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SEASONAL VARIATIONS IN INDUSTRY AND TRADE

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SEASONAL VARIATIONS IN INDUSTRY AND TRADE

SIMON KUZNETS

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1933

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FOREWORD

In the course of the nineteenth century, analysis of statistical records led to the discovery that the bewildering variety of changes in economic activities belong to at least four distinct species. Cournot pointed out that secular movements, long recognized in astronomy, have their analogues in economics. Juglar gave precision and content to the conception of cyclical fluctuations that earlier writers had suggested. Jevons developed, though he did not originate, the notion of seasonal variations, seeking to demonstrate their regularity and to measure their amplitudes. Meanwhile the idea that ' disturbing circumstances ' of great variety are continually interfering with the ' normal ' course of events had become a commonplace in economic theory.

As the multiplication of statistical data and the improvement of statistical technique encouraged economists to attempt bolder quantitative work, they found these concepts useful tools. Most of the time series with which they dealt could be treated as synthetic products of the four recognized types of concurrent changes. While secular trends are creeping up or down, cyclical waves wash above or below the secular levels of the day; seasonal variations diversify the secular-cyclical patterns, and random factors add their unpredictable complications to the secular-cyclical-seasonal complex.

Like most conceptual tools, the four classes of economic changes tended to become independent entities in men's minds, each calling for scientific study. Cyclical fluctuations attracted most attention. Indeed, most of the attempts to measure secular trends and seasonal variations have been made by men who wished merely to eliminate these movements in order to get a clearer view of ' cycles '. Only sporadically have investigators treated secular or seasonal changes as problems possessing interest in their own right. The literature upon these topics is scanty in comparison with the voluminous publications upon business cycles. To random perturbations scarcely any attention has been given except as the most troublesome of all side-issues in cyclical studies.

The time is ripe for more systematic and more thorough work. To promote that understanding of economic fluctuations which the world so sorely needs, the intensive study of business cycles must be supplemented by equally intensive work upon secular trends and seasonal variations. That much seems clear. It is not sure that systematic study of random perturbations will yield valuable results; but the prospects are good enough to justify experiments. Efforts should be made also to determine whether other types of change, in addition to the four familiar types, must be recognized. Only by learning all we can about the several components of economic changes shall we learn all we can about the total situation. But concentration upon one type of change should always include consideration of the way in which the type under scrutiny is related to the others.

For several years the National Bureau of Economic Research has been working upon business cycles. One of its research associates has been studying secular movements. An extension of this program to seasonal variations was a natural development, since the cyclical work required measurements of the seasonal components in some hundreds of statistical series.

Dr. Kuznets was peculiarly fitted by his earlier investigations to direct the seasonal studies. His first book, *Cyclical Fluctuations, Retail and Wholesale Trade,* published in 1926, and the leading part which he had taken in the National Bureau's business-cycle program gave him intimate familiarity with the cyclical component in economic changes. His second book, *Secular Movements in Production and Prices,* published in 1930, made him familiar with another component. With seasonal variations themselves he had an intimate acquaintance gained in the process of eliminating them from some hundreds of time series.

In preparing the present report Dr. Kuznets has supplemented the seasonal by-products of the cyclical work by making many additional measurements. The result is a systematic account, unrivalled in scope and vividness, of the rôle played by seasonal variations in production and prices. The way in which these changes dovetail into one another, the way in which they affect and are affected by changes in industrial equipment and in stocks of commodities; the alterations to

which seasonal variations are subject from year to year and over longer periods, and the relations of seasonal to cyclical and secular movements are all set forth. I am sure that economists and statisticians will find the work enlightening; I think that business men will find it of practical value.

WESLEY C. MITCHELL

National Bureau of Economic Research
January 21, 1933

ACKNOWLEDGMENTS

This book is the product of more than one man's work and application. Its basic data could not have been assembled and analyzed without the resources of the National Bureau of Economic Research. And the task of organization and interpretation was greatly facilitated by the participation of many individuals to whom I wish to express appreciation.

The manuscript was read by the Directors and research staff of the National Bureau. Especially valuable comments were made by Professor Edwin F. Gay, Colonel Malcolm C. Rorty and Professor Harry Jerome. Of the Research Associates, Dr. A. G. Silverman, and particularly Mr. Arthur F. Burns, have made far-reaching suggestions, most of which have been adopted.

Throughout the progress of the study, I have been greatly helped by Mr. Denis Volkenau and Mr. H. Irving Forman. Mr. Volkenau has had a large share in the task of computation and has also contributed various criticisms. Mr. Forman, besides assisting also in the computations, is responsible for the charts. Miss Cicely Applebaum made numerous suggestions towards the revision of the manuscript and has prepared the index. The editing of the manuscript has been carried through by Miss Martha Anderson.

Of those outside the National Bureau, I am indebted most to Miss Aryness Joy of the Research Division of the Federal Reserve Board. Miss Joy not only read the manuscript and gave valuable advice, but also made available the results of the Federal Reserve Board's extensive studies of seasonal variations. Mr. A. W. Zelomek of the Fairchild Publications has been helpful in connection with Chapter IV, and Dr. E. H. Hempel of General Motors Export, in connection with Chapter V.

To all these who have assisted me, sincere thanks are given.

SIMON KUZNETS

New York
January 22, 1933

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INTRODUCTION

The origin of seasonal variations in the forces of nature has led to their acceptance as inevitable, if expensive, irregularities and recently the acute cyclical depression has pushed into the background these less intensive disturbances. But neither consideration should obscure the need for a better understanding of the human and controllable element in seasonal variations and for a better appreciation of the urgency of reducing their cost to society as a whole or to the various social groups.

Seasonal variations in the rate of industrial activity imply a volume of equipment, stocks of raw materials and a supply of labor in excess of what would be required were activity to proceed at an even rate throughout the year. The waste thus involved is considerable for society as a whole. The establishment of the incidence of its cost to the various social groups is indispensable to an analysis of the forces involved and to the formulation of policies directed towards stabilization of economic activity.

The need for a more thorough study of seasonal changes is accentuated by their growing intensity in many industries since the World War. The production of most semi-durable and durable consumers' goods has been especially affected, for the spread of hand-to-mouth buying by those engaged in their merchandising has made for a seasonally more variable demand for such goods from manufacturers, and has therefore imposed a larger share of the seasonal burden upon them. The seasonality of demand for these goods by final consumers has, in its turn, become greater with the increasing prominence of elements of style and fashion, originating partly in a rising standard of living and partly in the attempt by manufacturers to enhance the appeal and perishability of their products.

The intensification of seasonal variations in productive activity has resulted in increasing the instability of employment and payrolls and has in some degree stimulated additions to equipment beyond any ordinary requirements. Plans for economic control and stabilization that derive their impetus from the acute disturbances of recent years will even-

tually have to face a seasonal problem which will be more considerable than that of the past. Furthermore, although business cycles may be abolished by the introduction of complete economic planning, even Soviet Russia, whose economic system is organized upon a principle differing from ours, has to contend with grave problems arising from seasonality.

Quantitative measurements are essential to an appraisal and comparison of seasonal swings in various branches of industry and trade. The knowledge that the business man gains in carrying on his business may sometimes be sufficient as a guide for his individual policy, but the general experience in any industry and those industries related to it can be properly studied and evaluated only with a set of scales of adequate precision.

Exact data may be of some practical use to those engaged in a particular industry or pursuit. They contribute chiefly, however, towards an understanding of the mechanism by which the economic system solves the seasonal problem in its various manifestations. While statistical description by itself does not explain *why* seasonal variations have been met in this or that particular fashion, it indicates *how* and thus constitutes a basic point of departure for any intelligent consideration of the way in which seasonal disturbances work themselves out in the complex economic system.

Moreover, the increased precision of observation made possible by detailed statistical analysis reveals the diversity of form that seasonal variations may assume. Knowledge of fluctuations in the size of seasonal swings from year to year and of the character of industrial and regional differences will arm us against misleading interpretations which are likely to be offered when the phenomena are viewed superficially. The familiarity with the measurable aspects of seasonal variations thus gained seems a necessary prerequisite also for any evaluation of social policies undertaken to mitigate variations or to offset their undesirable consequences.

Therefore, the various aspects of seasonal variations in the trade and industry of the United States are measured in this study. Seasonal disturbances are traced in the productive process—from the production of raw materials to the sale of their finished products. Tests are made to determine the persistence of the variations from industry to industry, from

region to region and from period to period. The purposes of the study may, then, be described as follows: to throw more light upon seasonality and its various manifestations as a contribution to a fuller comprehension of the manner in which the economic system responds to the fluctuations that periodically disturb economic processes; to serve as a basis for any policy directed toward lessening the burden of the variations; and finally, to yield a set of measurements for the guidance of individual enterprises and business analysts in their estimates of the seasonal swings typical of specific branches of business.

Every economic problem is at bottom a conflict of aims, and its solution a compromise between or a sacrifice of one or more aims. Similarly, the economic problem created by seasonal variations necessitates a solution that is dependent upon some reconciliation of conflicting purposes. This conclusion is indicated in Chapter I and serves as a unifying thread in the detailed discussion throughout the volume.

The statistical task of measuring quantitatively the disturbances which seasonal influences introduce into the rate of flow of commodities in industry and trade raised many questions of technique which had to be answered before the investigation could be carried through. The technique adopted is explained in Chapter II to enable the reader to pass upon the validity of the measures presented.

Part II is devoted mainly to an analysis of the seasonal movement of commodities in four groups of industries. An examination of all fields of industry and trade for which appropriate data are available was, because of the immensity of the task, quite impossible. Detailed discussion is therefore confined to industries in which seasonal disturbances are conspicuous at any stage between the production of raw materials and the sale of finished goods, and which illustrate an adjustment to different types of seasonal problem. Food products are chosen for detailed discussion as typical of industries the supply of whose raw materials is seasonally affected but whose finished products are subject to a relatively even final demand. Cotton textiles are selected as representative of industries in which both the supply of raw materials and the demand for finished products are seasonally variable. Automobiles and related products are discussed as characteristic of industries

PART I

The Economic Problem of Seasonal Variations and their Statistical Measurement

CHAPTER I

THE ECONOMIC PROBLEM

1. The Causes of Seasonal Variations

Nature and human institutions conspire to produce seasonal variations in industrial and trade activity. Climatic seasons bring changes in the length of the day and night, in temperature and precipitation; and these in manifold ways affect conditions of production and demand for commodities. In the temperate zone the supply of all agricultural products and of some other raw materials varies strikingly from month to month in response to successive climatic changes. Climate determines the periods of growth and maturity of crops and livestock; consequently, economic activity connected with planting and harvesting, as well as most related processes, bear marked evidence of seasonal influence.[1] Limited seasons in outdoor pasturage time the breeding of livestock and tend to create definite periods in their maturity for slaughter or milk production. In the less important industry of trapping fur-bearing animals the influence of climate on breeding leads to closed seasons for game. Similarly, iron ore and other materials cannot be transported on the Great Lakes when winter closes them to navigation; tree-felling is possible only under certain conditions of moisture and temperature; clay cannot be obtained easily from frozen ground.

Demand for finished goods also is affected by climatic seasonal changes. The readiness of consumers to purchase textiles, shoes and automobiles varies with changes in temperature and precipitation. Warm weather reduces demand for some food products, such as meat, and increases that for others.

But all seasonal changes are not induced by climate. Conventions also exercise a pervasive and often a conspicuous in-

[1] Note that etymologically the word 'season' expresses the influence of climate upon one field of productive activity, agriculture. 'Season' is derived from the Latin 'sation-em' meaning the act of sowing, which in vulgar Latin came to mean 'time of sowing, seed-time.' See *The New English Dictionary*, Vol. VIII, Part II, p. 337.

fluence upon business and its periodical records. In monthly time series,[2] our most common quantitative measure of economic activity, the most pervasive of all seasonal variations is due primarily to the calendar, which makes February nearly 10 per cent shorter than January and April nearly 3 per cent shorter than March.[3] Appreciable in their influence upon many business processes are such conventional seasonal factors as religious observances, folk customs, fashions and business practices. Social life, like individual life, runs in grooves set by habits and customs, many of which spell recurrent modifications in the rate of economic activity.

Some economic pursuits escape the more conspicuous direct effects of climate and convention. Manufacturing activity, which involves the transformation of raw materials but is carried on indoors under controlled physical conditions, is affected by such conventional factors as holidays or vacations but obviously does not show seasonal swings as wide as those of agriculture or construction. Railroad transportation is little affected by changes in weather, or, since operation is continuous, by holidays and vacations. Trading on the security and produce exchanges is directly affected by holidays but is otherwise scarcely subject to the influence of seasonal factors.

2. The Economic Problem Defined

Thus, although seasonal changes affect most elements of economic life, they do so in differing degree. The direct influence of climatic and organic seasons upon the rate of flow of crops and livestock is clearly more conspicuous than upon the production of steel; the demand for clothing varies much more with changes in climate than does the demand for bread. Nor is it only the *magnitude* of the primary effects of seasons that differs for the various economic activities, producing seasonal swings of varying size or amplitude; the *timing* of these effects is also different, creating different patterns as the season begins in one month or another. The barley crop appears on the market during July and August, cotton during September and October; a large proportion of cattle and calves

[2] For a description of the time unit of measurement adopted in this study, see Chapter II, p. 23.

[3] For an interesting discussion of the influence of the calendar on the comparability of periodical statistics see *Statistical Errors and Calendar Reform* by Dr. H. Platzer (World Calendar Association, New York 1932).

are marketed in October, peak sales of hogs occur in January; and fruits and vegetables flood the markets from May to September. In winter occur both the seasonal low in agricultural crops and the peak in urban retail trade. Examples of such diversity in the timing of the direct effects of seasonal factors upon various branches of economic activity might easily be multiplied (see Chapter IX).

In the modern economic system, however, all phases of economic activity are interrelated. Wheat is grown by farmers and sold to grain houses and flour mills. Flour mills grind the grain into flour and sell it to flour wholesalers and to bakers. The latter, in their turn, convert flour into bread and bakery products which are sold to the ultimate consumers. Every branch of activity is thus a link in the long chain of buying-selling relationships that begins with the supply of the raw material and ends with the sale of the finished product. Perhaps we should not say 'ends,' for the final consumers themselves are usually active agents in economic life, each contributing to the total circular flow of commodities and services through the economic system.

Each branch of economic activity not only supplies commodities to some other branch, it also uses raw materials, labor and machinery to carry on its own processes. Thus, the production of cotton cloth is related on the one hand to the demand for textile mill goods and on the other to the supply of labor and machinery necessary to carry on the manufacturing process.

Other conditions being equal, the rate of output of any commodity ought to keep pace with the rate of its consumption, and the rate of productive activity and of the demand for labor and machinery with that of the supply of labor and machinery. Only under such an arrangement can the harmonious and efficient cooperation of the separate branches and factors in economic life, which is the implement and aim of the social division of labor, be achieved. But the direct effects of seasonal factors upon branches of activity whose economic interrelation implies the necessity and desirability of a similar rate of flow in each are frequently diverse. The problem then arises of how the cooperation can be effected; how the diverse consequences of seasonal influences, which disturb the harmonious and efficient coordination of the various elements in the economic system, can be adjusted.

3. The Scope of the Problem

Up to this point we have discussed the various elements in the economic system as if they were only cooperatively related. Such a description is valid if we are considering the sequence of a specific commodity from one stage of fabrication to the next or the cooperation of several productive factors in the output of a single commodity. But a consideration of the concomitant production of several economic goods makes it clear that in respect of the several uses to which a good belonging to any particular stage may be applied a competitive relationship exists. Thus, any raw material may be used in the production of several commodities; competition then arises among various branches of production for it, becoming especially extensive when it is a productive factor such as coal, iron, labor or credit. Even among final consumers the demand for clothing competes with that for automobiles, one article of food with another.

Obviously, competition among several elements, *a, b, c,* arises from the cooperative relation of each within the system to element *d.* Hence, in studying cooperatively related elements and the consequences of diversity in the seasonal influences acting upon them, we should define them as inclusively as possible, with all the competing branches of activity on both the supply and the demand side of the relationship considered together. Thus in studying the seasonal influences on the supply of labor and on the demand for it by agriculture we may confine ourselves to agriculture only upon the assumption that agricultural labor and other types of labor are non-competing. Otherwise, the seasonal influences on the total supply of labor should be compared with those on total demand.

Such an inclusive study of related elements presents certain difficulties. Seasonal influences can be clearly discerned only in their effect upon specific commodities, and their total impact upon several competing specific elements is not easy to ascertain. Nor is the distinction between competing and non-competing elements easily made. To what extent do agricultural and non-agricultural labor constitute non-competing groups? Or if they compete, is there perfect mobility, and therefore, perfect competition between them? In the measurement of seasonal influences on the totality of productive factors such as labor or credit questions of this kind arise frequently.

When two cooperative elements have been defined inclusively, the disturbance created by the differences between the primary seasonal influence upon each is measured by the disparity in respect of (a) *magnitude,* (b) *timing.* The greater the disparity in magnitude between the seasonal influences and the longer it is allowed to persist by the disparity in timing, the greater is the seasonal disturbance and the more formidable is the problem created.

The limits to the disparity measured under either of these two aspects are fixed by the definition of seasonal variations as those changes which recur monthly within an annual period.[4] Some branches of economic activity may be so affected by seasonal factors that we lose sight of them completely for some months and find them concentrated in a single month of the year. At the other extreme, an activity may be left entirely undisturbed by seasonal influences. But in respect of magnitude the disparity for any single month can be no greater than the volume of activity for eleven months (or, if a weekly unit is chosen, to the volume of activity for fifty-one weeks). In respect of timing the upper limit cannot exceed eleven months, if monthly units be adopted for measurement. Although the disparity possible between these limits may appear modest as compared with the degree of disparity involved in business cycles, disturbances even within them give rise to acute problems.

4. Solutions of the Seasonal Problem

When two specific activities in the economic system, cooperatively related, are directly affected by seasonal factors disparate either in timing or amplitude or in both, how can the necessary similarity in the rate of the two activities be attained, or what can be done in order to avoid at least the undesirable effects of dissimilarity in these rates? Several solutions are open:

(1) It is possible to reduce the disparity in primary seasonal influences upon any two specific elements by adding to either a competitive activity subject to other seasonal changes. Thus, the disparity in seasonal influences on the sale of one commodity (for example, ice) and on the supply of such selling

[4] See Chapter II, p. 25.

facilities as office and delivery equipment, sales and delivery force, goodwill, may be reduced by adding to the sales list another commodity (for example, coal), the seasonal demand for which is different from and complementary to that for the original merchandise. Similarly, the situation created by seasonality in the demand for agricultural labor may be relieved by calling on this labor supply to satisfy a demand for industrial as well as for agricultural activity.

This solution settles the problem and is, as will be seen presently, less burdensome than any other, but it assumes a mobility of factors which exists only within narrow limits. Productive equipment and intangible assets are adapted to the specific field in which any individual enterprise operates, for machinery, with the exception of power-producing units, has become more and more specialized with technical progress. A newspaper printing press cannot be used to produce cotton prints or a petroleum tank car to transport automobiles. Similarly, the knowledge of the market and the goodwill of an enterprise are usually confined to a single field of activity and cannot always be easily extended to include another. The more circumscribed the capital fund and entrepreneurial talent at the disposal of an enterprise the more difficult becomes expansion to another market, for a different field of operation can rarely be added without at least a partial investment of new funds and without straining the managerial ability of the concern.

Planning and regulated distribution of equipment might overcome some of the problems arising from the limitations of an individual concern. Also mobility of labor might be facilitated by helping workers to move in response to seasonal demand. The mobility of short-term capital has been increased through the establishment of central banks and the seasonal strain on money and credit thereby rendered much less acute. Nevertheless, in the existing system of private money economy, rather narrow limits are imposed upon the movement of capital once invested in specific equipment and upon the mobility of labor once made specialized by training and rooted to one spot by its adjustment to specific social conditions. Similar limitations apply to all large groups of productive factors.

Consequently, although this first solution of the seasonal problem promises to yield something of value if a conscious

social and technical policy is pursued, it can at present be applied only in a rather narrow field. In many progressive enterprises that deal in commodities subject to seasonal demand an effort is made to introduce by-products for the special purpose of reducing the seasonality in activity.[5] Extensive migration of labor to rural areas occurs during the harvesting season, and in some countries considerable movement of agricultural workers and of farmers during the dull winter months toward city pursuits. But this still leaves many activities, cooperatively related, for which the problem created by disparate primary seasonal influences must be solved in a different and much less satisfactory fashion.

(2) The rate of one activity may be changed so as to conform more closely to that of others. Such changes appear as a result of seasonal variations in prices on the market that connects the two branches of activity in question. These variations are the reaction of a competitive market to the disparity of seasonal influence on supply and demand, a manifestation of the tendency of the price mechanism to restore the balance. Thus, for example, the concentration of wheat output in one season of the year, while its industrial consumption is much less affected by climate, causes seasonally low levels in wheat prices in the months after the harvest and seasonally high levels in the months immediately preceding the new harvest. These *derived* or *induced* seasonal variations in the price of wheat provide an incentive to wheat consumers to buy and possibly even to consume more of the cheap grain during the months of seasonally high levels of wheat supply and less during the off-season months. Thus there appear in wheat purchasing *derived* or *induced* seasonal variations, and these bring its seasonality into closer conformity with that of wheat output.

It is by virtue of this solution of the seasonal problem that many branches of economic activity are characterized by changes that arise not from the direct effect of seasonal factors upon them but from seasonal influences upon some related branch. This fact, which will appear in the detailed exposition in Chapters III through VII, also accounts for the pervasive character of seasonal variations. In the numerous interrelations that bind the various elements in the economic system a

[5] For a discussion of some specific examples see Edwin S. Smith, *Reducing Seasonal Unemployment,* Chapters V and VI (New York 1931).

pronounced primary seasonal influence upon a few of these elements radiates throughout the system by imposing upon it derived variations.

From the activities directly affected by climatic or conventional seasons, acting separately or in unison, seasonal influences radiate to all other activities, probably without exception. In part these radiations are due to the conscious efforts already spoken of to counteract seasonal changes in demand or supply; in part they are unplanned consequences of these changes. For example, the fact that American crops are harvested largely in the autumn gives rise to a seasonal demand for currency in the farming districts, to seasonal changes in interest rates (and sometimes stock prices) in the financial centers, to seasonal changes in railway traffic, to seasonal changes in farmers' receipts, to seasonal changes in their payments to creditors, to seasonal changes in the business of country merchants, and to seasonal changes in wage disbursements. So, too, the expectation of heavy buying by consumers in the holiday season leads retailers to increase their stocks at earlier dates. In turn, the prospect of these large orders injects still earlier seasonal variations into manufacturing, into the demand for raw materials, into employment, and into wage payments, thus tending to produce secondary seasonal variations in retail buying itself.[6]

In the illustration above it is the seasonally less affected branch of activity (wheat purchasing and consumption) that, by becoming more seasonal, is brought into closer conformity with the branch seasonally more affected (wheat output). In a number of industries the adjustment may take an exactly opposite direction, the more affected branch of activity being rendered less seasonal. In the building industry, for example, the greater demand for construction materials and labor during the summer may and does result in higher summer prices for these factors of production; as a consequence the economic disadvantages of winter construction of buildings are reduced, more materials and labor tend to be purchased during the winter and the seasonality in the purchase of construction materials and labor is brought into closer conformity with the influence of seasonal factors on the production of construction materials and on the supply of building labor. Similar attempts to counteract primary seasonal influences and thereby to reduce disparities between related activities are prevalent among retailers in the form of price discounts during off-season periods.

