself

TABLE XLVII

COMPARISON OF CHANGES IN THE ABSOLUTE VOLUME OF THE SERIES WITH THE STANDING OF AND CHANGES IN AMPLITUDE RATIOS

SELECTED SERIES ON INDUSTRIAL PRODUCTION

Series	Changes in Volume and Standing of Amplitude Ratios: Number of Times the Two In Sign: Agree	Dis-agree	Indeter-minate	Changes in Volume and Changes in Amplitude Ratios: Number of Times the Two In Sign: Agree	Dis-agree	Indeter-minate
Cotton Consumption	5	6	0	3	8	0
Wool Consumption	3	9	0	5	7	0
Shoe Production	4	3	1	3	4	1
Hosiery Production	3	4	0	2	5	0
Passenger Car Production.	5	6	0	3	8	0
Inner Tube Production....	2	7	0	1	8	0
Steel Ingot Production....	1	9	0	1	9	0
Building Contracts, Residential	4	5	0	3	6	0
Total of 8 Series.....	27	49	1	21	55	1

is allowed to fluctuate seasonally as the best possible adjustment to the situation. When volume of activity is rising, which usually occurs during a period of cyclical expansion, the tendency to hand-to-mouth buying on the part of traders and consumers is diminished, the surplus equipment needed to facilitate seasonality in output is smaller, and there is a temptation to produce for stock, if price improvement is expected. As a result the seasonal swing tends to decline in the years when absolute volume of activity expands.[10]

[10] This intimate relation between changes in seasonal amplitude and cyclical fluctuations has been pointed out by two Scandinavian students of the problem. In his recently translated *Economic Progress and Economic Crises* (London 1932) Dr. Johan Åkerman writes

> "it may be asked whether *each year* has approximately the same seasonal variation, or whether the deviations from the mean figure are very

Indeed, when the dates of the expansion and contraction in volume and in seasonal swing in such industries as automobiles, steel ingots and construction are examined, they are found to mark years of cyclical rise and fall. Thus, absolute volume of passenger car production declined in 1921, 1924, 1927, 1930 and 1931. These, with the exception of 1924, were all years in which the amplitude ratios were higher than in the preceding year. On the other hand, the amplitude ratio declined in 1922, 1923 and 1928, years of marked cyclical expansion.

In industries supplying a seasonally stable demand, however, expansion in absolute volume, in so far as it indicates less hand-to-mouth buying on the part of the trades, should have been accompanied by widening seasonal swings, and shrinking absolute volumes should have been accompanied by declining seasonal swings. The absence of such a positive association would be attributable to the influence of variations in the seasonal swing of the supply of the raw material. For unlike most of the industries in the present group, industries dealing with meat and flour have to adjust themselves to a seasonal raw material. And it is variations in the size of the latter, combined possibly with changes in climate, that determine, either positively or negatively, changes in the size

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great. If we examine the economic statistics we shall find not only that the deviations are very great, but also that they show an association between seasonal waves and cycles which has not yet been sufficiently considered. It appears in fact that the seasonal variations of iron and steel production are very conspicuous during bad times, while during good times they are, so to speak, swallowed up by the cyclic wave. In other words, seasonal demand determines the whole trend of industrial life during depression, when no one dares to trust in the future, whereas seasonal demand becomes of small importance during the prosperity phase, when everyone is counting on a large future demand and a constantly increased formation of new means of production. The very dissimilar aspect of seasonal variations during good and bad times in industry only applies to those economic phenomena which are more or less directly associated with the creation of new capital, that is to say, in the long run, with economic progress." (pp. 41-2.)

Mr. Eilif Gjermoe has found upon analyzing the statistics of trade union unemployment percentages in The Netherlands, Sweden, Denmark and Norway that the amplitude of the seasonal swings depends upon the level of business conditions; that a month in a year of low business activity will thus show a more seasonal character than a similar month in a year of high business activity. (See his The Business Cycle Element in the Seasonal Fluctuation of the Degree of Business Activity, *Staatsøken. Tidsskrift* no. 2-3, 1931, abstracted in *Social Science Abstracts*, July 1932, abstract no. 11746).

of the seasonal swing of the corresponding manufacturing activity.

Since the annual movement of seasonal amplitude in industries producing semi-durable and durable consumers' goods is primarily a reflection of the cyclical swing in these industries, we find a similarity in the changes of amplitude ratios in series whose cyclical fluctuations tend to show similarity. It is for this reason that the amplitude ratios of cotton and wool consumption, automobiles and inner tubes, passenger cars and steel ingots, steel ingots and building contracts move together. On the other hand, there is little similarity in the annual changes in the size of the seasonal swing in cotton consumption and passenger car production, or wool consumption and building contracts.