[6] W. C. Mitchell, *Business Cycles* (National Bureau of Economic Research 1928) pp. 237-8.

Whether it is the less or the more seasonally affected branch of activity that is brought into closer conformity with the other through the appearance of seasonal variations in the prices on the market that connects the two, the reduction of seasonal disparity between the two may be made more effective by a controlled, seasonal scale of prices. If wheat producers could act in concerted agreement, they might, if they so desired, force into operation greater seasonal price differentials, making it still more advantageous for wheat purchasers to vary their buying and consumption with the seasons in wheat output. The producers of construction materials can reduce still further the disadvantages of winter building by setting up a clear-cut and rigid seasonal scale of prices. In their turn, house builders and owners may set up a sliding scale of rents to induce prospective tenants to lease their quarters during months other than those customary. A controlled scale of prices of that type, with the assurance to prospective purchasers of definite price advantages and disadvantages, may be much more effective in influencing purchasing policy than seasonal variations in free and competitive prices, which may be obscured by cyclical and random price changes.

Whether it be free or controlled seasonal variations in prices on the market connecting two related branches of activity, the seasonal disparity at these two branches may be reduced, if not completely eliminated, but at the expense of augmenting the disparity at the next link. An adjustment of the rate of wheat consumption by flour mills to conform with seasonal variations in the supply of wheat will increase the difficulties of harmonizing the rate of productive activity with the rate of the supply of productive factors other than wheat, such as machinery and labor, and also of adjusting the supply of wheat flour to the demand for it. A greater spread of winter construction of buildings will partly solve the problem created by the greater effect of weather on construction than on the production of building materials or on the supply of labor. But if, on the other hand, prospective tenants persist in renting new quarters on October 1, the disparity of seasonal influences on ' production ' and ' purchase ' of new quarters will only have been augmented by the spread of winter construction and the consequent increase in buildings completed by spring. Similarly, if by a seasonal scale of discounts, consumers are

induced to buy coal more heavily during the summer, the disparity in seasonal influence on production and purchase of coal is shifted to the next pair of related activities—purchase and consumption.

The effectiveness of this type of solution of the seasonal problem must, therefore, be measured in terms not only of the two given branches of activity but also of the related links. But even for each pair of related activities taken separately, the possibility of restoration of balance through seasonal variations in prices is limited. Where the attempt is to reduce seasonality in the seasonally more disturbed branch, the original seasonal disturbance in many instances is not sufficiently controllable to make feasible considerable elimination of it by any measure short of a technological revolution. In other cases, where technical conditions are more favorable, the effectiveness of economic incentives is limited by lack of response on the part of prospective purchasers, especially characteristic of ultimate consumers.[7] In addition, there is the difficulty of carrying through a systematic seasonal price policy in a competitive market with its manifold price changes, often more appreciable than the seasonal variations. But the main reason for the limited use of this solution of the seasonal problem is the possibility of an alternative solution, that of allowing the two related activities to proceed at disparate rates and of taking care of the disparity by accumulating seasonally variable stocks of the commodity in question. Seasonal price variations, on a free or controlled market, are obviously limited, since the loss to sellers arising from price discounts during months of seasonally heavy output cannot exceed the costs involved in retaining the surplus output in stock for sale during months of seasonally small output.

The same limitations restrict the effectiveness of seasonal price variations in instances where it is the less seasonally disturbed activity that is to be rendered more seasonal. In such instances there is the additional difficulty that the intensification of seasonality usually aggravates the seasonal problem at related links. To apply this type of solution throughout the chain from raw materials to the finished product becomes then particularly burdensome when manufacturing processes intervene between the seasonally affected supply of raw materials

[7] See again Edwin S. Smith, *Reducing Seasonal Unemployment,* Chapter III.

and the demand for finished goods. The variations in prices of seasonal raw materials may induce more seasonal purchasing by industrial consumers. But the further transference to manufacturing of seasonality in the purchase of raw materials is possible only if, during the seasonally heavy months, productive equipment and labor supply are increased to a level much above the average of the year. This means considerable instability in employment and in the utilization of machinery and the maintenance of idle labor and machinery during the seasonally low months. Furthermore, it may mean an increase in the disparity between the rate of supply of the finished product and the rate of demand for it.

The type of solution discussed will therefore be employed to reduce the seasonal disparity throughout the chain from raw materials to the finished product primarily when there is no possibility of stocking the commodity, that is, in the case of goods that are perishable in either the technical or the economic sense. Such physically perishable commodities as most fruits and vegetables, sugar-beets or milk must be converted or consumed immediately; no stocks may be kept to enable industrial or private consumption to proceed at a rate much different from that of the supply. Finished goods that are subject to fashion are economically perishable, for with a change in vogue, stocks decline in value as the nature of the demand is modified. In such instances, also, productive activity must follow closely the seasonally changing rates in the demand for the finished commodities.

(3) The third solution, the accumulation of stocks of the commodity in question, is economically feasible when the original seasonal disparity cannot be removed by dovetailing activities with diverse seasonal influences; when it cannot be eliminated through the incentives of a seasonal price scale whose costs to the sellers do not exceed that of stock accumulation; and when the commodity is by its physical and economic nature durable within the time range involved in seasonal variations and disparities. This solution is most commonly employed at points where the original seasonal disparity is greatest, that is, between the seasonal supply of raw materials and the comparatively unaffected manufacturing activity, and between industrial activity and the comparatively seasonal demand by final consumers.

Seasonal stocks of all raw materials that must be processed prior to consumption by ultimate buyers are kept so as to enable productive activity itself to proceed at the most even rate. Furthermore, the resultant manufactured products for which demand is highly seasonal are stocked to enable the industrial system to supply the demand during seasonally high months without unduly raising the rate of productive activity.

While stocking commodities seems preferable to maintaining idle equipment and labor, it is not without its burdens. From the social point of view, keeping stocks means diverting goods from active use into an idle state, a situation undesirable because of the limited amount of goods at the disposal of society. In addition, most commodities, if they are to be kept without physical deterioration, require protection, and this involves further outlay. While interest payments and cost of protection may be regarded as expenses expressive of the social cost of delay, the individual holder must add a further cost element as compensation for the risk of a decline in the price of the commodity held. Where the goal of the individual enterprise is that of profit, any delay in sale, other conditions being equal, is a burden that is to be avoided, if possible.[8]

5. Types of Seasonal Sequence in Industry and Trade

The present study deals primarily with seasonal changes in the flow of commodities in industry and trade, although it takes into account their radiation into the demand for labor and credit. Because of the necessity of limiting the field of inquiry, the seasonal aspects of economic activity, other than those affecting the flow of commodities, are discussed in general only (see Chapter VII).

Within the field delineated the most conspicuous type of seasonal problem is created by the fact that at both ends of the stream of commodities—at the appearance of the raw materials and at the point where the finished goods pass to ultimate consumers—primary seasonal factors exercise a conspicuous influence upon the rate of activity, and that on the intervening branches of manufacturing activity their influence is quite mild. In the following discussion seasonal changes are traced

[8] On the problem of manufacturing for stock see Edwin S. Smith, *Reducing Seasonal Unemployment*, Chapter XII.

from their origin in the supply of raw materials through the intervening stages to the production of finished goods and on to the flow of finished commodities through the hands of wholesalers and retailers into the possession of final consumers. Confining our study to those industries in which the seasonal influences are conspicuous at any one stage of this sequence we find the following four groups:

1. Industries in which the supply of raw materials is subject to large seasonal variations while the demand for the finished products is rather constant. Most food products fall into this category. The supply of such commodities as wheat, tobacco, sugar, milk and the dairy products and livestock is intermittent, resulting from organic processes that culminate only once, or at most twice a year. On the other hand, since they constitute the basic elements of our diet, the demand for most of them is rather constant.

2. Industries in which not only the supply of raw materials but also the demand for the finished product is subject to large seasonal variations. The most outstanding examples of this group are cotton and wool, both of which, in their raw form, are marketed once a year. Their finished products, cotton cloth and the various cotton products, wool clothing and wool sweaters, are also bought chiefly at definite seasons. Consequently the amplitude of the seasonal variations in final demand is almost as wide as that in the supply of the raw materials.

3. Industries that utilize raw materials whose supply is continuous, subject to rather mild seasonal variations, but whose final product is subject to a seasonally variable demand. Outstanding examples in this group are automobiles and gasoline. Rubber, steel, glass—the various raw materials that are utilized in the manufacture of automobiles—are produced at a relatively constant rate, their output being fairly independent of seasonal factors. On the other hand, the demand for cars, especially passenger cars, is highly variable, being concentrated in the spring. Similarly, crude petroleum is produced continuously throughout the year, but the demand for gasoline is

greatest during the summer when cars are used most extensively. Examples might be given of other durable consumers' goods, such as furniture.

4. In the construction industries neither the raw materials nor final demand but the productive process itself is subject to conspicuous primary seasonal influences. Most of the important construction materials are or can be produced steadily throughout the year. Disregarding the need for summer homes and the influence of moving dates, we have no reason to expect that the demand for dwellings is highly seasonal. But construction itself, being carried on out-of-doors, is subject to climatic influences. This is a highly interesting case, where, in contrast to all other manufacturing activities, the intermediate stage between the raw materials and the final product is subject to conspicuous seasonal influences of its own.

Examples of seasonal variations in each of the groups just outlined are discussed in detail in Part II. But first, the statistical methods of analysis must be presented. These tools for quantitative description of seasonal variations are discussed briefly in Chapter II.

CHAPTER II

THE STATISTICAL MEASUREMENT

1. The Time Unit

Statistical measures of seasonal variations are obtained from time series, that is, from quantitative records arranged in chronological sequence. Time series, suitable for this purpose, may record the given aspect of economic activity by days, weeks, months or quarters. Since the choice of the statistical technique to be used depends upon the time unit adopted, the first step in our statistical analysis was to decide upon a standard time unit.

The decision was largely predetermined by the fact that most records available in units of less than a year are monthly series. The number of weekly measures of industry and trade is negligible, while daily time series are almost entirely lacking. The statistical technique is, therefore, discussed only with respect to monthly data. And the analysis in chapters to follow confines itself, with the exception of a few quarterly records brought in to fill gaps, to monthly series.[1]

2. The Statistical Definition of Seasonal Variations

In Chapter I seasonal variations have been defined as changes in rate of activity attributable to the influence of climatic and conventional seasons. Although these seasons and their influences recur from year to year, the time of their appearance is not precise in terms of months. Though in every year in the temperate zones higher temperatures prevail in summer than in winter the relative differences in temperature between months do not remain the same year in, year out. Similarly, and partly as a consequence, the bulk of the wheat crop may be harvested in July this year and in August next.

[1] For the problems raised in measuring seasonal variations in weekly data see *The Review of Economic Statistics*, January 1927, Weekly Fluctuations in Outside Bank Debits, by W. L. Crum, pp. 30-36, and February 1931, Seasonal Variations in Selected Series of Weekly Data, by B. Fox, pp. 26-33.

A like shifting is characteristic of the conventional seasons. In some years Easter occurs in March, in others in April, and the number of Sundays and holidays in any month of one year is not necessarily equal to that in the corresponding month of another year.

Thus, strictly defined, monthly seasonal variations do not possess statistical characteristics precise enough to make the establishment of a typical seasonal change easy. The strict definition, if followed, would lead to the investigation of the records of variable precipitation, temperature and other climatic elements, the dates of planting and maturity of crops. These data would be combined with indexes measuring variations in the conventional seasons and then correlated with the series that describe economic activity. The correlation of measures of both natural and conventional seasons with those of business activity might establish the amount of variation in economic activity associated with variations in all seasonal factors; and from these segregated variations typical seasonal changes could be derived.

The difficulties of such a procedure are only too obvious. First, continuous data on variations in seasonal factors are seldom available for the entire area involved in the correlation. Second, the attempt to correlate economic series with a series describing variations in seasonal influences is beset with the usual grave difficulties of correlation analysis in time sequences, especially since in the projected analysis the dependent variable, an economic time series, is affected by many more factors than are enumerated in the independent variable, the seasonal changes. Both of the series involved are affected by factors other than seasonal and these are often the preponderant influence. Longer cycles, secular movements and random changes must be segregated. The complex correlation analysis would be extremely laborious and the validity of its segregation of changes due specifically to seasonal factors would be very dubious.[2]

[2] The difficulty of correlation analysis may be reduced considerably by eliminating from the series, through a moving average, the secular movements and a large part of the cyclical swing. Chapter X presents an attempt to use the mechanism of correlation for testing the persistence from year to year of the average seasonal variation. But there is no simple way of removing the difficulty arising from the absence of data on variations in seasonal factors for the entire area involved in the correlation.

The usual solution is easier, although much more crude and approximate in result than the analysis just suggested. The most widely used statistical technique for measuring seasonal variations is based upon the assumption that they are recurrent by months within each twelve-month period. This assumption is largely valid. The calendar is constructed in such a way that a year encompasses the full succession of climatic seasons; there is also within the year a rough recurrence of climatic changes by months. Conventional seasons, including holidays, are, for the most part, definitely dependent upon the calendar. On the other hand, although the assumption of recurrence by months is an over-simplification, it makes possible a precise statistical definition upon which to base the technique.[3] Moreover, the concept may be modified somewhat when the problem of changing seasonal swings arises, for recurrence may shift gradually within the period, altering the relative position of the months; or amplitude may change gradually; or the relative position of a pair of months may alternate from year to year. With these qualifications, then, seasonal variations are changes that recur monthly within every year, for a given number of years. Their recurrence and the limited duration of their swing serve to distinguish them clearly from other significant changes in a series. Their oscillating movement differentiates them from the secular trend and their confinement within the limits of the calendar year from cyclical fluctuations. The condition of their recurrence distinguishes them from random movements which do not appear in the same calendar month in successive years.

[3] Some of the current seasonal studies attempt to eliminate the variable influence of conventional seasons by dividing production or volume of output by the number of working days in each month, this number fluctuating from month to month and from year to year. While such an operation improves the seasonal measure obtained, it is beset with difficulties. To establish the number of working days in an industry is often impossible, the number being at best an estimate. In many economic processes it is difficult to assume that volume of activity is directly proportional to the number of working days (for example, bank clearings or retail sales). Besides, the amount of variation eliminated by such an analysis is usually small when compared with the magnitude of the swings in the seasonally affected industries.

3. The Measurement of Average Seasonal Variations

a. *The General Problem*

Since seasonal changes are assumed to be recurrent, the problem of statistical measurement is that of discovering the seasonal variation that characterizes a given time series over a given period of years. Considering for the present the measurement of only the *average* seasonal change, we find that each of the procedures customarily followed may be subdivided into two steps: (1) treatment of the data in order to eliminate completely or partly the non-seasonal elements; (2) striking an average from the residuals of step (1) to obtain the typical seasonal variation.

As has already been pointed out, the non-seasonal elements in a time series consist of secular movements, cyclical fluctuations and random changes. Over a long period the elimination of the cyclical and random elements seems at first to present no difficulties. When successive Januaries, successive Februaries, etc., are each added over a long period, the random changes and the cyclical movements will be cancelled, since random perturbations tend to be distributed symmetrically about the other components of a time series and since pure cycles, by definition, add up to zero within the limits of each complete cycle. Even if the latter condition does not hold strictly for any cycle in the series, it will be more valid when several cycles are taken, that is, when a long period is covered. The only possibility of distortion will then be afforded by any incomplete cycles that the period may contain and by the presence of secular movements. The elimination of the latter from the resulting seasonal averages presents little difficulty.

Hence, it would appear that in a series covering a long period any preliminary treatment of the data might be dispensed with and the stable seasonal measure computed directly from the original series, by averaging successive Januaries, successive Februaries, etc., and then correcting these averages for the secular trend. But the basic difficulty of such a procedure lies in the assumption that seasonal variation remains constant over a long period. Such an assumption may be valid for a short interval, such as six to twelve years, but it is obviously dangerous to assume that seasonal variations persist, without modification, long enough to secure the proper cancellation of cycles and of random changes.

In addition to this theoretical consideration, there is the practical circumstance that many of the monthly series on production and trade have become available only recently. Some go back to 1919, many to 1920 and 1921, and quite a few begin between 1923 and 1925. For such series it would be dangerous to rely upon the length of the period for the complete elimination of the cyclical elements. Thus, both theoretical and practical considerations require a preliminary treatment of data to remove as much of the non-seasonal element as possible. After this is done the establishment of the typical seasonal variations by the process of averaging will obviously yield more reliable results.

b. *Standard Method of the Study*

The method adopted in the present study was that of relative deviations from a properly centered twelve-month moving average. For each series a two-item total of a twelve-month moving total was taken and the final sum divided by twenty-four. This amounts to taking a thirteen-month moving average with the two end months at half weight. The reason for thus modifying the simple, twelve-month moving average is twofold: (1) the average may be properly centered at the seventh month of the original twelve; (2) the resulting line of moving averages is slightly more elastic than the line of a simple, twelve-month moving average; this tends to reduce the erratic elements in the relative deviations.

These relatives were obtained by dividing the original data by the ordinates of the moving average and multiplying the ratio by 100. Only in the rare instances where the original series contained items of small absolute size were absolute instead of relative deviations taken. (In these series relatives would have given distorted results.) Relative rather than absolute deviations were taken because the underlying moving average represents both the secular movement and at least a large part of the cycle. The secular trend affects the size of the absolute deviations from it and the cyclical movement has, if in less degree, a somewhat similar influence.[4]

The relatives of the original data to the moving average were then plotted separately for successive Januaries, succes-

[4] This choice between absolute and relative deviations is not as simple as it may at first appear. For some of its interesting implications for the constancy of seasonal amplitude see Chapter XI.

sive Februaries, etc. The resulting small charts, one for each month, served as a graphic check upon the final index.

The index itself was computed by the method of positional arithmetic means. For each month the successive relative deviations from the moving average were arrayed and the arithmetic mean of the two or three middle items, four or five middle items, six or seven middle items and so on, was taken. Such a mean removes the influence of extreme values and is not subject to the vagaries of a median chosen from a small number of items.

For each number of middle items the twelve means (one for each of the twelve months) were centered about 100 to allow for a better comparison of the means derived for one and the same month from successive numbers of middle items. This comparison for each month usually revealed some one figure about which the means for successive combinations of middle items tended to cluster. The final seasonal index was then chosen as the series of twelve means for that combination of middle items for which the largest number of means showed values identical or close to the central tendency for each month.

The seasonal index thus obtained was already centered at 100. The value for each month was plotted as a horizontal straight line on the small chart that gives for this particular month in successive years the relatives of the original data to the moving average. This graphical comparison of the seasonal index with the successive relatives tested the validity of the index as a description of the central tendency. Inspection sometimes caused a decision to alter the index by one or two points but the change was never large.

As a final step, the original data were divided by the seasonal index except when absolute deviations from the moving average were taken. In these few instances the seasonal index was subtracted from the original data.

To recapitulate the procedure:

1. For the original data a two-item moving total of a twelve-month moving total is computed. The original data, and this total, divided through by 24, are plotted for comparison on one chart. The original data are divided by the moving average and the ratio multiplied by 100.

2. The relatives for each month for successive years are plotted, yielding a set of twelve charts for the twelve months.

3. These relatives for each month are then arrayed and an arithmetic mean of a successively increasing number of middle items is taken.

4. The means for the twelve months for each combination of middle items are centered at 100.

5. The means for some one combination of central items show in the greatest number of months a value close to the central tendency for each month. This set of means is chosen as the seasonal index.

6. A line is drawn on each chart (under 2) representing the arithmetic mean obtained from the selected number of central items (chosen under 5). Sometimes, as a result of the graphical comparison, these means may be changed slightly.

7. This set of twelve means yields the final, average seasonal index. The original data are divided through by this index and plotted on another chart, analogous to the chart giving the uncorrected data with the moving average. A graphical comparison of these two charts affords an approximate test of the success of the correction by the stable index and reveals roughly the significance of regularly recurring seasonal variations in the series under analysis.

The method of measuring the average seasonal variations described above is substantially similar to that first suggested by Dr. F. R. Macaulay and adopted by the Research Division of the Federal Reserve Board.[5] The minor differences are as follows: (a) instead of the unweighted average, a two-item total of the twelve-month moving average was used in the present study; (b) no allowance was made for the number of working days in the month; (c) the means for each successive number of middle items were centered to afford better comparisons.

For reasons discussed in Chapter X few moving seasonal indexes were computed. Instead, whenever the behavior of the

[5] Aryness Joy and Woodlief Thomas, The Use of Moving Averages in the Measurement of Seasonal Variations, *Journal of the American Statistical Association,* September 1928, pp. 241-52.

series necessitated it, average seasonal indexes were established for rather short periods. Hence, the brevity of the period used in the analysis has often been determined not by lack of data for a longer interval but by the necessity of taking care of changes in the seasonal variations.

In view of such brevity of the periods, it might be suggested that a graduation line more flexible than the thirteen-month average should have been used to eliminate the non-seasonal elements. But this criticism is of limited significance. The moving average of the type used eliminates the major portion of the secular and cyclical movements and the averaging of selected relatives may be trusted to remove the remainder. In any case, the brevity of the series makes impracticable the computation of any more refined graduation lines, for those based on averages involve the loss of a period at both ends, which is the larger the more complex the type of averaging. In the present study the moving average used involves the loss of six months at each end of the series. In some of the very short series it was found advisable to compute for these months relatives to the average for the last twelve-month period or to a moving average extrapolated free hand. Any more complex graduation of the moving average type would involve a still greater loss of the period. And such methods as the Whittaker-Henderson, while giving the graduation for the full period of the series, are too labor-consuming even to be thought of for use in a study of the present scope.[6]

c. *Other Methods Used*

The procedure of measuring average seasonal swings, just described, was applied to most of the series presented in the study. However, a somewhat different procedure was followed for two groups:

(1) A number of series had already been analyzed by the National Bureau in preparation for the second volume of Professor Mitchell's *Business Cycles*. This analysis involves the establishment and elimination of seasonal variations. The method used was that of a positional arithmetic mean of ratios to ordinates, the ordinates being an arithmetic mean established for each complete cyclical swing in general business conditions. It was not considered important to recompute the

[6] For the discussion of these graduation methods, see Frederick R. Macaulay, *The Smoothing of Time Series* (National Bureau of Economic Research 1931).

series since the differences between the results of this procedure and the one used in the study would be, on the whole, rather small.[7]

(2) In several series, especially where the seasonal swing was very pronounced, a short-cut method was used, that of positional arithmetic means of relatives to annual averages. These means, when corrected for secular trend, yielded the average seasonal index. This method was applied usually where data were available for one and the same branch of activity in several regions. The large number of series then to be analyzed made it important to employ a time-saving procedure.

4. Testing the Significance of Seasonal Indexes

In the procedure described above of establishing average seasonal measures it is almost always possible to obtain results deviating from 100. The probability of a perfect cancellation of cyclical and random items is so remote that even a series that by supposition is not subject to seasonal influences is likely to yield a set of indexes differing from 100, indicating thereby the presence of some seasonal variation. To be sure, such variations will be small, but it is important to have some criterion that will indicate in fairly familiar terms the significance of the seasonal indexes obtained.

For this purpose, several tests, of varying rigidity and involving different assumptions concerning the nature of the statistical universe from which seasonal indexes are obtained, may be used. The choice depends largely upon the judgment of the investigator as to which assumptions he accepts as valid or rejects as unjustified by the character of the data. Consequently, it is advisable to present briefly the various tests and then to indicate which have been employed in the present study.

a. *Standard Error of the Arithmetic Mean*

This test may be applied on the basis of the following assumptions:

(1) That the value that forms the seasonal index for each month may be taken as the true arithmetic mean of the scatter for the corresponding month.

[7] For a description of the ratio-to-ordinate method see Helen D. Falkner, The Measurement of Seasonal Variations, *Journal of the American Statistical Association,* June 1929, pp. 167-79. For the dates demarcating cycles in general business conditions in the country see *Recent Economic Changes* (National Bureau of Economic Research 1929) II, 892.

(2) That the scatter from which these means have been derived contains, in addition to the constant seasonal, only random changes. The standard error of the mean for any sample is given by the formula:

$$\sigma_{A.M.} = \frac{\sigma \text{ of the sample}}{\sqrt{n}}$$

(n being the number of cases in the sample)

Since seasonal analysis deals with small samples, two modifications should be introduced:

(1) In computing the standard deviation of the sample the sum of the squares of the deviations from the mean is to be divided by the number of items less one.

(2) In evaluating the probability significance of the standard error allowance should be made for the smallness of the sample. This is done most conveniently by utilizing the table of t given by R. A. Fisher for this purpose.[8]

In our procedure for computing the seasonal index this test may easily be applied. The seasonal index for a given month, for example, January, is assumed to be the true arithmetic mean of the scatter, the items in this scatter being the relatives of the original data to the moving average for successive Januaries. There will, therefore, be as many items in the scatter as there are years in the period for which the seasonal index is computed.

The standard error of the index for January is the standard deviation of the relatives for successive Januaries from the index divided by the square root of the number of items (years in the period). In order to apply this standard error to test the significance of any difference, t must be computed and its value looked up in Fisher's Table IV.

Example:

For the series of the number of shares sold on the New York Stock Exchange the seasonal index for December for the period 1919-30 is 111. The standard error of this mean is 5.96. If it is desired to ascertain whether or not the difference of the December index from 100 is significant, t is equal to 11 divided by $5.96 = 1.85$. The probability value for a t of 1.85 and

[8] See his *Statistical Methods for Research Workers* (Edinburgh 1925) pp. 106-10 and Table IV of t appended at the end of the book.

for n of 11 (there are 12 items in the scatter, but 11 degrees of freedom) is slightly less than 0.1, signifying that in conditions of random sampling the probability is slightly less than one out of ten that the mean of another sample will depart by as much as 11 from the given mean of 111. These are rather large odds and the difference of the index 111 from 100 may be considered significant.

If the same standard errors are computed for the seasonal index for each month, it is possible, utilizing Fisher's Table IV of t, to estimate:

(1) the significance of the difference of the seasonal index for each month from 100 or from any other value;

(2) the significance of the difference between the seasonal index for one month and that for any other month.

b. *Correlation of the Average Seasonal Index with Relatives to the Moving Average*

In the procedure just described a test is provided for the significance of the seasonal index for each single month or of the difference between seasonal indexes for any pair of months. In order to test the significance of the seasonal index as a whole, the following procedure is suggested:

(1) The sum of the squared deviations of the relatives to the moving average from the seasonal index for the twelve months yields the total squared error about the seasonal index. Dividing this sum by the number of years yields the mean squared error about the seasonal index

$$\left(\frac{\Sigma d^2}{y}\right).$$

(2) Were there no seasonal variations in the data, the mean for every month would have tended to be 100. Let us compute the mean squared error from a seasonal index in which the standing for each of the twelve months is 100. Upon the assumption that the actually computed seasonal index is a set of true arithmetic means the mean squared error about a set of means of 100 can be obtained by adding to the mean squared error under (1) the square of the *correction* (for we are actually computing a squared standard deviation about a set of assumed means). This squared correction is the sum of the

squares of the deviations of the computed seasonal index from 100. The total obtained then is

$$\frac{\Sigma d^2}{y} + c^2,$$

$c^2 = (\text{January seasonal} - 100)^2 + (\text{February seasonal} - 100)^2 + \ldots . (\text{December seasonal} - 100)^2.$

(3) The ratio of the squared correction to the total under (2) yields a fairly precise idea of the significance of the total seasonal index. This ratio, varying from zero to one, is a coefficient of determination in a correlation between the seasonal index and the relatives of the original data to the moving average, *upon the assumption that the coefficient of regression involved is one.* It is obvious that since the computed seasonal index is so chosen as to represent precisely the *average* amplitude of seasonal variations in the series for the period covered, the coefficient of regression of the dependent variable (relatives of original data) on the independent variable (average seasonal index) is always close to one (see Chapter XI).

(4) A coefficient of determination measures the proportion of the variance in the dependent variable accounted for by the variations in the independent variable. It is equal to the square of the coefficient of correlation. The square root of the ratio under (3) yields the coefficient of correlation between the seasonal index and the relative of the original data to the moving average for the total period covered by the analysis.[9]

(5) If this correlation is significant, the seasonal index is obviously significant. In most instances the number of pairs

[9] Another way of conceiving this coefficient is as a correlation ratio between the deviation of the data from the moving average (y) and time (x), the latter being taken in its seasonal order (that is, Januaries, Februaries, etc. being grouped together) rather than in a continuous chronological order. The correlation ratio is a ratio of the standard deviation of the means of columns from the central mean to the standard deviation of the ungrouped scatter around the central mean. If we arrange time (the independent variable) in its seasonal order, then the means of the columns are the seasonal indexes for each month. And the correlation ratio is the ratio of the standard deviation of the seasonal index from 100 to the standard deviation from 100 of the original data adjusted for the moving average.

For the significance of the seasonal index the correlation ratio and the coefficient of correlation are about equivalent since the standard error of the correlation ratio is approximately the same as that for the coefficient of linear correlation.

involved is sufficiently large so that recourse need not be taken to R. A. Fisher's tables for small samples.[10]

Example:

For the same series of number of shares sold on the New York Stock Exchange the quantities involved are as follows:

1. The mean squared error around the seasonal index = 4,992.
2. Square of Correction, that is, the sum of the squares of the deviations of the seasonal index from 100 = 1,496.
3. Total Variance about a Set of Means of 100 (1) + (2) = 6,488.
4. The Coefficient of Determination $\frac{(2)}{(3)} = 0.2306$.
5. The Coefficient of Correlation = $\sqrt{(4)} = 0.48$.

There are 108 pairs in this correlation (9 years with 12 months in each) and hence 106 degrees of freedom. Since a p of 0.01 for $n = 100$ is given for a coefficient as low as 0.254, the correlation in the example is undoubtedly significant.

a-b. *Validity of the Tests*

The standard error test, applied to seasonal indexes for single months, and the correlation coefficient, available as a test of seasonal indexes as a whole, provide in combination a rigid assay of the validity of the seasonal indexes computed. The answers yielded by these procedures are definite and precise, once the investigator accepts certain probability values as indicating significance. Brief reflection will show, however, that the assumptions of these tests are far from generally valid and that consequently the utility of the precise results that they yield is drastically limited.

Both tests assume that the seasonal index is the true arithmetic mean of the scatter for each month. This assumption does not hold whenever the extreme items excluded for the given month do not average out to its seasonal index, or whenever the selected mean is changed as a result of the graphical comparison. Thus, one of the valuable features in the procedure of establishing the seasonal index, namely, the rejection

[10] See Table Va, Values of the Correlation Coefficient for Different Levels of Significance, in his *Statistical Methods for Research Workers.*

of extreme items through the selection of a positional arithmetic mean and the graphical comparison, is completely neglected by these tests. Since it is only the true mean that yields the smallest standard deviation, the result in most instances is that the standard error is larger and the coefficient of determination smaller than they should have been.

Both tests assume that the scatter is composed of random changes. This implies that the moving average used eliminates all of the secular and cyclical movements and that the time series contains, in addition to the average seasonal index, only random elements. But the moving average never eliminates the cyclical swing entirely and a further analysis of the series indicates that in addition to average seasonal variations there are variations related to the average seasonal swing that are far from random in character (see Chapter XI).

Inspection of the scatter in a few series indicates that for single months, and even for months combined into quarters, the frequency distribution of deviations from the seasonal index of the relatives to the moving averages is highly irregular in character. Even when the scatter is combined for all the months for the period as a whole the total frequency distribution still shows considerable departures from normality in the case of some series, for which, owing to the sharp turns in the cycles and the presence of large random disturbances, the moving average is not a satisfactory graduation line (for example, number of shares sold on the New York Stock Exchange). Consequently, the standard errors are invalid even in their purely descriptive function.

But another even more fundamental question is in respect of the imputation of probability significance to the standard errors and the correlation coefficient. Even if the time series under analysis were adjusted for all of the secular and cyclical changes; even if, with the help of refinements upon the average seasonal index, the seasonal variations were described as precisely as possible, can the residual changes be treated as random in the meaning given to this term by the statistical theory of random sampling? Are these changes, taken out of the context of a continuous historical process, similar in nature to variations under conditions of random sampling, strung out in time?

This question opens up a field in which, heretofore, there has been little thinking and study. It seems that current rapid

progress of the statistical technique of time series analysis is likely to result in the segregation of certain continuous movements in what at present appear to be casual changes. Moreover, the residual changes found in many time series are certainly not random in the sense of being produced by a large number of small, independent disturbing factors (consider, for example, strikes, and changes in foreign trade as a result of modification in tariffs). Great caution must, therefore, be exercised in accepting any tests of probability significance for measurements derived from time series.

The precision of the tests by standard errors and the coefficient of correlation is, for reasons just stated, of limited value. Consequently in the present study standard errors were computed for a few series as a matter of experiment. The coefficient of correlation, by the procedure just described, was also applied to only a few series. But the same coefficients were obtained as a result of an attempt to measure short-time changes in the amplitude and pattern of seasonal variations. Readers interested in the value of these coefficients will find them in Tables XXXVI and XXXVIII. Brief inspection will reveal that in the large number of cases where such coefficients were computed the values are so high as to admit no question regarding their significance, even if the assumptions necessary to assure their validity are accepted.

c. *Size of Seasonal Variation and Graphical Inspection*

These procedures are rough in character and their conclusions are merely an approximation to the more precise results yielded by the two tests described above.

The absolute size of the seasonal variation, as reflected in the average index, is in itself a rough guide to its significance, especially when compared to the average absolute size of the deviations of the original data from the moving average. If the seasonal index for a given month is 75 (in terms of the average for the year as 100), while the relative deviations from the moving average for the same month range between -35 and -15, the seasonal index is obviously significant. In such instances the precise measurement of the standard error is not necessary to confirm the significance of the seasonal measurement. Its added precision is of little value, in view of the above mentioned doubts as to its validity.

A similar rough test is afforded by a graphical comparison of the original data with the seasonal index. If this comparison indicates the presence of a recurrent variation in the original data, a variation similar to that shown by the seasonal index, the latter is obviously significant. In such instances the refinement introduced by the coefficient of correlation described above is unnecessary and its precision of relatively small value.

These two rough tests may be applied not only to each average seasonal index but also to comparisons between indexes for single months or for a full year. Of course, in such instances the approximate character of the procedures renders them valid only for rather obvious and substantial differences.

The tests just presented are used widely by investigators who deal with the measurement of seasonal variations. Rough as they are, they are yet sufficient in many series and have been used extensively in the present study.

d. *Similarity of Seasonal Variations in Successive Periods and Among Related Series*

If, for a given series, average seasonal indexes are computed for more than one period a comparison of the resulting measures may afford a test of significance. Close similarity for two periods is substantial evidence of the significance of the indexes, unless for some reason a difference was expected, for the probability of obtaining closely similar variations of twelve items each, in a series that contains random variations only, is very small. The test becomes still more reliable when more than two periods are available for comparison and close similarity is observed not merely for two but for a larger number of periods.

Similarly, if seasonal indexes are computed for related branches of activity, as for example, production, shipments and stocks of one and the same commodity, or consumption of several commodities all used in the same industry, comparison affords a good basis for estimating the significance of the measures. Substantial similarity, or the presence of an *expected* difference, lends weight to the recognition of the seasonal indexes involved as significant, for recurrence under variable conditions is proof of reliability.

Both comparisons may be applied to test the significance of differences between seasonal indexes but the tests are valid within a much more circumscribed area.

In the present study the technique employed led to the computation of an average seasonal index for each of several short periods. Consequently, the first of the two comparisons could be and was applied to a very large proportion of the series analyzed. Likewise, the detailed consideration of seasonality at the successive stages of the flow of a commodity made feasible numerous comparisons of seasonal measures in related branches of activity.

e. *Conformity to Non-Statistical Data*

This test is most important from the point of view of the present study and was applied, as far as was possible, to each seasonal index obtained. The purpose of statistical analysis is to measure more precisely the influence of seasonal factors on a given branch of economic activity. The nature of these factors and the general character of their influence is known or should be ascertained in all seasonally affected economic series. General conformity of the statistical index to this otherwise known effect of seasonal factors is an important test in a study dealing not only with description but also with explanation.

Failure of a seasonal index to pass this test is an indication either of the unreliability of the index or of the insufficiency of the non-quantitative knowledge of the factors and influences involved. Then an attempt may be made to 'explain' the seasonal index better, that is, to add further non-statistical data to the stock of knowledge and thus to restore the conformity between statistical measurement and non-quantitative data. Or upon investigation of the reliability of the statistical index the conclusion may be reached that it is not sufficiently significant.

The tests presented above to estimate the significance of average seasonal indexes vary from precise ones, such as the standard error and the correlation coefficient, to the more approximate ones listed under c, d and e. The precision of the exact tests is conditioned by the assumptions that they imply concerning the nature of the data from which the indexes are obtained. The validity of the more approximate tests derives from wider and more easily acceptable assumptions in regard to the data upon which they may be based.

The choice among these tests depends upon the investigator's judgment as to the validity of the assumptions implicit in each. The present study employs almost exclusively tests c, d and e, while measures for test b are available for several series analyzed for the persistence of the average seasonal swing from year to year. Standard errors were computed merely as an experiment for a few series.

PART II

Average Seasonal Variations in Selected Groups in Industry and Trade

CHAPTER III

FOOD PRODUCTS
(Group I)

A. General Characteristics of Group I

The first group of industries to be discussed covers those whose supply of raw materials is subject to marked seasonal variations while consumers' demand for the finished products is more or less constant seasonally. This different susceptibility of raw materials and finished products to the influence of seasonality at once raises the question as to how the stream of goods which enters productive processes at a highly variable rate is transformed into a relatively steady outflow of finished commodities. The problem becomes complicated if the manufacturing activity intervening between the raw materials and the finished goods presents its own demands as to the most advantageous rate of flow of commodities through the productive process.

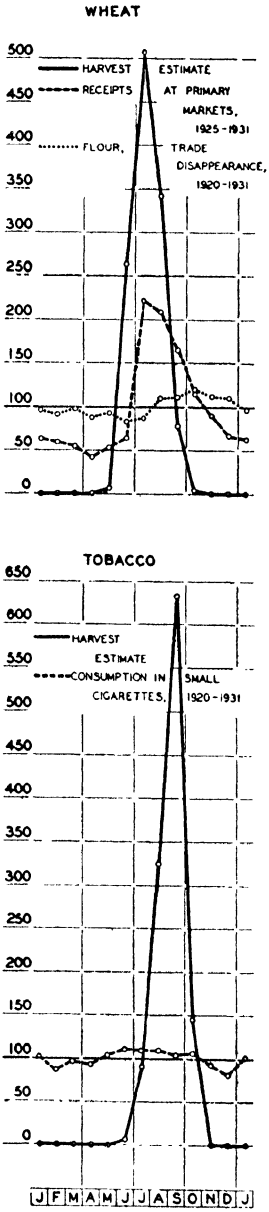
Group I includes many products; for only a few do the statistics available admit measurement of typical seasonal variations. Indexes were calculated for nine commodities to reflect the seasonal swings in both the inflow of raw materials and the outflow of the finished product. It was rarely possible to measure directly the flow of goods into the hands of ultimate consumers and in most instances lack of data forced a stop a few links short of the final stage. But for the products discussed the mildness of seasonal variations in a series such as disappearance into trade [1] only under-estimates the mildness of the seasonal swing in demand by final consumers.

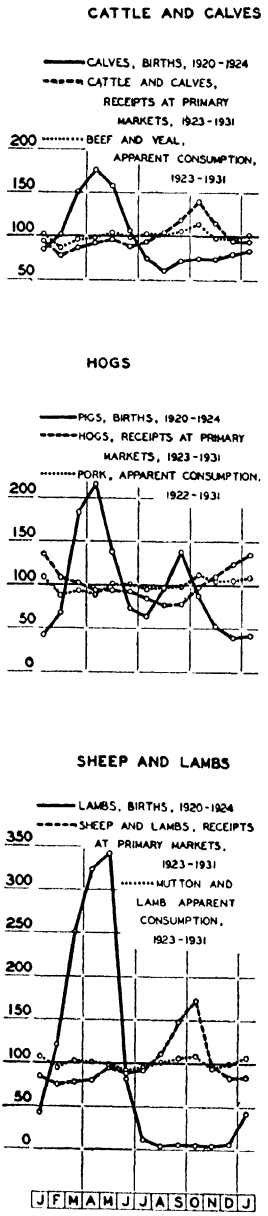
Chart 1 presents graphically these groups of seasonal indexes for the nine commodities. It reveals clearly the differences between the size of the seasonal swing in the inflow of raw materials and that in the outflow of finished products.

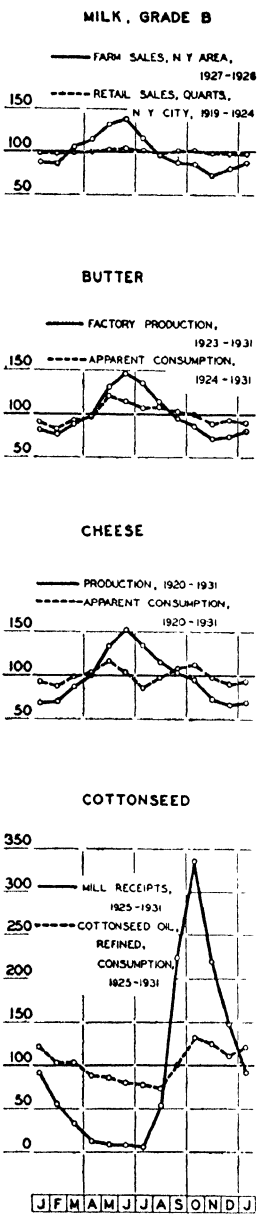
[1] Trade disappearance usually denotes the outflow of finished commodities from producers to wholesalers, retailers and sometimes even to final consumers.

CHART I

SEASONAL MOVEMENT OF COMMODITIES IN GROUP I







This may be expressed numerically by two coefficients that measure the amplitude of the seasonal swing: (1) the average deviation of the seasonal index; (2) the range, that is, the difference between the highest and the lowest month in the index. The former measures the average departure of the index from the level at which no seasonal change is recorded; the latter measures the maximum variation involved in the seasonal swing.

Table I indicates differences so large as to preclude all doubt as to their significance. In all series the inflow of the

TABLE I

AMPLITUDE OF SEASONAL VARIATIONS: COMMODITIES IN GROUP I

Series	Average Deviation	Range
Wheat and Flour		
Wheat, Harvest Estimate	135.4	508
Wheat, Receipts at Primary Markets, 1925-31	51 7	181
Wheat Flour, Trade Disappearance, 1920-31	10.5	37
Cattle and Beef		
Calves Born, 1920-24	31.7	116
Cattle and Calves, Receipts at Primary Markets, 1923-31	13.2	63
Beef and Veal, Apparent Consumption, 1923-31	4.8	28
Sheep and Lambs		
Lambs Born, 1920-24	106.1	337
Sheep and Lambs, Receipts at Primary Markets, 1923-31	21.6	97
Mutton and Lamb, Apparent Consumption, 1923-31	4.2	17
Hogs and Pork		
Pigs Born, 1920-24	46.1	177
Hogs, Receipts at Primary Markets, 1923-31	13.3	58
Pork Products, Apparent Consumption, 1922-31	5.9	24
Milk		
Grade B, Sales by Farms, N. Y. Area, 1927-28	17.3	65
Grade B, Retail Sales in Quarts, N. Y. C., 1919-24	1.7	6
Butter		
Factory Production, 1923-31	21.2	74
Apparent Consumption, 1924-31	9.4	39
Cheese		
Production, 1920-31	23.1	86
Apparent Consumption, 1920-31	7.8	31
Cottonseed		
Receipts at Mills, 1925-31	88.1	328
Refined Cottonseed Oil, Consumption, 1925-31	15.7	58
Tobacco		
Harvest, Estimate	133.8	632
Consumption in Small Cigarettes, 1920-31	8.2	30

raw material is clearly more subject to seasonal influences than is the outflow of the final product.

A brief consideration of the seasonal pattern, that is, of the relative position of months in the seasonal index, clearly reveals the causes of marked seasonal variation in supply. In wheat, tobacco and cottonseed the patterns reflect the familiar fact that in the temperate zones products mature only once a year. In livestock the birth cycle is connected with climatic and planting seasons. The mating of sheep, cattle and hogs is timed so that lambs, calves and pigs are born in the spring and can be fed on cheap outdoor pasture. A secondary peak in the birth of pigs is timed to occur in September, probably for the purpose of utilizing corn (in hogging down a field) and whatever indoor feed is to be had advantageously.

While the seasonal peak in livestock births is in the spring, the peak in receipts of the product at primary markets is in the autumn or winter. Thus, receipts of cattle, calves, sheep and lambs are at seasonal peak in October, of hogs in January, because of the advantage of marketing livestock after rather than before the end of the outdoor feeding season.