Thus, just as the trends prevalent during the post-War years in purchasing policy, over-equipment and the style elements in consumers' demand have affected the size of the seasonal swings in industries producing semi-durable and durable goods when measured from period to period, so have the cyclical oscillations in business conditions had an influence on year-to-year changes. To the extent that seasonal swings in the flow of agricultural commodities are influenced by prospective price movements and changes in the size of the crop, the variations in the size of the seasonal swing from year to year are also a secondary reflection of the cycle, in this case, of the agricultural cycle.

This correlation of the size of the seasonal swing with the cyclical movement in the time series means that not every increase in the seasonal variation implies ipso facto an increase in the total burden that it imposes upon the productive factors. If in the course of cyclical contraction considerable over-equipment develops and unemployment grows large, both serving to increase seasonality in industrial activity, the expansion of seasonal swing then occuring involves no demand for additional machinery or labor. Similarly, if in the course of a post-War readjustment, such as took place in this country after 1920, a secular tendency towards over-equipment and unemployment develops that causes a secular rise in the seasonal swing of productive activity, the rise cannot be debited with imposing additional burdens on equipment or labor. On the other hand, if it could be said that the over-equipment

and surplus labor have themselves been called into being, if only partly, by a rise in the seasonal swing of consumers' demand, or by the refusal of the distributive trades to assume as much as before of the task of meeting a seasonally variable demand by final consumers, then, of course, to the increasing seasonal swing characterizing industrial output could be imputed the full burden of the over-equipment and surplus labor.

This difficulty of proper imputation should be kept in mind whenever inferences are to be made concerning the burden involved in seasonal variations and changes in it implied by changes in the size of the seasonal variations. Thus, as we pass now to study changes in the seasonal swing in payrolls, we can consider the measures only as reflecting modifications in the specific burden of seasonal instability. But it must be remembered that such changes in seasonal instability of the flow of labor incomes may be taking place within the much wider maladjustment caused by cyclical oscillations or secular movements.

d. *Payrolls in Selected Industries*

Table XLVIII presents the amplitude ratios for payrolls in eleven branches of industry, selected for study as characterized by wide seasonal swings.

These amplitude ratios disclose first of all whether, on the whole, the size of the seasonal swing in payrolls was increasing or decreasing after 1924. Inspecting Table XLVIII with the purpose of discovering the direction of the change, we find that in flour, sugar refining, and to a certain extent even in cotton goods, there is a declining trend in the size of the seasonal swing. In all other industries the amplitude ratios are definitely rising, most markedly in automobile tires and tubes, automobiles and Portland cement. This showing confirms what might have been expected from the movement of the seasonal swing in industrial activity.

Furthermore, the amplitude ratios of payrolls and industrial activity in the few branches of activity for which both were analyzed move in rather close agreement. Thus, out of a total of seven comparisons, in flour and automobile tires the direction of change is the same in five instances, in cotton goods, passenger cars and steel ingots, in six. In the case of shoes only is the anticipated similarity in movement lacking.

TABLE XLVIII

SEASONAL AMPLITUDE RATIOS BY YEARS

SELECTED SERIES ON PAYROLLS IN MANUFACTURING INDUSTRIES

Year	Flour	Sugar Refin., Cane	Cotton Goods	Men's Clothing	Women's Clothing	Boots and Shoes	Auto-mobiles	Auto Tires and Tubes	Iron and Steel	Cement	Furni-ture
1924.....	1.06	2.32	1.92	1.05	1.20	0.60	0.76	0.04	2.26	0.42	0.96
1925.....	1.23	1.28	1.53	0.88	0.87	0.71	0.58	0.70	1.06	0.83	1.03
1926.....	1.50	0.79	1.61	0.86	0.96	0.80	0.61	0.28	0.47	1.03	1.13
1927.....	0.83	1.14	0.37	1.10	0.81	1.04	1.33	1.08	0.87	0.98	0.94
1928.....	0.92	0.37	0.81	0.95	0.98	1.30	0.71	0.70	0.81	0.90	1.19
1929.....	1.09	0.91	0.59	0.87	1.09	1.14	1.18	2.12	0.31	1.01	1.30
1930.....	0.55	0.90	1.24	1.27	1.10	1.27	1.34	1.72	1.33	1.51	0.77
1930–31....	0.72	0.86	1.09	1.11	1.13	1.14	1.63	1.73	1.73	1.60	0.78

It might be expected that, as in industrial activity, changes in amplitude ratios would be negatively associated with changes in the absolute volumes of payrolls. This is found to be the case in only five of the eleven series: cotton goods, women's clothing, automobiles, iron and steel and cement. In the other series the lack of association indicates that the size of the seasonal swing in payrolls may increase or decrease without definite connection with changes in the absolute volume of payrolls. This may be because the absolute volume of payrolls itself does not vary precisely with the volume of industrial activity. But this hypothesis cannot be pursued further at this point.

By and large, it may be said, however, that fluctuations in the size of the seasonal swing in industrial activity are reflected in the changes in the seasonal swing in the flow of purchasing power to labor and that for industries in which seasonality of employment and payrolls is considerable the result of this connection was to increase during recent years the seasonal instability in the volume of purchasing power disbursed.