The same set of factors determines the season in dairy products. Since spring is the high point in the birth of calves, more milk is produced in the summer. The availability of outdoor pasture as a cheap feed further augments the supply. The resulting surplus of milk is reflected in a seasonal peak of sales even by farms that specialize in providing fluid milk to city consumers. Butter and cheese factories naturally find it advantageous to buy up cheap fluid milk during the summer for conversion into more durable commodities which will later be absorbed gradually by final demand. Thus, as in the case of livestock, climatic and planting seasons determine the variability in the supply of the raw material.

The factors conducive to mild seasonal variations in demand for the final product are no less obvious. Being perishable, food products must be bought more continuously than such more durable articles as automobiles or clothing. Although the demand for these products is somewhat affected by weather (for example, consumption of meat and flour tends to be greater during cold months, consumption of milk by adults during the summer), or by holidays (demand for poultry tends to be heavy during the Christmas holidays), it is

comparatively regular, since all these products satisfy stable needs, modified but slightly by the succession of seasons.

The list of commodities might be augmented considerably beyond the nine presented above. Thus in both beet and cane sugar the supply of the raw material is decidedly more affected by seasonal factors than is the demand for the finished product. Fruits, vegetables, poultry and eggs, and most products that are derived from the culmination of a process of organic growth are similarly affected. To increase the list would add but little of interest. Instead, in order to describe more precisely the solution of the problem created by the disparity between the seasonality in demand and in supply, it seemed advisable to trace in greater detail changes in seasonal variations in the sequence from raw materials to finished commodities.

Such an analysis is presented for three subgroups of Group I: (1) wheat and wheat flour; (2) dairy products; (3) fruits and vegetables. Wheat is representative of durable raw materials that can be stored. In dairy products the raw material (milk) is perishable but can be converted into such comparatively durable products as butter and cheese. Among fruits and vegetables, however, there are perishable commodities that are neither storable nor easily convertible into durable products. These differences in technical properties of the raw materials in Group I have, obviously, direct bearing upon the solution of the seasonal problem.

B. Wheat, Wheat Flour and Their Products

GENERAL CHARACTERISTICS

Charts 2 and 3 and Table II [2] present in a summary fashion a graphical and quantitative picture of seasonal movements of wheat from the harvest to the outflow of the finished commodity to final consumers. The picture is simple but significant. From the harvesting of grain in various states to the con-

[2] The charts give an exact picture of the seasonal swing and make possible graphical comparison of seasonal patterns. Because of changes in the vertical scale of the charts, necessitated by considerations of economy of space, graphical comparisons of amplitude are valid only within each chart, or between separate charts with an identical vertical scale. Comparison of amplitude is given more precisely in tables that present the average deviation and the range of each seasonal index. In the following discussion no direct citation of these measures is made, but the reader will find them easily in such summaries as Table II and in Appendix I.

sumption of its major finished product, bread and baked goods, wheat is subject to seasonal variations. A substantial identity of pattern characterizes all the indexes from harvesting through flour production; but the swing decreases materially as wheat passes through the successive stages, reaching its narrowest amplitude in the relatively stable demand for the finished product. This indicates clearly that the origin of seasonal disturbances is in the organic processes of wheat cultivation. Coincident with this damping of amplitude are minor shifts in pattern. The peak in wheat flow from the fields is in July, in flour milling in October, in flour consumption during the winter. But the shift in timing from one link to the next is not as consistent as the damping of amplitude.

Such changes in seasonality at successive, and hence cooperatively related, stages of production are possible only if stocks are kept and if they are allowed to fluctuate seasonally. Since the most conspicuous declines in seasonal amplitude from one link to the next are shown from harvesting to marketing, and from receipts at or shipments from primary markets to the grinding of wheat by flour mills, it is obviously at these two points that considerable stocks are being held by one of the links involved. Further investigation reveals that it is the farmers who hold stocks of wheat and thus make the flow of wheat to primary markets much more even than harvesting; and that it is largely the flour mills that hold considerable, seasonally variable stocks of wheat and thus carry the burden involved in a variable supply of raw materials to an evenly functioning industry.

Between flour production and the passing of finished goods to final consumers there is undoubtedly a further decline in seasonal amplitude and a shift in timing. The available data do not admit of a more precise study of the changing seasonal swing and of its incidence on the various links. It is obvious, however, that seasonally variable stocks of wheat flour are carried not by the flour mills but by wholesalers and large bakers.

DETAILED COMMENTS

A closer inspection of the charts and a more minute quantitative analysis of the seasonal measures make possible numerous observations that are of interest and provide details supplementary to the essentials summarized above.

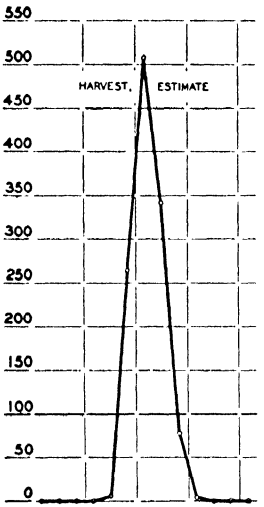
1. Harvesting

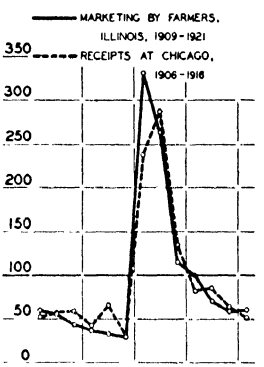
The estimate of wheat harvest for the country as a whole (Chart 2) understates the extent of seasonality, in so far as it combines areas in which the harvest occurs at different times of the year. The earliest date given by the Department of Agriculture (*Wheat and Rye Statistics,* Statistical Bulletin no. 2, 1926, p. 23) for the beginning of the winter wheat harvest is May 29 in Texas and the latest, July 15, in Michigan. The general harvesting dates extend from June 9 in Texas to July 23 in Michigan. The duration of the winter wheat harvest period in single states averages only two and a half weeks; 26 days is the longest period, 13 days the shortest. Thus for each state the seasonal index of harvesting runs as follows: the month of harvest—index of 1200; all other months—0. For the country as a whole, however, the harvest estimate indicates that three months, June, July and August, account for substantial portions of the annual harvest, and that in three other months, May, September and October, some fraction is harvested.

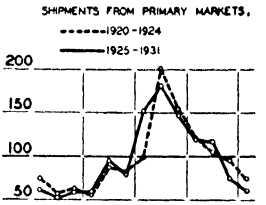
In this and the four following chapters, only the national aspects of the seasonal problem are considered; the regional aspects are reserved for detailed treatment in Chapter VIII where indexes by states are discussed at length. But even in the present context, the under-estimates involved in national measures of seasonal variations should be kept in mind, especially since they may reduce the differences in seasonal amplitude or timing at successive links of a related group of processes. Thus, while both harvesting and marketing by farmers show regional differences, these diversities appear less conspicuous in marketing than in harvesting (see state indexes for marketing in Appendix I). Hence, the national index for wheat harvesting serves to dampen the intensity of the seasonal swing more than does the national index for wheat marketing by farmers; and, when reduced to smaller regional units, the drop in seasonal amplitude from harvesting to marketing is still sharper than it appears in the present comparison in Table II.

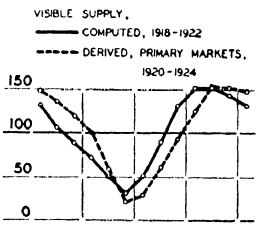
CHART 2

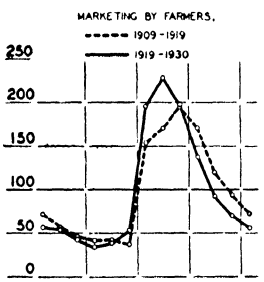
SEASONAL MOVEMENT OF WHEAT

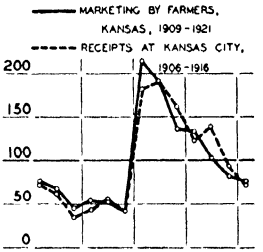


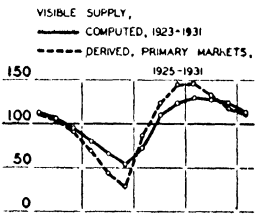


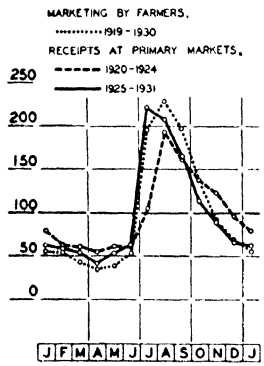


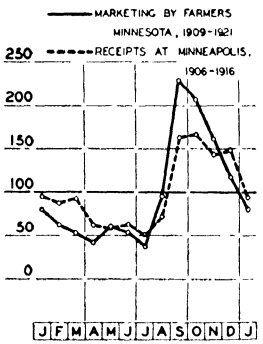












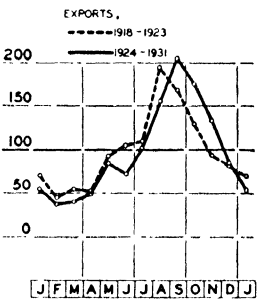


TABLE II

AMPLITUDE OF SEASONAL VARIATIONS: WHEAT, WHEAT FLOUR AND THEIR PRODUCTS

Series	Average Deviation	Range
WHEAT		
Harvest Estimate	135.4	508
Marketing by Farmers, 1909-19	51.5	157
1919-30	59.9	194
Marketing by Farmers, Selected States, 1909-21		
Illinois	68.3	301
Kansas	46.6	173
Minnesota	52.7	191
Receipts at Primary Markets, 1920-24	36.8	138
1925-31	51.7	181
Receipts at Selected Markets, 1906-16		
Chicago	60.0	256
Kansas City	49.3	156
Minneapolis	36 8	116
Shipments from Primary Markets, 1920-24	30.5	146
1925-31	36.2	130
Visible Supply, 1918-22	36.0	120
1923-31	22.3	76
Visible Supply at Primary Markets, Derived, 1920-24	39.2	132
1925-31	30.2	119
Exports, 1918-23	35.0	150
1924-31	45 8	168
Stocks held by Flour Mills, Quarterly, 1926-31		
In country elevators	38.5	101
In transit	25.5	76
In terminal elevators	43.5	116
At mills and in mill elevators	30.0	87
Total	33.0	88
Borrowing by 121 Flour Mills, 1919-21	25.2	86
Wheat Grinding by Flour Mills, 1923-31	7.7	28
WHEAT FLOUR		
Production, 1918-24	12.6	46
1924-31	7 8	29
Stocks held by Mills, Quarterly, 1926-31	7.0	25
Stocks, All Positions, 1920-31	8.6	29
Trade Disappearance (Consumption), 1920-31	10.5	37

TABLE II (CONTINUED)

Series	Average Deviation	Range
Employment		
Flour Mills, 1919	5.4	18.4
1925	3 6	14.1
1930	2.1	8.5
Baking Industries, 1919	1.8	6.9
1925	1.4	6.0
1930	1.4	5 6
Sales by Federal Bake Shops, 1928-31	6.3	25

2. Marketing by Farmers

The Department of Agriculture considers as marketed only the part of the crop that is shipped out of the county in which it is grown. On this basis farmers marketed only about 68 per cent of the total crop during the crop years 1919-29 (average crop, 841 million bushels, average amount shipped out of the county where grown, 568).[3] Thus, farmers retained on the average over 30 per cent of the crop.

That there was considerable seasonal movement in these stocks held by farmers is evident from a comparison of the seasonal indexes for harvesting and for marketing. But still more direct evidence lies in the reports on the size of wheat stocks held on farms on March 1 and July 1 of each crop year; for the crop years 1919-29 these averaged 143 million and 34 million bushels.[3] Thus, as late as six months after the harvest, about 17 per cent of the old crop was still in the hands of farmers. Four months later the stocks dropped to 4 per cent of the old crop. These figures suggest that the seasonal movement of farmers' stocks is a rapid and rather consistent decline from the peak immediately after one harvest to the trough immediately preceding the next.

3. Receipts at Primary Markets

Average annual receipts at primary markets amounted during the years 1919-31 to 426 million bushels. This constitutes over two-thirds of the amount reported as shipped out of the county where grown. A part of the discrepancy is ac-

[3] See *Yearbook of Agriculture, 1931*, pp. 583, 592.

counted for by stocks at country elevators, a part by direct shipments from country elevators to points other than primary markets. But the agreement between farmers' marketings and receipts at primary markets is rather close in volume and in the character of the seasonal variations. Thus, there is only a slight decline in seasonal amplitude between these two links.

The Federal Trade Commission's *Report on the Grain Trade,* 1924 (VI, 83) provides figures that throw some light on the regional differences between the three most important terminal points, Chicago, Kansas City and Minneapolis. For the crop years 1906-07 to 1916-17 the report publishes the average percentage received each month. In converting these percentages into seasonal indexes no correction for trend was made, since this would have introduced only a minor change. These three seasonal indexes for receipts are plotted with the indexes of marketing for the corresponding states on Chart 2.

These comparisons support the conclusions drawn from the analysis of the corresponding series for the country as a whole. In each series receipts at the primary market show a somewhat smaller seasonal swing than marketing for the state as a whole. The only exception is in the average deviations for Kansas City and the State of Kansas. Were data available on receipts at all the primary markets within the state rather than at one center only, the difference in amplitude would have been still more considerable. Another interesting showing is in timing. In all three series the peak in receipts at the center lags one month behind the peak in marketing by farmers.

The greatest difference between marketing and receipts appears in the comparison between Minneapolis and Minnesota, and the closest similarity between Kansas marketings and Kansas City receipts. The differences between the first two series are obviously due to the position of Minneapolis as a flour-milling center. In addition to the wheat that it receives from Minnesota, large quantities are also sent in from other wheat-growing states. On the other hand, Kansas City receives most of its wheat from the huge granary of the State of Kansas itself.

4. Shipments and Visible Supply

The average annual volume of shipments from primary markets amounted during 1919-31 to 284 million bushels, that is, about two-thirds of receipts. This outflow is chiefly to secondary markets and consuming units. The decline in seasonal amplitude from receipts to shipments indicates that considerable stock-carrying for purposes of seasonal adjustment takes place at the primary or terminal markets. This is generally recognised to be one of their most important functions. A portion of the wheat retained at primary markets is kept in stock, while some is consumed in flour mills and other establishments but it is impossible to distinguish between the two parts. As we shall see later, wheat is consumed at a much more even rate than it is received or shipped. Therefore, in an attempt to derive seasonal variations in stocks at primary markets as successive discrepancies between receipts and shipments, consumption may be assumed to be seasonally constant.[4]

An index of seasonal variations in wheat stocks at primary markets was constructed upon the assumption that shipments constitute two-thirds of receipts and that average stocks are equal to average monthly receipts. These derived measures may be compared with the indexes computed from the series of ' visible supply ' of wheat. Visible supply refers to stocks at interior and seaboard points of large accumulation, as well as to grain in transit by canal, lake and rail. The series covers a varying, ever increasing number of points, and for recent years includes an area much wider than that covered by the primary markets. The latter, however, probably account for a very large percentage of the total volume.

Comparison of the derived and computed indexes for stocks of wheat at primary markets (see Chart 2) is possible for two periods, 1920-24 and 1925-31, into which all the series involved were divided for the purpose of seasonal analysis. In both periods there is a close and reassuring similarity of seasonal pattern in the two sets of indexes. For the earlier period the sizes of the seasonal swing also are almost the same. But in the recent period the derived index shows a much wider amplitude than that which was computed. This may be because the assumption of equality between average volume of stocks and

[4] An example showing how a seasonal index for stocks may be derived from indexes relating to in- and out-flow of the commodity is given in Appendix I.

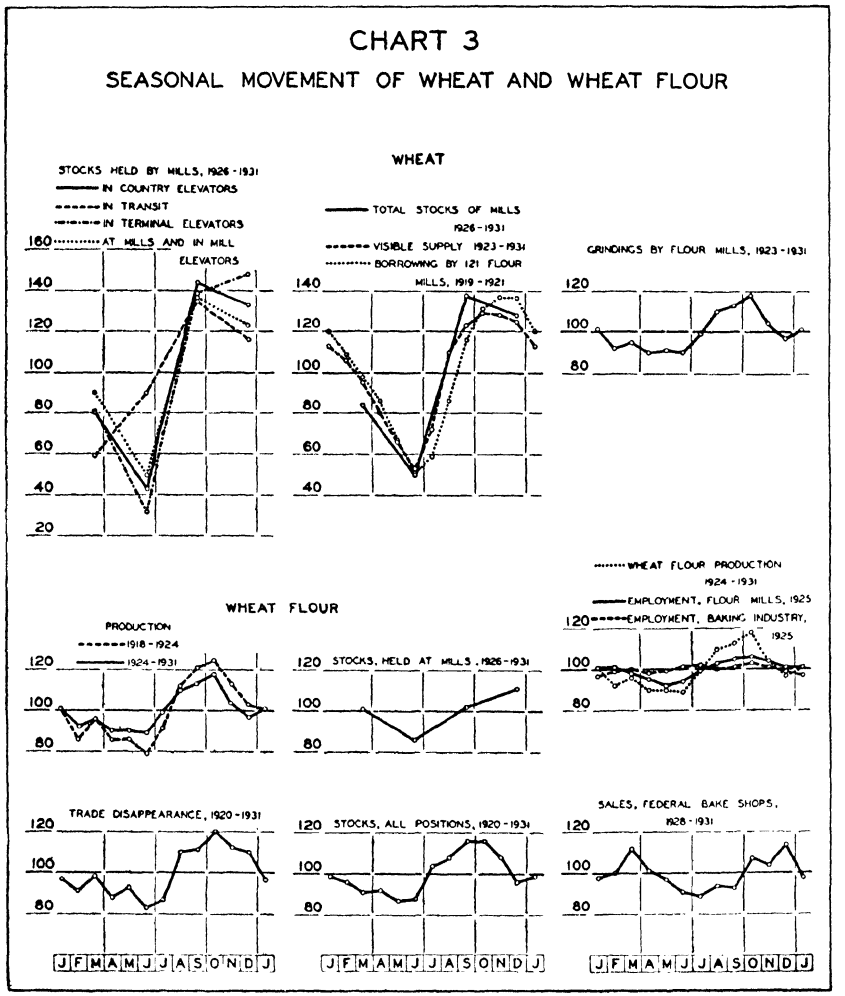
average monthly receipts was true of the years before 1925 but not of the period since 1925. During recent years stocks of wheat have expanded and their ratio to monthly receipts has risen very sharply. Thus, average monthly receipts increased 14 per cent from the first to the second period, while visible supply increased 116 per cent. Were a larger ratio of stocks to receipts allowed in our derivation of the index for the later period, the derived index would have shown a milder swing with an amplitude close to that of the index computed for visible supply.

5. Stocks of Wheat Carried by Flour Mills and Flour Production

Quarterly data on wheat grain owned by the flour mills classify total stocks into those: (1) in country elevators; (2) in transit; (3) in private terminal elevators; (4) in public terminal elevators; (5) at mills and in elevators attached to the mills. For the present purpose stocks in private and public terminal elevators may be treated as one. The relative importance of the four groups is indicated by the average number of bushels of wheat at each point in 1930: in country elevators 7 million; in transit 12.6 million; in terminal elevators 17.9 million; at mills and in mill elevators 76.1 million. Thus about three-quarters of total mill stocks were held at mills and in elevators attached to the mills.

There is an interesting contrast between the seasonal swings in stocks held at the elevators attached to the mills and in stocks in other elevators (Chart 3). Mill elevator stocks and stocks in transit show an amplitude appreciably lower than that in stocks at country and at terminal elevators. Obviously, the portion of wheat stocks that is retained by mills in elevators other than their own represents the auxiliary and hence most variable elements in their holdings. This is especially true of stocks at terminal elevators, whose seasonal index shows the highest amplitude of all four, and whose pattern suggests that these stocks are kept high only as long as stocks at mills are large. Thus, volumes at terminal elevators continue to rise from the third quarter to the last quarter of the year, part of the new wheat arriving for the mills being stored outside of the overloaded mill elevators. On the other hand, mill holdings in terminal elevators decline to their lowest at the end of the second quarter.

That flour mills carry large seasonal stocks of wheat may be seen from the seasonal index of their total stocks of wheat grain. Immediately after the harvest they buy wheat heavily and allow their stocks to fluctuate with the inflow of wheat as



measured by farmers' marketings. Of course, their holdings do not vary to the full extent that would be inferred from farmers' marketings. But from a comparison of their stocks with the visible supply of wheat, which reflects holdings also by the grain trade, it is clear that the mills as well as the trade

itself carry seasonal stocks, thus taking the burden from the farmer or any middlemen that may intervene between him and them.

This importance of the mills as grain traders is reflected also in the fact that the milling concerns make the grain trading function a separate and autonomous part of their business.

Apart from side-lines such as breakfast cereals and compounded feeds, the profits of a milling concern proceed separately from the grain division and the milling division. In a sense, these are antagonistic, that is, a season favorable to larger profits on wheat is likely to show smaller profits on flour and vice versa. The crop year 1929-30 in the United States was one unusually favorable to profit on handling wheat and not conducive to profit on merchandising flour, so much so as to lead to the exaggerated but illuminating declaration in an editorial in the *Northwestern Miller* of July 9 that milling concerns with large storage facilities would have done better if they had shut down the mills and operated solely as wheat dealers. In most large mills the milling division buys its wheat from the grain division day by day, at the prices of the day.[5]

Seasonal variations in wheat stocks held by mills do not appear to be necessitated by similar variations in the demand for flour. Consumption of flour may be said to be fairly constant; if it varies at all it is to rise slightly in cold weather. If a substantial seasonal swing exists in flour production and wheat grinding, it is imposed by seasonality in the wheat supply.

This impression is confirmed by a comparison of the seasonal index for wheat grindings with that for total stocks kept by mills. While the seasonal swings are similar in pattern, the size of the former is appreciably less. From a seasonal peak twice as high as that for grindings, stocks decline to a trough about five times as low. This is in no way attributable to the small volume of stocks as compared with grindings. For 1929 the mills reported average stocks of about 125 million

[5] Wheat Studies of the Food Research Institute, Stanford University, VII, no. 1, November 1930, *The United States Wheat Flour Export Trade*, pp. 42-3. Another substantiation of the wheat stock carrying function of flour mills, and one that throws light on the credit side of the business, lies in the monthly borrowings by flour mills to finance their wheat purchases and the carrying of stocks. In its report on the *Wheat Flour Milling Industry* (May 1924), the Federal Trade Commission quotes data for monthly borrowings by one hundred and twenty-one flour milling concerns for the years 1919-21 (p. 30). The index computed from these data is plotted on Chart 3, together with those for quarterly stocks and monthly visible supply. The similarity of the three indexes is a further indication of the stability of the seasonal pattern in wheat stocks carried by flour mills.

bushels, while grindings averaged about 44 million bushels a month. In other words, the average volume of holdings was about three times as large as that of monthly grindings. The consideration of seasonal indexes for the production of wheat flour yields the same conclusion, these indexes repeating the showing of wheat grindings.

6. Wheat Flour Stocks and Their Disposition

Wheat flour is either shipped immediately to the purchaser or retained by the mill. The data on flour stocks kept by mills show that, in contrast to wheat grain stocks, they are not large. The mills that supplied data on wheat stocks and milling (representing 90 per cent of the industry) held average stocks of flour during the last five years of about four million barrels. As their monthly production was above nine million barrels, their holdings of flour were equivalent to at most half a month's production. The seasonal indexes for the two series on wheat flour stocks reflect a similar type of movement, tracing a pattern that is almost an exact duplication of that in output itself. In view of what was just said concerning the nature of these stocks, this was to be expected. These stocks are not an accumulation of flour in a pool, in which discrepancies between inflow and outflow may gather. They are merely the level of the flow of flour from production through the mill warehouses almost directly into other hands. If there is any discrepancy between the seasonal in the final consumption of flour and that in output, it is obviously not the mills but some other economic agents who carry the seasonal burden of large stocks of flour.

Accordingly, the series commonly labeled flour consumption, which is usually computed from output, stocks, net exports and shipments to possessions of the United States, is not a series of actual consumption of flour either by commercial bakers or housewives. It reflects, disregarding export and shipments by flour wholesalers and dealers, the movement of flour from the mills to domestic dealers, bakers and retail outlets.

No definite statistical information is available on the flow of flour once it leaves the mills. But the Food Research Institute [6] made an attempt to estimate the changes in total stocks

[6] Wheat Studies, IV, no. 2, December 1927, *Statistics of American Wheat Milling and Flour Disposition since 1879,* pp. 63-102.

of flour. The assumption upon which the estimate is based is that flour is consumed in fairly even quantities throughout the year. While it is admitted that consumption may be slightly heavier during the winter than in summer, this difference is disregarded. With allowances for changes in the number of days in the month and for the trend from year to year in per capita consumption, final flour consumption is then computed for an increasing population.

The comparison of consumption thus computed, with output, adjusted for net exports and shipments to United States possessions, indicates the monthly additions to or subtractions from total flour stocks. From these net changes in total stocks it is possible to subtract the net changes in producers' stocks, and thus obtain net changes in stocks kept by wholesalers, bakers, retailers and final consumers.

Such a series of net changes in total stocks, primary and non-mill, is given by the Food Research Institute for the four years 1923-27. We have no definite base to which these changes could be related (with the exception of the mill stocks), but it is still possible to average them for the four years and compare both the magnitude and the timing of the seasonal variations.

Four years is a rather brief period for which to compute seasonal indexes, but stability of the seasonal in the series is conspicuous, as shown by the following means of the two and four (three and five for some months) central items. In each instance the means were corrected to make the algebraic sum for the year equal zero.

The comparison thus afforded reveals interesting differences. In terms of absolute amplitude the largest seasonal variations are in total flour stocks, although those in non-mill stocks are almost equally violent. The variations in mill stocks are only from one-third to one-half as large as those in the other groups. Whether this difference in amplitude would persist were the absolute figures related to the average size of stocks is, of course, a question. As was noted above, mills carry quite small stocks; therefore, the small absolute variations may arise partly from the small absolute volume. Wholesalers and bakers may carry much larger stocks of flour than do the mills, and in that event the large absolute variations would appear much smaller when converted into percentages.

However, it is obviously the wholesalers, bakers and retailers who carry the stocks and take the speculative risks as well as assume the task of reconciling fluctuating output with constant demand. Looking at the seasonal pattern of their stocks, we find significant differences from the swing in mill

ARITHMETIC MEAN OF CENTRAL ITEMS, NET CHANGES IN NON-MILL AND TOTAL FLOUR STOCKS 1923-1927

	Non-Mill Stocks		Total Stocks		Mill Stocks Difference Between Col. (4) and Col. (2)
	2 or 3	4 or 5	2 or 3	4 or 5	
	(in thousands of bushels)				
End of Month	(1)	(2)	(3)	(4)	(5)
January	1733	1830	1792	1828	— 2
February	1639	1939	1274	1599	— 340
March	1651	1487	774	672	— 815
April	— 115	— 91	— 714	— 665	— 574
May	— 930	— 867	— 1845	— 1812	— 945
June	— 1936	— 1884	— 2777	— 2679	— 795
July	— 3238	— 3066	— 2942	— 2799	267
August	— 2156	— 2286	— 1817	— 1909	373
September	— 1625	— 1753	— 195	— 425	1328
October	605	647	1990	1982	1335
November	1852	1788	2429	2373	585
December	2521	2255	2030	1840	— 415
Range	....	5321	....	5172	2380
Average deviation from 0..	....	1658	....	1764	648

stocks, which have a flat peak in September and October and a trough in May. (Note that the index for these net changes in mill stocks is almost identical in pattern, as it should be, with the index of wheat flour stocks, all positions.) But the stocks in the hands of wholesalers, bakers and consumers have a trough in July, that is, two months later, and a peak in December, also two months later.

7. Flour Milling, Baking and Bakery Sales

Flour sales in the United States may be divided into six groups with considerable overlapping and varying widely from region to region, as follows: (1) flour passing into household consumption, distributed through chains or individual retailers; (2) flour sold to institutions, public and private, including the Army and the Navy; (3) flour sold to

large bakeries; (4) flour sold to small bakeries and pastry shops; (5) flour sold to public eating places, directly or indirectly through middlemen; and (6) flour passing to export.[7]

Monthly series on employment are the only ones available to throw light on the similarities and differences in the seasonality of the flour milling and the baking industries. A comparison of the seasonal swing in flour output with those for employment in 1919, 1925 and 1930 reveals an essential similarity in pattern but a significant difference in amplitude (Chart 3). Thus, for 1930 the range in employment was only 8.5, while that in output was 29. But the decline in amplitude revealed during the period by employment agrees with the showing of the seasonal indexes for flour milling.

The seasonal pattern in employment in the baking industries differs materially from that in flour milling, but the significant feature is the narrower amplitude of the swing in the former. Throughout, the range in the baking series is appreciably lower than in flour milling (Table II). We may infer that in output also the baking industry is subject to milder seasonal swings than the flour industry. The gradual damping of the seasonal swing from the raw material to the finished product may be expected to continue through baking, which shows a milder swing than does flour milling.

No data are available on the movement of flour or of bakery products through the hands of wholesalers and retailers, nor any precise information on their stocks. The recorded series of wholesale and retail trade represent sales by grocery wholesalers and retailers. Since in these series flour and bakery products are more than outweighed by a variety of other goods, it would be inappropriate to compare seasonal indexes for total grocery sales with the movement of flour and bakery products only. Some information, however, is contained in a series of monthly sales by a large concern, the Federal Bake Shops, which operates directly or through subsidiaries as a chain of about 100 retail bake shops in eastern, southern and middle western sections of the United States. The company

[7] Wheat Studies of the Food Research Institute, VII, no. 1, November 1930, p. 43. According to the census report on the distribution of sales in 1929 of the manufacturing plants in the flour and other grain-mill products industry, 9 per cent of sales went to the manufacturers' own wholesale and retail branches, 40 per cent to wholesalers, 27 per cent to retailers and 24 per cent directly to users (bakeries, manufacturers of food products, institutions, farmers, etc.).

specializes in the production of sweet bakery goods, such as cakes and pastries. Also, lunch departments have been installed in several stores.[8]

The sales figures are available for only 1928-31, but the seasonal swing is so clear-cut and stable that a significant measure may be obtained in spite of the brevity of the period. The ratios (to the thirteen-month moving average) are as follows:

	Middle Ratio	Average of Three		Middle Ratio	Average of Three		Middle Ratio	Average of Three
January ..	98	99	May	98	97	September..	93	93
February ..	100	100	June	91	91	October	108	107
March	113	111	July	90	89	November..	103	104
April	101	101	August	93	94	December ..	114	114

In evaluating the significance of this seasonal index of retail sales it must be remembered that these sales are in dollar volume and that shifts in demand between standard cheap goods, such as bread, and the more expensive pastries may account for a large part of their seasonal movement. Thus the two peaks, in March and in December (Chart 3), are undoubtedly associated with larger purchases of cakes and pastries for the Easter and Christmas holidays. Also, part of the summer drop is explained by a considerable decline in demand for sweet baked goods. The decline in the demand for bread, if any occurs during hot weather, is probably not as large. In terms of commodity units of the simpler type, such as bread, the seasonal swing in retail sales must undoubtedly be much milder than that shown by the sales of the Federal Bake Shops. But even as the index stands, its swing is smaller than that of any production index encountered heretofore.

C. Dairy Products

GENERAL CHARACTERISTICS

Wheat is a comparatively durable raw material. Its loss of weight in storage is quite small, and for the purpose of milling, wheat kept in stock under proper conditions is as good as grain just received from the fields. But not all raw materials in Group I are so durable. There are also perishable raw materials, some not capable of preservation, others equally per-

[8] From the description of the business in the Corporation Records of the Standard Statistics Co.

ishable but convertible into durable goods. For perishable raw materials, of course, an entirely different solution of the seasonal problem must be sought. Unlike wheat, they cannot be kept in stock. Either final demand must adapt itself to the seasonal swing in supply, or, if possible, raw materials must be converted into durable goods before they can be stocked for eventual absorption by final consumers.

Milk and cream, whose seasonal movements are summarized briefly in Charts 4, 5, 6 and Table III, are typical of perishable raw materials in Group I that may be converted into durable goods. Fluid milk is perishable, and the demand for it by final consumers is relatively constant through the year. The production of milk, on the contrary, is subject to marked seasonal variations, natural conditions of pasturage favoring increased milk production during the summer. It is true that with the development of urban demand for milk, recourse is had to the more expensive winter dairying to supplement summer dairying. This serves to overcome the winter shortage of milk that is created by the disparity between the influence of original seasonal factors on milk production and on demand by consumers. But at best a change from summer to winter dairying is a slow, costly process.

The problem of the surplus milk available in summer is solved by the conversion of milk into more durable goods, primarily butter. With the development of cold storage, such durable goods may be kept in stock until final consumer demand forges ahead of the output of the industry.

Thus, the seasonality in the supply of raw milk imposes marked seasonal variations upon the production of such durable dairy goods as butter, condensed and evaporated milk and cheese, their output being at peak during the summer, when fluid milk is abundant and cheap. In its own turn, the summer peak production of durable dairy goods tends to lower their prices and to exercise a marked effect upon the production of substitutes. For example, the seasonal swing in the production and consumption of oleomargarine, the most important butter substitute, shows seasonal peaks in winter and troughs in summer, a pattern attributable not to any factors in the production of margarine but to an adjustment to the seasonal swing in the production of butter.

The original seasonal factors in the output of raw milk thus

radiate their influence far along the sequence of production stages. At the source these original forces are only partly overcome by the development of winter dairying. Such an emancipation from the disturbing seasonal factors is, of course, true of a large dairying area taken as a whole rather than of the single farms, which usually specialize either in winter or in summer dairying. But even for large dairying areas a complete balancing of the summer and winter system and the consequent possibility of producing butter, cheese and other durable dairy products at an even rate appears more costly and less preferable than a preponderance of summer dairying with its consequent seasonality in the production of such durable goods.

DETAILED COMMENTS

1. Fluid Milk and Cream

a. *Sales at Retail and Wholesale and Total Receipts at City*

Of the total quantity of milk produced in the United States about 46 per cent is consumed for household purposes in the form of milk and cream, and about 47 per cent for manufacturing, the latter including diverse products, such as butter, cheese, condensed milk, ice cream.[9]

In studying seasonal changes in the supply of fluid milk and cream it seemed best to ascertain first whether ultimate demand fluctuates significantly and then to trace the seasonal movements to their origin in the supply of the raw material. Detailed data are available for two urban centers—New York and Chicago—while a less extensive study has been made for Los Angeles.[10] Only the data for New York City are presented; data for Chicago confirm on the whole the showing for New York.

Seasonal changes in consumers' purchases of different types of milk and cream are compared graphically on Chart 4

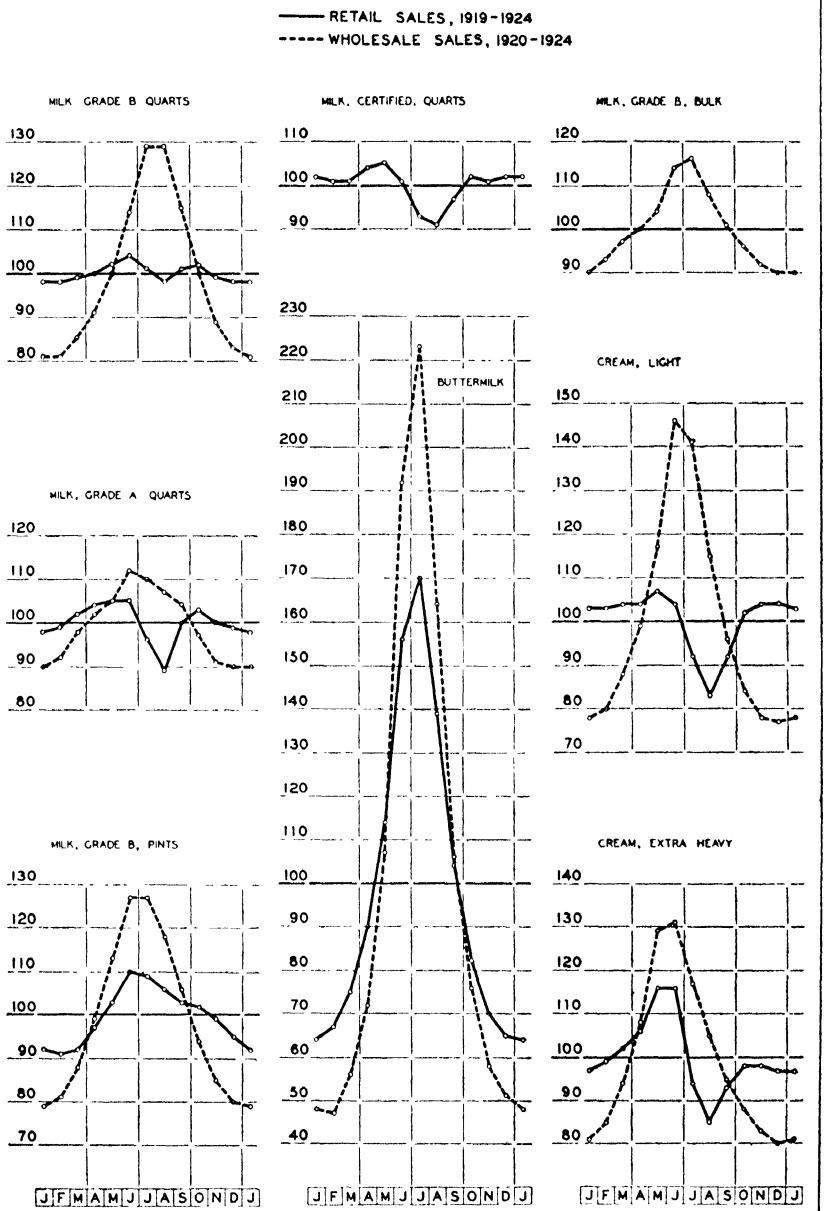
[9] U. S. Department of Agriculture, *Yearbook 1922,* p. 293.

[10] For New York City, see H. A. Ross, *Some Factors Affecting the Demand for Milk and Cream in the Metropolitan Area of New York,* Technical Bulletin of the U. S. Department of Agriculture, No. 73, June 1928; for Chicago, H. A. Ross, *The Marketing of Milk in the Chicago Dairy District,* University of Illinois Agricultural Experiment Station, Bulletin No. 269, June 1925; for Los Angeles, Leland Spencer, *An Economic Survey of the Los Angeles Milk Market,* University of California, Agricultural Experiment Station, Bulletin No. 513, May 1931.

CHART 4

SEASONAL MOVEMENT OF MILK AND CREAM

NEW YORK CITY



with sales by wholesalers. The factors determining these changes for each specific commodity have been described fully by H. A. Ross.[11]

RETAIL

Quarts, Grade B

Retail sales of quarts of grade B milk increase slowly with the increasing temperature and reach a peak late in June. The temperature, of course, continues to rise, but schools close at this time, and the vacation migration causes an abrupt drop in demand. During July and August there is a continual movement of people to and from the city, but the out-of-city movement is the heavier, and sales continue to decline until the last of August. With the opening of schools, the cityward movement of population sends demand sharply upward. This trend continues until about the first of October, by which time practically all vacationists have returned, and the cold weather causes a falling-off in demand.

Quarts, Grade A

A somewhat similar seasonal variation is shown by the sales of quarts of grade A milk, although minor differences may be noted. Sales fall off much more in the summer, and the low demand begins before schools close and continues after they have opened, because a larger proportion of grade A milk is consumed by children not yet of school age, and many families can leave on their vacations without waiting for the close of school. Similarly, they are under no necessity of returning for the opening of school.

Quarts, Certified

Certified milk is consumed so largely by children under school age that, unless there are older children in the family, no attention need be paid to the opening or the closing of school. As a result the vacation decrease covers a still longer period. Neither grade A nor certified milk shows the sharply marked changes in demand which characterize the vacation period in the case of grade B milk.

There is a slight increase in sales of certified milk in the coldest part of the winter, when sales would naturally be expected to decline. This appears to be due to a distinct seasonal variation in the number of births in New York.

Pints, Grade B

The sales of pints of grade B milk present a different picture, because a much greater proportion is consumed by adults. Temperature affects the adult demand for milk much more than it does the children's demand, because children do not shift from milk to tea or coffee as do adults. The drinking of milk with luncheons has much to do with the high summer demand. Working people who lunch down town consume large quantities of milk when the weather is hot, but when the weather is cold they change to a hot drink, and the demand for pints is therefore much greater in

[11] The quotations are from *Some Factors Affecting the Demand for Milk and Cream in the Metropolitan Area of New York*, pp. 22, 24-30.

summer than in winter. Vacations tend merely to check the increase rather than to cause an actual decrease.

Cream

Retail sales of extra-heavy cream reach their peak about the first of June, when fresh berries are on the market and before the vacation migration has begun. Sales at this time are more than 40 per cent higher than they are at the lowest point, in the latter part of August, when the maximum number of persons are out of the city. With the return of vacationists the sales of cream rise, but the berry season is past, and the high point in the fall is 17 per cent below the early summer peak. Light cream, on the other hand, fails to show as high sales when the berries are on the market. It is used in the home largely for coffee, and the demand is therefore high in winter and low during the hot weather.

Buttermilk

Buttermilk is a popular summer drink, since many persons consider the acid taste very refreshing during hot weather. Retail sales of this product reach a maximum about the last week in June, at which time the demand is almost three times as great as in the coldest months.

WHOLESALE

The seasonal variation in wholesale sales differs from that in retail sales because a number of new factors of demand are introduced. . . . . In addition to the bulk and bottled products sold to stores for re-sale to the consumer, large quantities of these products are sold to hotels, restaurants, stands, schools, hospitals, prisons, and like places, where they are consumed on the spot instead of being taken into the home. Smaller quantities of milk, cream, and condensed milk are sold also at wholesale to confectioneries, where they are made into ice cream or served in various ways at the soda fountain.

In most of the wholesale outlets for dairy products the adult consumers predominate, whereas in the retail trade the greatest proportion of the milk consumption is by babies and young children. Because of the greater tendency of adults to change their consumption with the weather, wholesale sales of almost all dairy products rise in the summer and fall in the winter. Even the vacation migration, so pronounced in retail sales, is much less effective here because these employed adults ordinarily have but a brief vacation. Furthermore, it appears logical to assume that dipped-milk sales are little affected by vacations because of the economic status of the purchasers. It also seems probable that there is some shift from retail deliveries to store purchases during the hottest months by families who are too poor to keep ice, and by that increasing class of people who depend on delicatessen stores for meal-to-meal purchases.

Milk

. . . . With the exception of quarts of grade B milk, the summer increase in wholesale sales is checked by the vacation movement out of the city. Since sales of quarts of grade B milk continue to rise until about the first of August, when the temperature reaches its maximum, it

TABLE III

AMPLITUDE OF SEASONAL VARIATIONS: MILK AND CREAM

Series	Average Deviation	Range
MOVEMENT OF MILK AND CREAM, N. Y. C.		
Retail Sales, 1919-24		
Milk, Grade B, Quarts	1.7	6
" " A, "	3.2	16
" " B, Pints	5.6	19
" Certified, Quarts	3.2	14
Buttermilk	30.8	106
Cream, Light	5.7	24
" Extra Heavy	6.6	31
Wholesale Sales, 1920-24		
Milk, Grade B, Quarts	14.8	48
" " A, "	6.8	22
" " B, Pints	15.4	48
" " B, Bulk	7.1	26
Buttermilk	48.7	176
Cream, Light	19.9	69
" Extra Heavy	15.3	51
Receipts of Milk		
N. Y. C., 1920-31	4.2	18
Boston, 1920-31	5.3	23
Receipts of Cream and Condensed Milk at N. Y. C., 1905-09	29.7	98
1919	32.8	111
1931	20.2	70
MOVEMENT OF MILK AND CREAM FROM FARMS TO CITIES		
Receipts of Milk at Cream-Shipping Stations, N. Y. Area, 1924	30.5	112
Delivery of Milk to 30 Shipping Stations, N. Y. Area, 1910-14	16.1	55
1920-24	13.4	45
Daily Deliveries per Dairy, N. Y. District, 1922-30	15.3	58
Raw Milk Production, Minneapolis District, 1920-31	13.2	47
Milk Sales by Farms		
Chicago District, 1920-22	13.2	44
Inner Part of Chicago District, 1918-22	12.9	38

TABLE III (CONTINUED)

Series	Average Deviation	Range
MOVEMENT OF MILK FROM FARMS (N. Y. AREA)		
SALES OF MILK IN RELATION TO COWS FRESHENING		
70 Farms Producing Grade A Milk, 1927-28		
Sales of Milk	17.8	70
Proportion of Cows Freshening	64.8	267
450 Farms Producing Grade B Milk, 1927-28		
Sales of Milk	17.3	65
Proportion of Cows Freshening	43.5	195
641 Farms Producing Milk, 1927-28		
Sales of Milk	15.2	58
Proportion of Cows Freshening	43.0	191
Winter Dairies, 1921-25		
Cows Milking	12.6	46
Cows Freshening	69.6	250
Cows Dry	62.9	228
SALES OF MILK FROM 641 FARMS GROUPED BY		
Pasture per Cattle Unit, 1927-28		
Group I (1.5 acres of pasture)	14.3	57
" II (2.9 " " ")	14.7	53
" III (4.8 " " ")	16.7	61
" IV (7.5 " " ")	24.2	84
Silage Fed per Cattle Unit, 1927-28		
Group I (none)	22.7	82
" II (1.4 tons of silage)	22.8	83
" III (2.9 " " ")	13.0	42
" IV (5.1 " " ")	16.8	54
Amount of Milk Produced per Cattle Unit, 1927-28		
Group I (3.3 thousands of lbs. of milk)	40.5	141
" II (4.5 " " " " ")	29.3	110
" III (5.4 " " " " ")	20.8	79
" IV (6.5 " " " " ")	14.0	55
" V (7.3 " " " " ")	12.3	43
" VI (8.4 " " " " ")	15.3	43
" VII (9.9 " " " " ")	13.5	49

appears that this commodity is the one most affected by the shift of the household trade from retail deliveries to store purchases.

Cream

Wholesale sales of extra-heavy cream are greatest at the height of the berry season, being about 75 per cent above the low point in December. Sales of light cream and condensed milk, on the other hand continue to rise until the last week in June, since the ice cream demand affects them more than it does sales of the high-testing cream.

This analysis affords an adequate explanation of the diverse patterns in the sale of milk and cream products at retail and wholesale. The comparison in Table III shows clearly that: (1) with the exception of buttermilk, retail sales of milk and cream are characterized by mild seasonal variations; (2) sales at wholesale are characterized by a seasonal amplitude higher than that for sales at retail; (3) although grade B milk (quarts) sales at retail are subject to a much smaller seasonal than those of grade A milk, the reverse is true of sales at wholesale. This may be attributable to the fact that most grade A milk sold at wholesale goes to hospitals and institutions that demand milk the year round, while sales of grade B are made primarily to restaurants and retail stores, where the demand fluctuates considerably with the weather and the vacation movement.

A summary measure of total consumption by final consumers is presented by the receipts of milk or cream at any city (Chart 5). Both products are perishable and hence cannot be kept in stock for any length of time; and the industrial demand for them in a city like New York or Chicago is likely to be negligible as compared with consumers' demand. Indexes for receipts of milk in New York City indicate clearly that seasonal variations are mild. Receipts are slightly larger than average in summer and slightly smaller than average in winter. In total consumption, therefore, not the vacation exodus from the city but the increased demand by adults in warm weather is the predominant factor. A similar picture is presented by receipts in Boston.

Total demand for cream and condensed milk is subject to a strikingly different seasonal swing, constant in pattern but rather variable in magnitude. The peak occurs in June, before the vacation exodus has affected the urban population, and is evidently connected with the consumption of berries. Variations in the demand for heavy cream for use with berries out-

weigh the milder fluctuations in the consumption of light cream for coffee and ice cream.

b. *Deliveries to Shipping Stations, Production and Sales by Farms*

Data throwing light on seasonal variations in milk supply are available only for single districts. Fortunately for purposes of comparison, however, these cover the same districts for which information is available on receipts and sales at retail and wholesale. Furthermore, though some series cover only one year, the seasonal swing is so large as compared with other changes that it can be measured with reasonable accuracy.

Of the seasonal indexes presented on Chart 5 two yield definite information on the receipt of milk by plants that supply New York City. These receipts do not accurately reflect the production of milk, for, of course, farms may prefer to retain varying proportions of milk output in the different months of the year. Besides, milk shipping stations are not the only recipients of milk; condenseries, butter and cheese factories, etc., also consume milk. But since milk shipping plant receipts do reflect the stage in supply nearest to its arrival in the urban center, the difference in seasonality between milk deliveries to the shipping stations and milk receipts at New York City is striking and at first incomprehensible. The seasonal pattern of milk deliveries to the shipping stations is fairly similar to that in receipts, with a peak in May or June and low levels during the winter, but the difference in amplitude is striking. It would seem either that the shipping stations retain some of the milk they receive or that there is some diversion of the supply between the shipping stations and New York. The former proves to be the case.

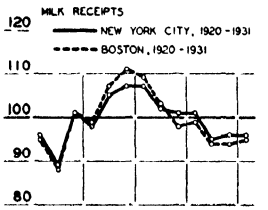
In 1922 and 1923, fluid-milk-shipping stations handled 56 per cent of all the milk delivered by farmers to the milk plants in these counties. Of the milk handled by these plants, 69 per cent was shipped as fluid milk and 22 per cent was shipped as cream, only 9 per cent being used for manufacturing.[12]

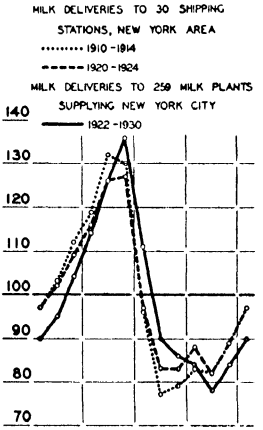
Comparison of milk deliveries to shipping stations with milk receipts at New York brings out clearly the disparity

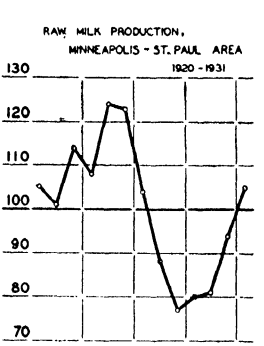
[12] L. J. Norton and Leland Spencer, *A Preliminary Survey of Milk Marketing in New York*, Cornell University Agricultural Experiment Station, Bulletin 445, November 1925, p. 24.

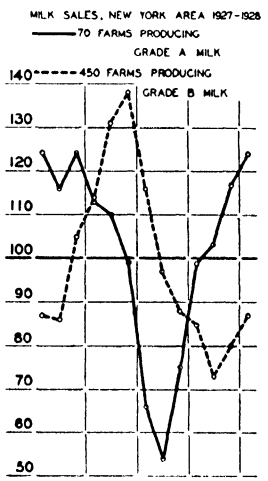
CHART 5

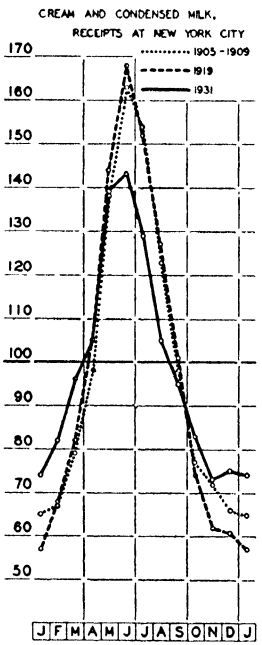
SEASONAL MOVEMENT OF MILK AND CREAM FROM FARMS TO CITIES

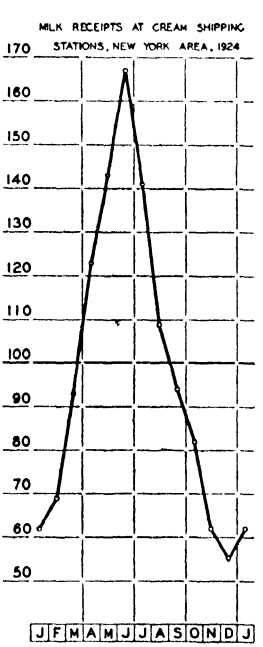


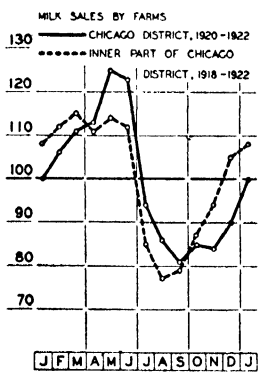












between the seasonal movement of demand and supply that is characteristic of the raw milk industry. Deliveries at shipping stations reflect total sales by farms. Receipts at New York measure total demand. The disparity between demand and supply is overcome by the conversion of milk into cream. In the industry as a whole the seasonal disparity between the supply of fluid milk and the demand for it by final consumers explains the seasonality in the production of the more durable dairy products, especially butter and cheese.

Seasonal variations in raw milk deliveries to shipping stations are an almost exact reproduction of fluctuations in total output of milk. This may be gathered from an inspection of the indexes relating to the Minneapolis-St. Paul, the Chicago and the New York districts. The pattern in each, with its peak in May-June, its trough in September-November, is similar to the patterns for New York State. There is apparently some powerful common factor that makes for one and the same type of seasonal swing in milk production in diverse regions. And if the indexes for receipts of milk in New York City and Boston may be taken as typical of all urban centers, the disparity in amplitude between urban consumption and total production in the United States becomes a country-wide characteristic of the industry.

Farms sell the larger portion of their milk and in most instances milk sold may be considered as measuring production. Thus, the farms that produce grade A and grade B milk in the New York milk-producing area sell 96 and 92 per cent, respectively, of their production in the form of loose milk.[13] The indexes of their sales, even though they cover only one year, may be considered as representative of the seasonal pattern in milk production.

Farms that produce grade B milk are the more numerous and engage chiefly in summer dairying. Farms that produce grade A milk usually engage in a more intensive type of dairying and most of their cows freshen in the autumn. This difference between the seasonal patterns of sales, which is indicative of a difference in the basic dairying system, does not seem to be necessitated by any difference in consumers' demand, for

[13] M. P. Catherwood, *A Statistical Study of Milk Production for the New York Market,* Cornell University Agricultural Experiment Station, Bulletin 518, April 1931, p. 90.

consumers' demand, as expressed in sales both at retail and wholesale, follows more or less the same pattern for grade A and grade B milk. However, since most of grade B milk is consumed by adults, its summer peak of consumption is more conspicuous than that of grade A.

The production of cream, if it may be judged by receipts at the cream shipping stations (Chart 5), follows very closely urban demand as expressed by receipts at the urban center.

c. *Sales by Farms and the Dairying System*

The seasonal factors in production become clear upon inspection of Chart 6, which presents the data on cows freshening on a number of farms in the New York dairy district, all farms and by groups. The close relation between changes in milk sold (that is, milk production) and number of cows freshening is clear. For all farms, both those producing grade A, for which the peak of freshening is in September, and those producing grade B, for which the peak is in March, the high and low levels of milk production regularly lag behind the high and low points in the number of cows freshening.

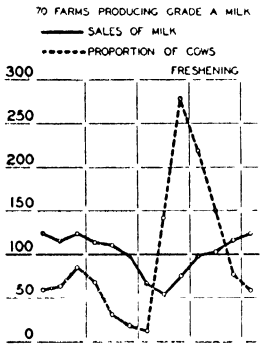
It is not the number of animals freshening in a given month but rather the cumulation of cows milking that determines the volume of milk production. At any given time cows milking outnumber those freshening. Consequently, the seasonal variation in the number of cows milking and, therefore, in milk production, is likely to be of a much smaller magnitude than in the number of cows freshening.

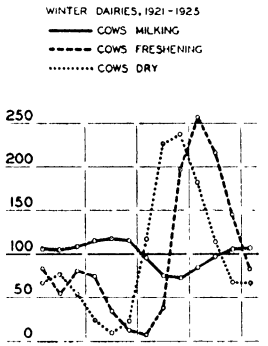
This expected difference in the size of the seasonal swing in the number of animals freshening and in milk production is found in the data on the number of cows milking, dry and freshening on one group of winter dairying farms in the New York district (Chart 6). The seasonal swing in the number of cows both dry and freshening is as wide as that observed in the other series of the same type. But the variation in the number of cows milking is much more comparable in respect of amplitude to the seasonal swings in the amount of milk sold, and should be, if anything, milder.

The most important cause of seasonal variations in the number of cows freshening and in the production of milk is the factor that exercises such far-reaching influences in determining the seasonals of all crops, namely, the climate. To have cows freshen in spring is convenient because in succeeding

CHART 6

SEASONAL MOVEMENT OF MILK FROM FARMS BY TYPE OF DAIRYING, NEW YORK AREA, 1927 - 1928

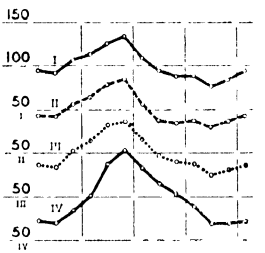


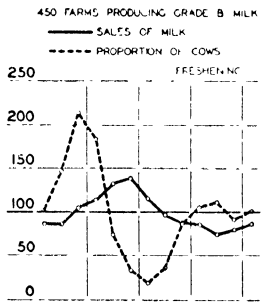


SALES OF MILK

641 FARMS GROUPED BY PASTURE PER CATTLE UNIT

GROUP	ACRES OF PASTURE
I	- 1.5
II	2.9
III	- 4.8
IV	- 7.5

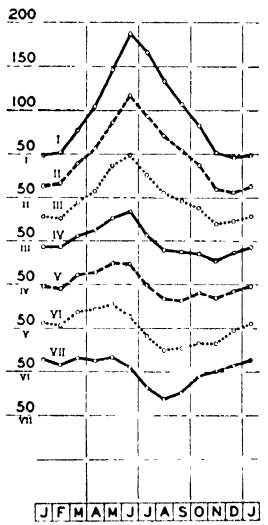




SALES OF MILK

641 FARMS GROUPED BY AMOUNT OF MILK PRODUCED PER CATTLE UNIT

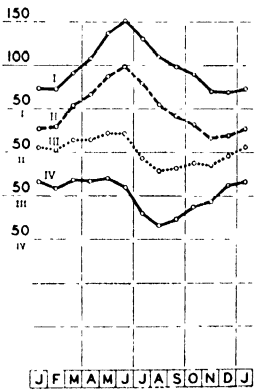
GROUP	THOUSANDS OF POUNDS OF MILK
I	- - - - 3.3
II	- - 4.5
III	- - 5.4
IV	6.5
V	7.3
VI	- 8.4
VII	- - - - 9.9

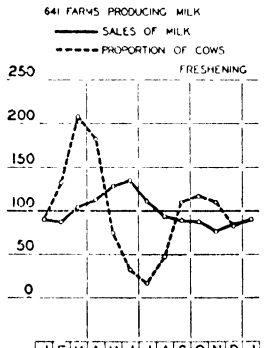


SALES OF MILK

641 FARMS GROUPED BY SILAGE FED PER CATTLE UNIT

GROUP	TONS OF SILAGE
I	- - NONE
II	1.4
III	2.9
IV	- - 5.1





months, when increased feeding is necessary for maximum yield of milk, pasture is available. A cow that freshens in autumn has to be kept indoors during the winter and fed a rather expensive diet of grain and silage. Hence winter dairying is practised chiefly by farms producing grade A milk or other of the more expensive milk products, for which the returns justify the more intensive and costly dairying system.

Catherwood's monograph, referred to above, throws a great deal of light on these causes of seasonal variations in milk output. Some of his indexes are presented on Chart 6. One group indicates the relation between seasonal variations in milk sold and the amount of pasture available per animal. When the pasture available is rather limited there is less tendency to rely upon outdoor feeding and the summer peak in production is less prominent. As the pasture allowance per animal increases the reliance upon outdoor feeding during the summer becomes greater and the summer peak more marked. Thus, Group IV, in which the pasture allowance is greatest, shows the most conspicuous summer peak in milk production.

Another group of indexes illustrates the relation between seasonality in milk production and the amount of indoor feed per animal. The flattening of the summer peak in milk output as the amount of silage fed per cattle unit becomes larger is striking. Thus, in Group I, where no silage is fed and pasture is relied upon entirely, the summer peak in milk output is high. On the other hand, in Group IV, where the amount of silage fed is rather large, the seasonal pattern in milk production is indicative of a winter type of dairying.

Still another group of indexes shows that summer dairying is of a much less intensive type than winter dairying. The farms are grouped according to the yield of milk per cow, and as the amount increases, the summer peak in milk production disappears, giving place gradually to the pattern associated with winter dairying, that is, rather high levels from December through May and a summer trough. As the intensity of the dairying system increases, the seasonal swing in the production of milk tends to decrease. As the industry reaches a higher technical level it becomes less subject to the disturbing influences of the seasonal factor that makes for the repeated variations in milk production.

2. Butter and Oleomargarine

a. *Butter*

In 1920 and 1921 the output of factory (creamery) and farm butter together consumed about 36 per cent of total milk produced in the United States.[14] Of this 36 per cent slightly over 20 per cent was accounted for by creamery butter and the remainder by farm butter. How important this use of milk is in comparison with its utilization in other dairy products may be gathered from the percentage of the total quantity of milk produced that was utilized for *all* manufacturing purposes, namely 47.

The data analyzed and presented below cover only creamery butter. For the production of butter on farms no monthly data are available, nor do large quantities of farm butter enter into the receipts at the most important markets or into the volumes in cold storage, both reported by the Department of Agriculture.

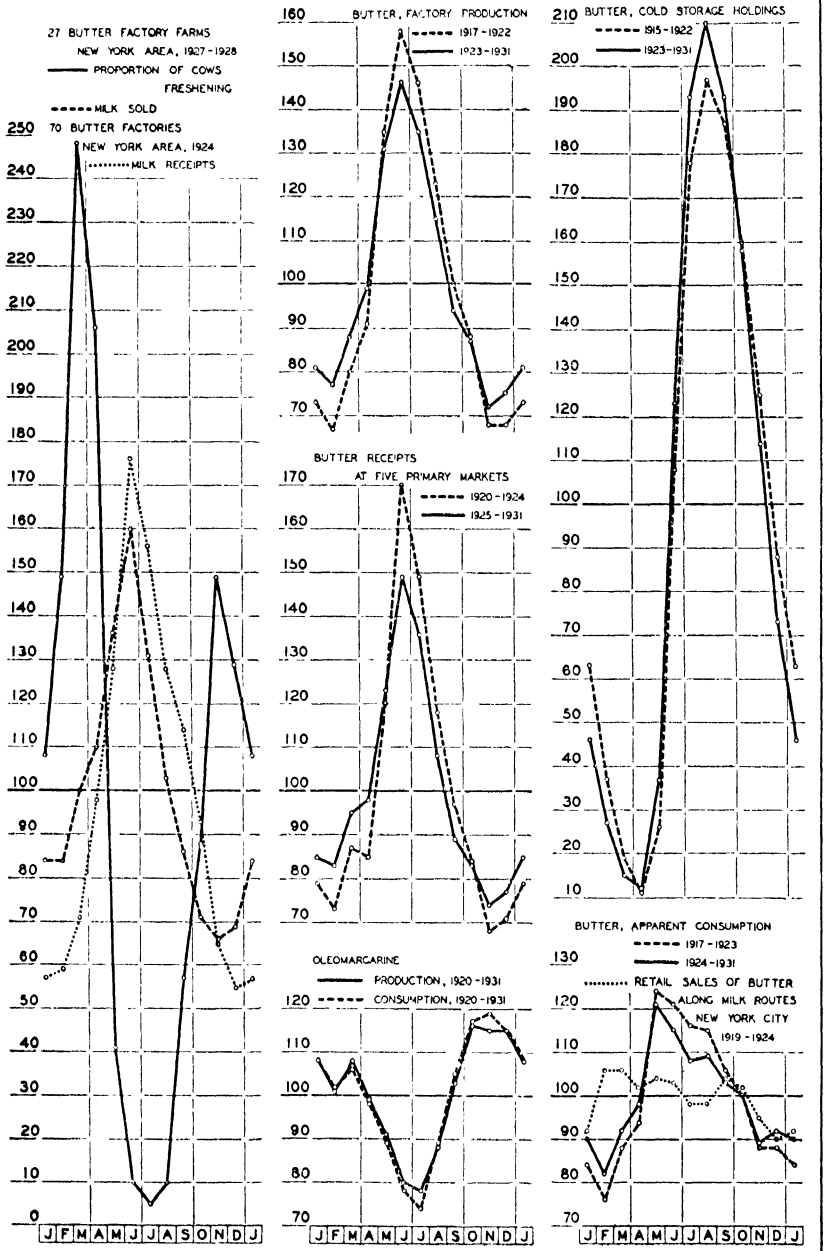
Before the seasonal behavior of butter production is examined it may be of interest to consider seasonal movements in the supply of milk to butter factories. In the first section of Chart 7 are presented fluctuations in the number of cows freshening and in milk sold on the farms that supply the butter factories (New York dairy district 1927-28). With these are compared changes in receipts of milk by 70 butter factories in the New York district in 1924. It is clear from the chart that farms which supply the butter factories carry on summer dairying primarily. Indeed, this is one of the most stable relationships. Butter factories, as well as most of the other industrial consumers of milk, pay low prices as compared with those obtained for fluid milk shipped to city consumers. In view of such low returns, only the less expensive type of dairying, that is, the less intensive summer type, is financially feasible. One of the most interesting transformations in any milk producing area is the shift from summer to winter dairying as the demand for fluid milk by urban consumers increases sufficiently to make the more expensive type of dairying profitable.

It is curious that fluctuations in the volume of milk sold by dairy farms are smaller than in receipts of milk by the butter

[14] Department of Agriculture, *Yearbook 1922,* p. 293.

CHART 7

SEASONAL MOVEMENT OF BUTTER AND OLEOMARGARINE



factories (Table IV). Such a disparity might arise from the somewhat different samples and years covered. On the other hand, it is known that butter producers are receiving milk not only from their regular sources of supply (that is, the farms whose milk sales were measured above) but also from

TABLE IV

AMPLITUDE OF SEASONAL VARIATIONS: BUTTER AND OLEOMARGARINE

Series	Average Deviation	Range
BUTTER		
27 Butter Factory Farms, N. Y. Area, 1927-28		
Sales of Milk	23.3	94
Cows Freshening	64.8	243
70 Butter Factories, N. Y. Area, 1924		
Milk Receipts	33.7	121
Factory Production, 1917-22	27.2	91
1923-31	21.2	74
Receipts at 5 Primary Markets, 1920-24	26.1	102
1925-31	19.3	75
Cold Storage Holdings, 1915-22	59.2	186
1923-31	65.1	198
Apparent Consumption, 1917-23	13.7	48
1924-31	9.4	39
Retail Sales, Along Milk Routes, N Y C., 1919-24	4.5	16
OLEOMARGARINE		
Production, 1920-31	10.8	38
Consumption, 1920-31	12.0	45

outsiders, the purchases from outsiders being made primarily in the early summer months when there is a surplus of fluid milk on hand. For this reason receipts of milk by butter factories would necessarily show a wider seasonal swing than sales of milk by the regular butter factory suppliers.

As is indicated by the changes in the amount of butter held in cold storage (Chart 7), the rather large seasonal swing in the supply of butter to the primary markets is not caused by any corresponding variation in final demand. These stocks, reported for almost all the butter held in public and private cold storage warehouses, average about half a month's total butter

production (but about one and a half months' receipts at the primary markets). At the peak, in August, the stocks cumulate to the equivalent of about one month's production, or three months' receipts at the primary markets.

The pattern indicates that these stocks accumulate as a result of too extensive a supply during the summer and become depleted through the winter. Thus the decline in stocks begins in September, the first month in which the seasonal index in production and receipts falls below 100, and the rise begins in May, the first month in which the seasonal for both receipts and production of butter is above 100.

Apparent consumption of butter is a series derived from production, exports, imports and stocks in cold storage. As such it really represents disappearance into trade channels, but since the trade does not call for butter unless it is needed for prompt sale, this index of apparent consumption constitutes a good measure of final consumption. The seasonal index for this series, computed again for two periods (see Chart 7), delineates a pattern somewhat similar to that of butter production and receipts. The significant feature is the small size of the seasonal swing (Table IV). It is thus apparent that the large seasonal swing in the series covering production and receipts of butter is attributable to factors in the supply of the raw material.

While apparent consumption represents disappearance of the commodity into the trade, some data reflecting actual consumption by ultimate consumers are available. The seasonal variations in consumption are measured, if only partially, by retail sales of butter on milk routes, data collected and analyzed for New York City by H. A. Ross in a study quoted above. Undoubtedly these data do not record the bulk of retail demand, since most butter is purchased from dairies rather than from milkmen. The index (Chart 7) is probably typical only of family demand, reflecting more than does total consumption the vacation exodus. However, the narrowness of the seasonal amplitude is significant, further confirming the comparative constancy of consumers' demand for butter.

b. *Oleomargarine*

The main raw materials in oleomargarine are oleo oil (obtained from beef fat), cocoanut oil, neutral lard (obtained

from lard), milk and cottonseed oil. The last two are subject to marked seasonal variations in production, but only milk is perishable. The importance of the ingredients available in a fairly continuous supply is much greater than of the materials whose output is seasonally variable.

Since on the side of production oleomargarine is not subject to the variability characteristic of commodities produced from seasonal and perishable raw materials, the seasonal variation in its output is relatively mild. The average deviation of the index is about half the size of that for butter production. Of more interest is the pattern; this moves directly opposite to that in butter output, running at low levels in summer and at high in winter, and appears to be due largely to an adjustment in the production of a substitute to the output of the principal commodity. When butter is plentiful and relatively cheap in summer, there is smaller demand for the cheaper but less desirable oleomargarine. Conditions are reversed in winter.[15]

Repetition of the pattern in the consumption of oleomargarine confirms this hypothesis. In its seasonal behavior consumption follows precisely the pattern traced by production, with a slightly wider amplitude.

Oleomargarine—an example of a substitute commodity—acts to supplement the output of the principal commodity, butter, in such a way as to correct some of the latter's seasonal variations. Other substitute goods may behave similarly. If the price of the principal commodity is sufficiently flexible to reflect changes in the volume of output; if purchasers' demand is sufficiently elastic to be directed by such price changes towards greater or smaller purchases of the substitute; if the production of the substitute can be varied with changes in demand by prospective purchasers, then the seasonal pattern in the output of the substitute commodity will be inverted to that in the production of the principal commodity. Under such conditions commodities should show an inverse correlation of seasonal variations, just as in complementary commodities we might expect a positive correlation of seasonal patterns.

[15] See K. Snodgrass, *Margarine as a Butter Substitute,* Food Research Institute, Leland Stanford University, Fats and Oil Studies, no. 4, 1930, pp. 208, 250-2.

D. Fruits and Vegetables

GENERAL CHARACTERISTICS

The propriety of classifying fruits and vegetables in Group I may at first be questioned. The group covers commodities for which final demand is relatively even through the year, but in the temperate zones fruits and vegetables are consumed mostly during the summer. However, it seems safe to assert that only a minor part of this seasonal variation in consumption is due to the direct influence of seasonal changes in final demand. Fruits and vegetables constitute part of a well-rounded diet throughout the year. Their heavier consumption in summer may be attributed largely to their scarcity during winter months and much less to increased demand in the warm seasons. This granted, it would still appear that perishable fruits and vegetables might resemble milk in that a part could be converted by canning, drying and other manufacturing processes into durable products. We find, however, that unlike milk products, the products manufactured from fruits and vegetables account for a relatively minor fraction of total output. Furthermore, fruits and vegetables cannot be converted at will into durable products; manufacturing utilization requires definite qualities in the raw materials, qualities often incompatible with those needed for profitable sale to final consumers.

"Canning quality" or "drying quality" is a very different thing from table or dessert quality; the material must be one which will pass through the manufacturing processes with the retention of satisfactory physical appearance and flavor, and many of our choicest table and dessert varieties are unable to endure this test.

For this reason the development of the manufacture of fruit and vegetable products to a position of importance in any territory results in a sharp differentiation between the growing of materials for manufacturing purposes and the growing of fruits and vegetables for market. This is especially true for the canning industry, in which the selective process just mentioned has been longest in operation. From the multiplicity of varieties of a given fruit or vegetable grown in his district, the canner selects a small number, sometimes a single one, possessing the combination of characters which he regards as most desirable in the finished product, employing these selected varieties to the exclusion of others. In the case of vegetables, many canneries grow their stocks of seed from selected strains with as much care to prevent contamination as is exercised by the best seedsmen. These selected seeds

are supplied under contract to growers who deliver the crop to the cannery.

In fruits an equally rigid selection of varieties is made, with the result that in a region in which canning becomes an important industry, the newer plantings of tree or bush fruits are made with reference to the requirements of the canners. As a consequence of the employment of selected varieties, the growing of crops for canning is so far divorced from the growing of fruits and vegetables for market that only in exceptional cases can the grower choose between placing his crop on the market for fresh products and delivering it to the cannery. For the same reason, the establishment of a cannery in a district can offer little immediate relief for the problem presented by a surplus of miscellaneous perishable crops. The cannery encounters very strong competition in a field in which standards of appearance and quality are constantly being elevated, and it would be business suicide to pack materials as they came to hand without reference to maintaining uniformity in the product.[16]

Perishable fruits and vegetables constitute, therefore, a third subgroup of Group I, different from those represented by wheat flour and the dairy products. The solution of the seasonal problem in this instance is obviously that of making final demand conform to the seasonal variations in supply. Charts 8 through 12 and Table V indicate clearly that for the perishable commodities the series nearest consumers' demand fail to evidence any appreciable damping of seasonal amplitude as compared with the indexes for harvesting and shipments. Nor does there seem to be any definite shift in timing, comparable to that found in the other two subgroups of Group I. This conclusion is valid for such fruits as pears, grapes, peaches, cantaloupes, watermelons and strawberries, and, by inference, for such vegetables as asparagus, cucumbers and eggplant. On the other hand, such relatively durable commodities as apples, potatoes, onions, tomatoes and cabbage show a marked drop in seasonal amplitude from harvest to shipments, or from shipments to unloads, accompanied frequently by a shift in seasonal pattern.

Two qualifications of this general conclusion may be stated: (1) the available data fail to reflect the actual purchase of the commodity by final consumers and this may prove to be seasonally more stable than unloads; (2) some amount of canning and preserving may be done by the final consumers themselves, in an effort to stabilize their consumption. Both qualifications, however, appear rather unimportant and do not seem to invalidate the general conclusion.

[16] *Agriculture Yearbook 1925*, p. 603.

While output of fruits and vegetables is generally subject to marked seasonal fluctuations, the amplitude varies appreciably from one commodity to another. Also, marked differences appear from commodity to commodity, even within the perishable and non-perishable divisions, in whatever seasonal disparity exists between harvest and shipments and shipments and unloads. These differences, of interest in themselves and as variations in the exact scope of the general conclusion just stated, are now discussed.

DETAILED COMMENTS

1. Harvest and Shipments of Fruits

Charts 8 and 9 present the seasonal patterns in harvesting and in carlot shipments of fruits. The seasonal factors operating in the case of each individual fruit are fairly clear and

TABLE V

AMPLITUDE OF SEASONAL VARIATIONS: FRUITS AND VEGETABLES

Series	Average Deviation	Range
FRUITS		
Apples		
Harvest Estimate	121.4	546
Carlot Shipments, 1920-31	81.5	408
1924-26	86.5	416
Unloads, 12 Markets, 1918-22	55.8	251
Pears		
Harvest Estimate	132.0	533
Carlot Shipments, 1924-26	119.8	372
Grapes		
Harvest Estimate	136.0	576
Carlot Shipments, 1924-31	128.2	535
1924-26	128.4	485
Peaches		
Harvest Estimate	119.2	412
Carlot Shipments, 1918-31	131.0	422
1924-26	132.5	470
Unloads, 12 Markets, 1918-22	122.0	455
Cantaloupes		
Harvest Estimate	123.2	440
Carlot Shipments, 1924-26	115.9	394
Unloads, 12 Markets, 1918-22	121.4	400

TABLE V (CONTINUED)

Series	Average Deviation	Range
Watermelons		
Harvest Estimate	132.5	478
Carlot Shipments, 1924-26	138.8	610
Strawberries		
Harvest Estimate	132.7	593
Carlot Shipments, 1924-26	138.2	659
Unloads, 12 Markets, 1918-22	141.8	645
Cranberries		
Harvest Estimate	152.0	805
Carlot Shipments, 1924-26	129.7	446
VEGETABLES		
White Potatoes		
Harvest Estimate	119.8	470
Carlot Shipments, 1920-31	16.3	102
Unloads, 12 Markets, 1918-22	23.3	97
Sweet Potatoes		
Harvest Estimate	132.5	589
Carlot Shipments, 1924-26	65.6	253
Onions		
Harvest Estimate	102.4	390
Carlot Shipments, 1920-31	29.2	143
1924-26	29.8	164
Unloads, 12 Markets, 1918-22	25.0	88
Tomatoes		
Harvest Estimate	113.2	476
Carlot Shipments, 1918-31	68.7	277
1924-26	71.8	278
Unloads, 12 Markets, 1918-22	75.7	290
Cabbage		
Harvest Estimate	96.5	485
Carlot Shipments, 1924-26	30.8	167
Unloads, 12 Markets, 1918-22	36.8	156
Beans		
Dry Beans, Harvest Estimate	141.2	659
Lima Beans, Harvest Estimate	122.0	521
String Beans, Carlot Shipments, 1924-26	85.6	329
Celery		
Carlot Shipments, 1924-26	52.0	160
Unloads, 12 Markets, 1918-22	48.0	175

CHART 8

SEASONAL MOVEMENT OF FRUIT

HARVEST, ESTIMATE, ------ CARLOT SHIPMENTS, 1924 - 1928

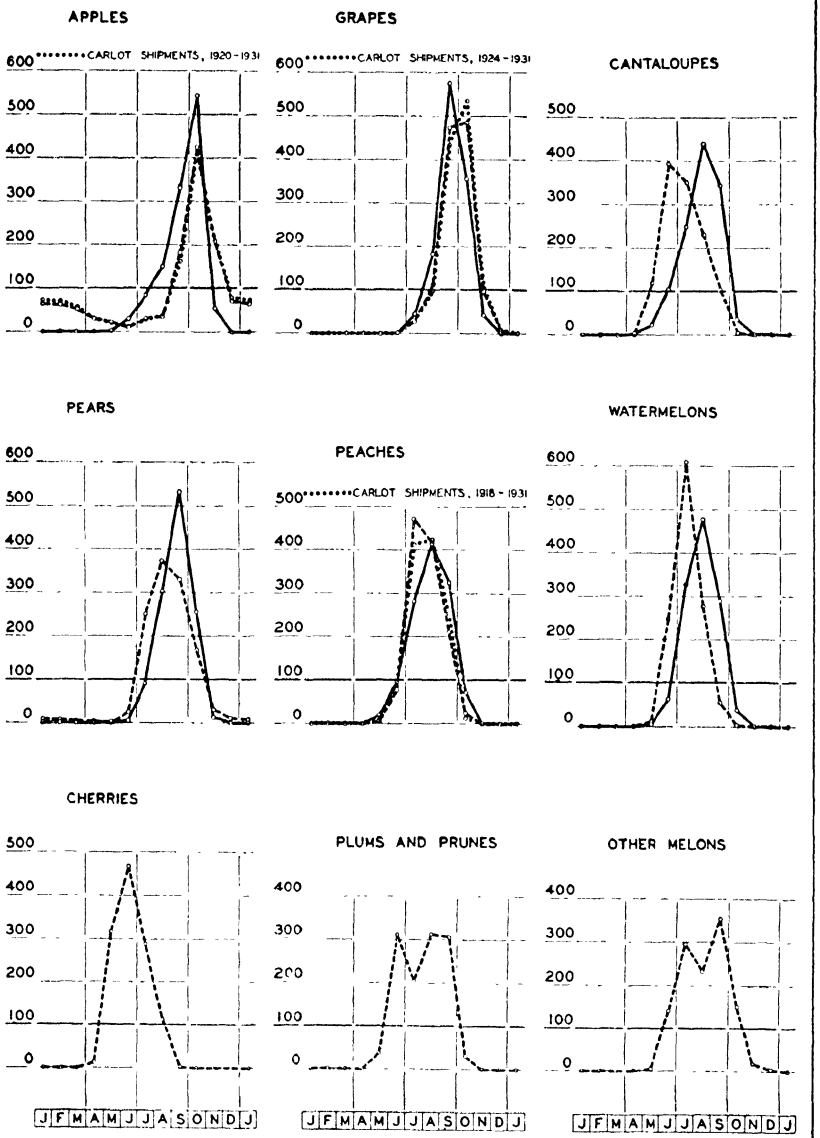
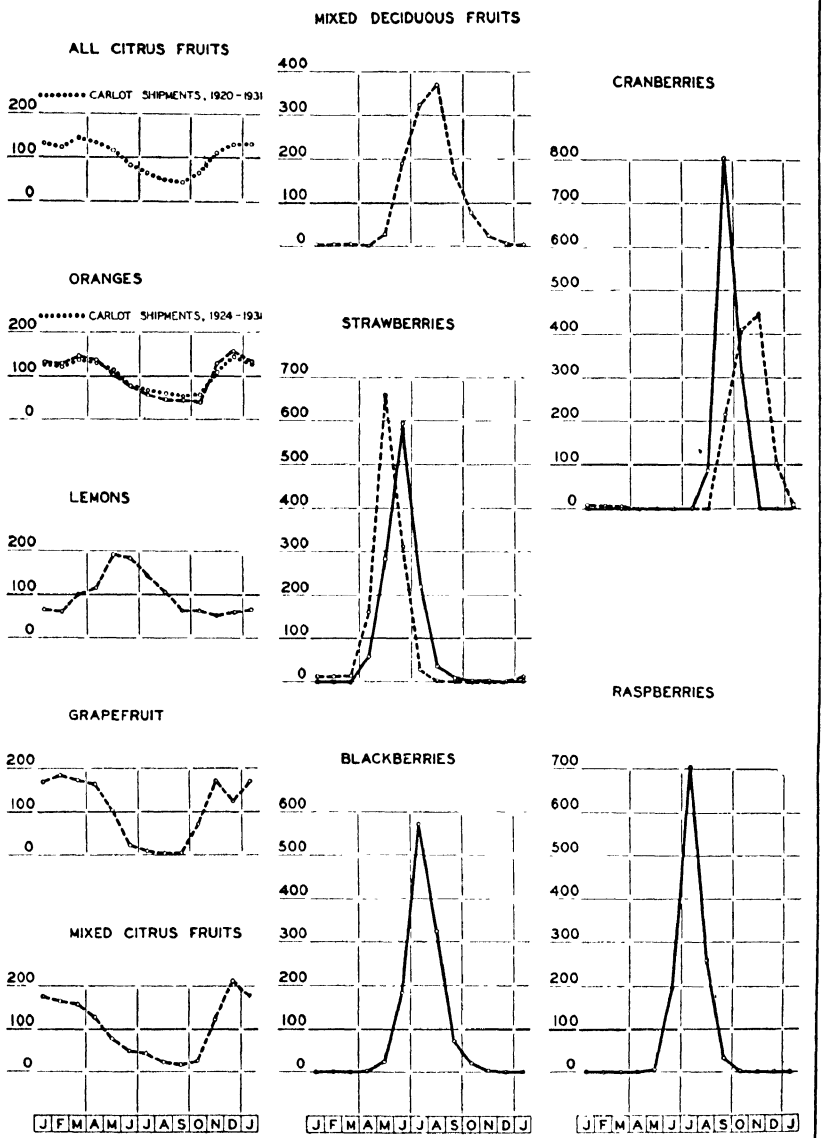


CHART 9

SEASONAL MOVEMENT OF FRUIT

——— HARVEST, ESTIMATE, ------ CARLOT SHIPMENTS, 1924 - 1926



there is no need to comment upon each single index. However, some outstanding general features may be mentioned briefly.

Harvesting. 1. The violence of seasonal swings in harvesting is striking. The indexes of fruit harvests are generally of wider amplitude than that of wheat. Of the ten fruits for which harvesting indexes are available, only three, peaches, cantaloupes and watermelons, show a lower range than wheat. In the other seven the smallest range is in pears, the largest in cranberries; the smallest average deviation is in peaches, the largest in cranberries.

Berries, especially cranberries and raspberries, show the most violent swing. Citrus fruits would probably show the mildest harvest seasonal were their picking measured. The absence of harvest dates is itself an indication that this would be true since it is a consequence of the fact that grapefruit, oranges and lemons are grown so that they may be harvested over a large part of the year.

2. In timing peaks tend, of course, to concentrate in the autumn. In their chronological order the peaks are as follows, from berries through melons to the deciduous fruits: the earliest, in June, in strawberries; in July, in blackberries and raspberries; in August, in peaches, cantaloupes and watermelons; in September, in pears, grapes and cranberries; in October, in apples.

Carlot Shipments. 1. The sizes of the seasonal swing in the shipments of various fruits differ curiously. Citrus fruits, as a group and individually, show very mild variations. This may be due to the nature of the fruit, which may be left on the tree for some time after it is ripe, or to the organized character of the industry, especially in the section concerned with growing oranges and lemons. About two-thirds of the oranges and almost all the lemons come from California. And "the citrus industry in California is very highly organized, over 70 per cent of the crop being handled through a cooperative organization which has proved a leading factor in developing improved methods of production, packing and marketing." [17]

In contrast to citrus fruits, the following rather miscellaneous list shows large seasonal swings in shipments: strawberries, cranberries, watermelons, cherries, grapes, peaches. The reason lies obviously in the highly perishable nature of these

[17] *Agriculture Yearbook 1926,* p. 241.

fruits, when fresh. Even under refrigeration strawberries, grapes, peaches and watermelons can be kept only a short while and cranberries and cherries not much longer. Moreover, each of these fruits is grown in a concentrated area and under conditions that make picking possible during only a brief period each year. The supply of fresh fruit cannot, therefore, be continuous.

The following fruits show a milder seasonal swing in shipments: apples, pears, plums and prunes, cantaloupes, mixed deciduous fruits, other melons (chiefly Casaba). They have only one picking season but are grown over a wide geographic area and can, with the possible exception of cantaloupes, be kept in cold storage for some time. Both these latter factors make for a smaller seasonal in shipments than is characteristic of the group of berries, peaches, cherries and watermelons. On the other hand, this group is not harvested as continuously as are citrus fruits, nor are shipments subject to the same control.

2. The timing of shipments, whenever peaks can be definitely established, appears to be as follows: February, grapefruit; March, oranges; May, lemons and strawberries; June, cantaloupes and cherries; July, peaches and watermelons; August, pears, plums and prunes, and the mixed deciduous fruits; September, other melons; October, apples, grapes; November, cranberries; December, mixed citrus fruits. Thus the distribution through the year appears to be even. But the two most important items in this array are oranges and apples and their peaks are some six months apart. A summation of the carlot shipments of all fruits would not yield as even a distribution through the year as is suggested by the listing of peaks.

Harvesting and shipments. For eight fruits estimates of harvest and data on carlot shipments are alike available, and a comparison of the seasonal indexes is suggested. The size of seasonal swings in carlot shipments ought to be less than in harvesting and the timing should lag behind or at the earliest be coincident with harvesting. But the behavior of the fruit series is not in accord with these expectations.

Seasonal variations in the harvesting of apples, pears, cantaloupes, cranberries and grapes are greater than those in their shipments. For some of these fruits, such as cranberries, the differences are striking. In grapes the difference is smaller

than in any of the other four fruits. On the other hand variations in the harvesting of peaches are of smaller magnitude than those in shipments. Nor does the seasonal swing in shipments of watermelons and strawberries show any decline as compared with that in harvesting. The reasons are not particularly clear. There is, of course, a possibility of error in the harvest estimates of the Department of Agriculture. But it may also be suggested that the perishable nature of these three commodities and the consequent influence on prices necessitates prompt and concentrated shipments by producers in an attempt to be the first on the market and thereby obtain the highest price. As the crop matures, shipments to distant centers tend to fall off, since the ripe fruit might spoil in transportation. Also, in the case of some fruits, such as watermelons, it is the best part of the crop that is picked first and shipped out to the higher price markets. A larger part of the ripe crop during the harvest peak may be consumed locally, or, whenever a canning crop is being produced, in canning. For these three fruits, then, the seasonal swing in shipments might be wider than that in harvesting and a peak might be reached earlier.

These expectations are confirmed. In all three instances in which the seasonal swing in shipments is wider than that in harvesting the peak in shipments precedes the peak in harvesting. Thus, in strawberries the peak in shipments is in May, in harvesting in June; in both watermelons and peaches the two peaks are in July and August. Evidently, a much greater proportion of the earlier crop of these fruits goes into carlot shipments than of the later.

But in two other fruits, pears and cantaloupes, for which seasonal variations in harvesting are greater than those in shipments, the seasonal peak in shipments precedes the peak in harvesting. In causing differences in the size of seasonal swings perishability apparently exercises a greater influence than the profit to be derived from early marketing. While there is an attempt to exploit the early market for pears and cantaloupes and the peak in shipments consequently precedes the peak in harvesting, shipments do not rise and decline as do those of the more perishable fruits such as strawberries and peaches.

The other three fruits, apples, grapes, and especially cranberries, have a peak in shipments either coinciding with or

lagging behind the peak in harvesting. For cranberries the lag is two months and the decline in amplitude from harvesting to shipments is appreciable, possibly because the large local industrial consumption of cranberries relieves the market from absorbing the surplus of fresh berries during the harvest period. The November peak in shipments may be associated with the Thanksgiving holiday demand.

2. Harvest and Shipments of Vegetables

The general features of the comparison of the seasonal variations in the flow of vegetables appear to be as follows (Charts 10 and 11):

Harvesting. 1. Vegetable harvests have on the average much milder seasonal swings than fruit harvests. The mildest is in onions and cabbage, with potatoes and tomatoes next. These four vegetables lead in quantity grown, are widely distributed regionally and are subject to a fairly steady demand. Sweet potatoes, a subtropical vegetable and somewhat of a luxury, and dry beans, a rapidly maturing vegetable harvested in September, show the widest seasonal ranges.

2. In timing, concentration of peaks in the autumn is even more conspicuous for vegetables than for fruits. The distribution is as follows: September, beans, onions and tomatoes; October, cabbage, white potatoes and sweet potatoes. However, harvest estimates are not given for several vegetables that mature in late spring and in summer.

Carlot Shipments. 1. The individual vegetables for which seasonal indexes of shipments are available again show a smaller magnitude of seasonal changes than was observed in fruits. Thus, the highest range in vegetables is 501 (asparagus) while for the majority the range runs between 150 and 300. In fruits the highest range was more than 600, while most series showed ranges of about 400 and higher. This milder seasonal variation in vegetables is undoubtedly due partly to their greater regional diffusion and the consequent dispersion of their harvesting peaks and partly to the fact that most vegetables are less perishable than fruits.

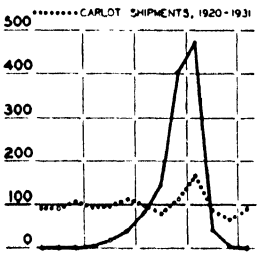
The sequence of these vegetables, when arrayed according to the amplitude of the seasonal swing of their shipments, fulfills expectations (Table V, and Appendix I, Part 1). The

CHART 10

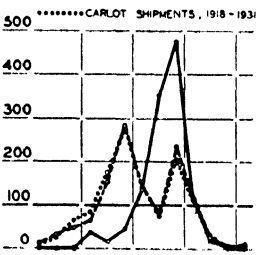
SEASONAL MOVEMENT OF VEGETABLES

——— HARVEST, ESTIMATE; ------ CARLOT SHIPMENTS, 1924 - 1926

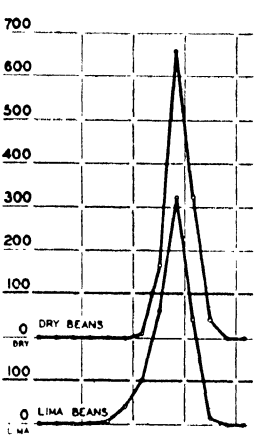
WHITE POTATOES, TOTAL



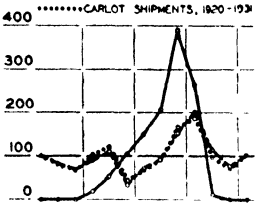
TOMATOES



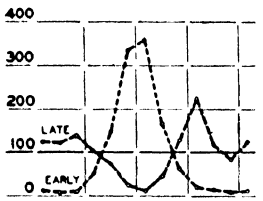
DRY BEANS AND LIMA BEANS



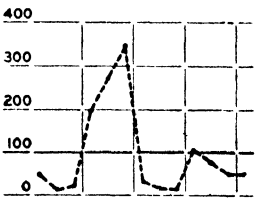
ONIONS



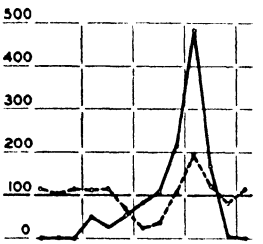
WHITE POTATOES, EARLY AND LATE



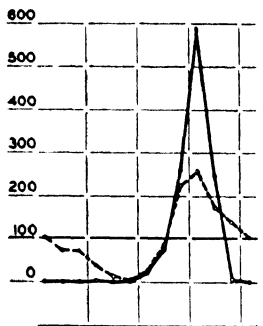
STRING BEANS



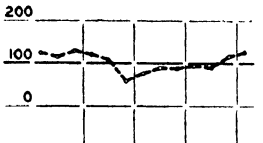
CABBAGE



SWEET POTATOES



LETTUCE



CELERY

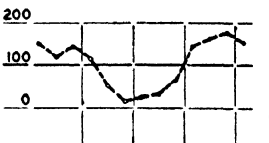
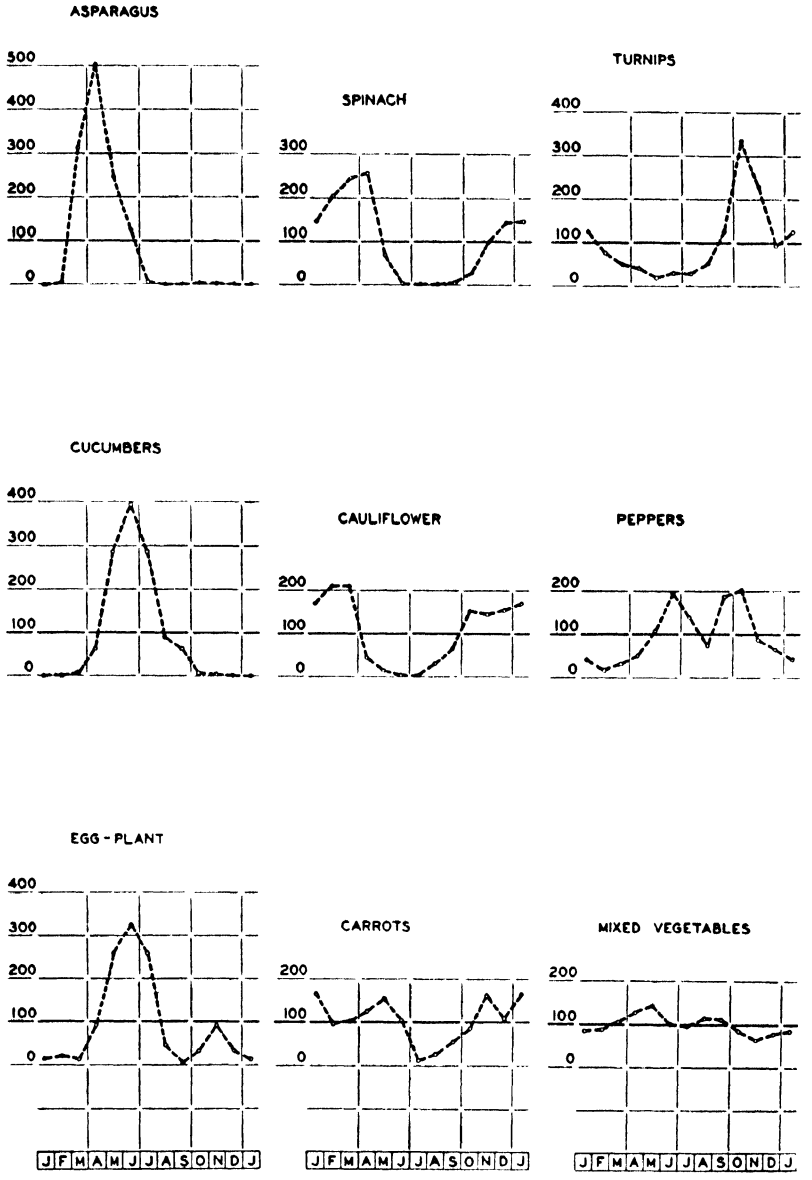


CHART II

SEASONAL MOVEMENT OF VEGETABLES:

CARLOT SHIPMENTS, 1924-1926



mildest seasonal variations are found in the geographically diffused, comparatively cheap vegetables subject to constant demand: lettuce, potatoes, carrots, celery, onions, cabbage. The greatest variability is shown by the more expensive vegetables which have only one crop a year, a short harvesting season and are subject to luxury demand for the early part of the crop: asparagus, cucumbers and early potatoes.

The vegetables characterized by rather mild seasonal variations—white potatoes (total), cabbage, carrots and onions—tend to have two peaks in shipments. In celery and lettuce only one peak and trough actually occur but they are more in the nature of plateaus than of sharp turning points. On the other hand, vegetables that show a high seasonal swing in shipments have only one peak, indicating a single harvesting season. This is especially marked in asparagus, cucumbers and early white potatoes. String beans and eggplant, which have a prominent single peak in the early summer, have a mild second peak in October or November.

2. The presence of double peaks in some series renders the comparison of timing less significant and somewhat more difficult. Disregarding the second peak, however, and considering for each series only the month of the most prominent peak in shipments, we obtain the following sequence: January, carrots; February, none; March, cauliflower, lettuce; April, spinach, asparagus; May, mixed vegetables; June, tomatoes, string beans, cucumbers, eggplant; July, early white potatoes; August, none; September, none; October, total white potatoes, late white potatoes, sweet potatoes, cabbage, onions, turnips, peppers; November, none; December, celery.

This list of peaks indicates roughly a subdivision of the vegetables into the spring type, shipped largely from April through June (spinach, lettuce, asparagus, tomatoes, string beans, eggplant, cucumbers, etc.) and the fall and winter type, chiefly root vegetables, such as potatoes, turnips, onions, carrots. The root vegetables are subject to milder seasonals, while the spring vegetables are on the whole subject to more violent seasonal swings.

Harvests and shipments. 1. It is possible to compare seasonal variations in harvesting and shipments for five rather important vegetables: white potatoes, sweet potatoes, tomatoes, cabbage and onions. Vegetables, in contrast with fruits,

show much smaller seasonal swings in shipments than in harvesting. The difference is most striking for potatoes and cabbage but it is significant also in the other three pairs of series.

2. Timing seems also to accord with expectations. In white potatoes, sweet potatoes and cabbage the peaks in harvesting and shipments occur simultaneously, while in onions shipments lag one month behind harvesting. But in cabbage, onions, and especially in white potatoes, there are two peaks in shipments as compared with one in harvesting, possibly because harvest estimates are given for the bulk of the crop only; none are given for the secondary part of the crop grown to supply early demand.

3. Unloads of Fruits and Vegetables

While unload figures do not reveal urban consuming capacity, they do reflect a stage in the flow of the commodity further removed from shipments. And although not accurate, they measure the consumption of the population in and about most of the cities. For the perishable fruits and vegetables especially, unloads reflect urban consumption accurately. It is therefore of interest to compare the seasonal variations in unloads with those in shipments and to ascertain the divergencies from commodity to commodity.

Unloads and shipments. Seasonal variations in shipments were studied for the country as a whole. Totals for unloads are not available, except during the early period 1918-23 when they are given for each of nine commodities in only twelve markets.[18] A comparison of seasonals in each of these nine commodities for the early years with those for the later period reveals no essential difference. Therefore the monthly means for 1918-22, given in Bulletin No. 7, were converted into seasonal indexes for unloads for the twelve markets covered: New York, Chicago, Philadelphia, Pittsburgh, St. Louis, Cincinnati, St. Paul, Minneapolis, Kansas City, Washington, Cleveland and Detroit. As these are among the largest cities in the United States, they account for a major portion of unloads,

[18] Nine products are covered for 12 cities for the years 1918-23, Statistical Bulletin of the Department of Agriculture, No. 7, April 1925; 16 products for 36 cities for the years 1924-26, Statistical Bulletin No. 23, August 1928; and 18 products for 66 cities for the years 1927-28, Statistical Bulletin No. 30, May 1930.

even when compared with the more complete data for sixty-six cities given for the years 1927-28.

These seasonal indexes for unloads can be compared with those for shipments of the same nine commodities. Chart 12 shows the close similarity between shipments and unloads. This is natural since what is shipped must be unloaded and only a relatively small proportion of total shipments can be stored in transit. Whatever discrepancy may arise between seasonality in shipments and in unloads is therefore associated either with storing in transit or reshipments, or to the inclusion in shipments of totals for the United States while unloads are given only for twelve principal cities. The latter fact is probably the more important, for the size of the city as well as its wealth influences the seasonality of its consumption, and therefore, of unloads.

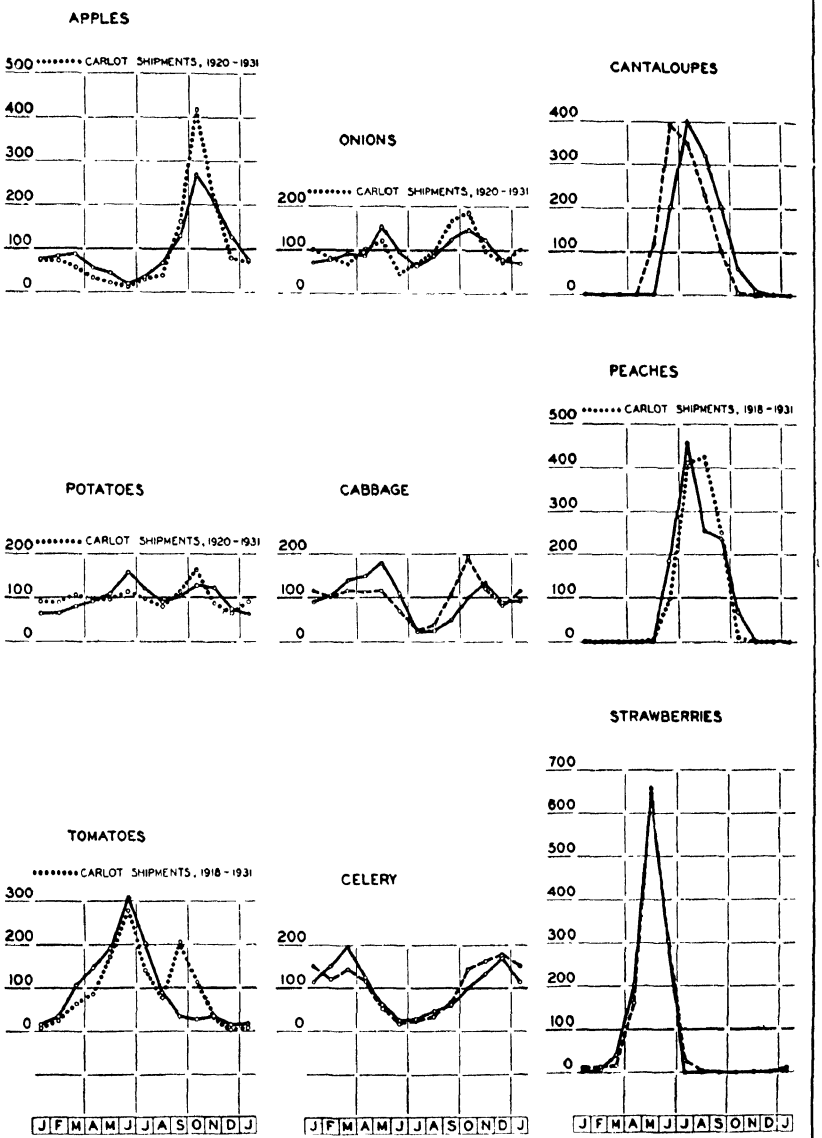
Chart 12 reveals a rather significant difference between fruits and vegetables. For fruits, which all happen to be of the luxury-perishable type, the seasonal movements in unloads and in shipments are closely similar. In cantaloupes unloads tend to lag a month behind shipments; in peaches they tend to precede, if anything, indicating that the twelve cities obtain the bulk of the crop earlier than does the country as a whole. In strawberries there is perfect coincidence in timing. There is also close similarity in the size of the seasonal variations in the four fruits (see Table V). Only in the case of apples, which can be stored for a relatively long period, is there an appreciable diminution of the seasonal swing from shipments to unloads. For other fruits no significant difference between the two seasonals is shown. And in the most perishable, strawberries, the agreement is closest.

While the seasonal patterns of the various vegetables are on the whole quite similar in respect of both shipments and unloads, they reveal significant differences in timing. There seems to be a tendency on the part of the twelve large markets to absorb the earlier part of the crop. Thus, in cabbage, whose seasonal pattern is characterized by two peaks, one in May and the other in October-November, it is the later peak that is on a higher level in shipments, but it is the earlier peak that is on a higher level in unloads. The same is true of celery and there is a similar change in the relative position of the early and the late peaks in onions. In tomatoes

CHART 12

SEASONAL MOVEMENT OF FRUITS AND VEGETABLES

——— UNLOADS AT 12 CITIES, 1918 - 1922; ----- CARLOT SHIPMENTS, 1924 - 1926



shipments have a double peak, one in June and the other in September, but unloads have only one, in June. The difference is most conspicuous in potatoes. Of the two significant peaks in shipments that occurring in October is on a higher level than that occurring in June. But in unloads the June peak is higher than the October. The large cities appear to prefer the early part of the vegetable supply, the part that is obtainable in the spring and early summer rather than during late autumn and winter. Also, some vegetables, such as tomatoes, are shipped green and are ripened by the distributors themselves in special plants. There is nothing to suggest that this showing might be due to the geographic location of the cities for most are northern cities and would have to import their early crop from states other than those in immediate proximity.

In the comparative amplitudes of seasonal movements in shipments and unloads of vegetables a distinct difference is shown only for onions, for which the seasonal variations in unloads tend to be milder than those in shipments. In the other vegetables, just as in fruits, there are no significant differences.

It is hazardous to conjecture what would be the size of the seasonal swing in total unloads in the United States. While the twelve cities tend to manifest (other things being equal) more conspicuous seasonal variations than would the country as a whole, they are *large* cities and tend to have milder variations than would smaller cities. The net balance of these probable corrections in opposite directions cannot even be surmised.

However, in so far as unloads reflect consumption by urban population, this final consumption of perishable fruits and vegetables is subject to seasonal swings not much smaller in size than the seasonal movement from the growing areas. In view of the perishability of most of the fruits and of a considerable number of the vegetables we cannot but assume that what is unloaded must be consumed within a relatively brief period, and that, therefore, unloads reflect, if roughly, the flow of products into the hands of ultimate consumers. While this flow is not as seasonally variable as are harvests, it still reflects most of the discontinuity in supply.

CHAPTER IV

COTTON AND COTTON TEXTILES

(Group II)

A. General Characteristics of Groups II and III

Groups II and III both cover industries for whose finished products consumers' demand is subject to marked seasonal variation. Although the degree of seasonal variation requisite for inclusion cannot be given precisely, the nature of Groups II and III becomes clear from an enumeration of the commodities that seemed properly to belong to them: most cotton, woolen and silk goods, shoes and gloves, automobiles, furniture, coal in so far as used by non-industrial consumers, cooling drinks and ice cream. For purposes of study, however, we consider only durable and semi-durable commodities. The few perishable consumers' goods for which there is a seasonally variable demand are excluded, because in respect of these the seasonal problem is very different from that affecting the more durable commodities. Most perishable consumers' goods cannot be stored and they require much less processing than durable products.

The importance of manufacturing processes in the production of the more durable commodities makes obvious the seriousness of the problem created by the appreciable seasonal swings in consumers' demand. It is to the manufacturer's advantage to carry on production at as even a rate as possible, since he is thereby enabled to reap the benefit of machine production to its full extent. It is also to his advantage (or to that of the intermediary between him and the final consumer) to sell his products immediately. If he keeps a stock on hand, he runs the danger of a decline in price, and, in the case of some products, of a change in fashion, and he has to carry the burden of the capital involved and the charges for stock protection. These two conflicting aims—to produce steadily and to dispose of output at once—create the seasonal problem. In some

instances it is resolved by keeping production relatively steady and allowing stocks to accumulate to take care of the intermittent demand by consumers. In others production is regulated to conform with consumers' demand. When more than one manufacturing process intervenes between the raw material and the final product some processes may be continued at an even rate while others are adapted to meet consumers' demand for the finished goods.

The adjustment of manufacturing and final demand is, however, only one phase of the seasonal problem, a phase common to both Groups II and III. Another is that of the adjustment of manufacturing with the supply of the raw materials. Group II covers industries in which, in addition to the seasonality of demand for the finished product, there are appreciable seasonal variations in the supply of the raw materials. Group III embraces industries in which marked seasonality in the demand for the finished product and a relatively even supply of raw materials co-exist.

The most important of the industries whose raw materials and finished products are both subject to considerable seasonal swings is cotton textiles. This chapter is devoted to a discussion of the seasonal movements at the various stages in production, shipments, stocks and sales of cotton and cotton textiles, as illustrative of the type of seasonal problem in Group II.

B. Cotton and Cotton Textiles

GENERAL CHARACTERISTICS

The composite picture of seasonal movements in raw cotton and cotton textiles is presented in Charts 13 through 18 and in Table VI. Of the long chain that leads from raw cotton to the sale of finished cotton goods by retailers, the first part, that ending with consumption of cotton by textile mills, shows the same damping of seasonal amplitude and shift in seasonal pattern that characterize the movement of wheat from the fields into the flour mills. Consumption of raw cotton by textile mills is relatively free from seasonal disturbances, while the harvesting of raw cotton is concentrated in four months. And, as in wheat, manufacturing activity is at seasonal peak

several months after the peak in harvesting. Cotton resembles wheat also in that the two most marked drops in seasonal amplitude occur between harvesting and marketing by farmers, and between deliveries of raw cotton to textile mills and its consumption by them. Another similarity is that in cotton also the farmer and the manufacturer both carry large and seasonally variable stocks of the raw material.

But it cannot be said of cotton that, as in wheat, the seasonal variation in manufacturing is imposed by the swing in the supply of the raw material. The movement of the finished commodity, that is, of cotton products, is, because of the marked seasonality of final demand for cotton goods, quite different from that of wheat flour products. This seasonality of demand finds only an attenuated reflection in the production of cotton textiles: with few variations from commodity to commodity, the output of specific cotton goods is not characterized by any appreciably larger seasonal swing than that in total cotton consumption by all textile mills. Shipments, in the case of the more finished commodities, already reflect somewhat more the seasonality of final demand; and the latter is still more apparent in new orders. But an analysis of producers' stocks of finished goods reveals that, while shouldering the burden of seasonal stocks of raw materials, manufacturers of cotton goods do not as a rule undertake to care for the disparity between the even rate of their productive activity and the highly seasonal final demand for their goods. This is particularly true of semi-finished cotton goods. It is less true of such completely finished goods as underwear or hosiery.

Thus, it must be the intermediaries between the manufacturers and final consumers who take over the burden of carrying seasonally variable stocks. Beginning with the production of cotton goods there is an increasing amplitude of seasonal variations as well as a further shift in timing. From the available data a precise tracing of this change from link to link is not possible. However, the data do indicate that the most marked jump in seasonal amplitude occurs between sales by wholesalers and by retailers, which suggests that extensive stocks, variable seasonally, may be held by the latter. This conclusion should be considered tentative, in view of the scarcity of data on purchases and sales by wholesalers.

DETAILED COMMENTS

1. Harvesting and Marketing

A comparison of the seasonal indexes for harvesting and for marketing by farmers (Chart 13) shows that cotton growers retain a considerable portion of the crop and dispose of their stock gradually during the months when no new cotton comes in from the fields. Thus, no cotton is harvested after January, while marketing takes place during each month of the year, the total amount marketed from the end of January to the end of July averaging over 20 per cent of the annual total.

It is probably safe to assume that the carryover of cotton by farmers from one crop year to the next is negligible. Consequently total marketing is equal to total harvesting, and changes in farmers' stocks are given by a direct subtraction of the index for marketing from that for harvesting. Inspection of the resulting figures indicates that: (1) farmers' stocks of cotton are at seasonal peak at the end of October and at seasonal trough at the end of July; (2) these stocks rise rapidly during August, September and October, the most conspicuous rise taking place in September; (3) in the decline in stocks from the end of October to the end of July the most marked decrease occurs in December, January and February, and the least appreciable in July.

2. The Consumption of Raw Cotton

During the years 1920-29 mills in this country consumed about 43 per cent of the crop; the remaining 57 per cent was exported. It is therefore not surprising to find that exports of raw cotton exhibit seasonal movements that correspond closely to those in the marketing of cotton by farmers and receipts into sight (Chart 13). There are interesting differences, however. The seasonal peak in exports lags one month behind that in domestic marketing and receipts into sight. Marketing and receipts are highest in October, exports in November. Also, the seasonal swing in exports is much narrower than that in the other two series.

The portion that is not immediately exported goes either to the public warehouses or to the manufacturers.

CHART 13

SEASONAL MOVEMENT OF COTTON

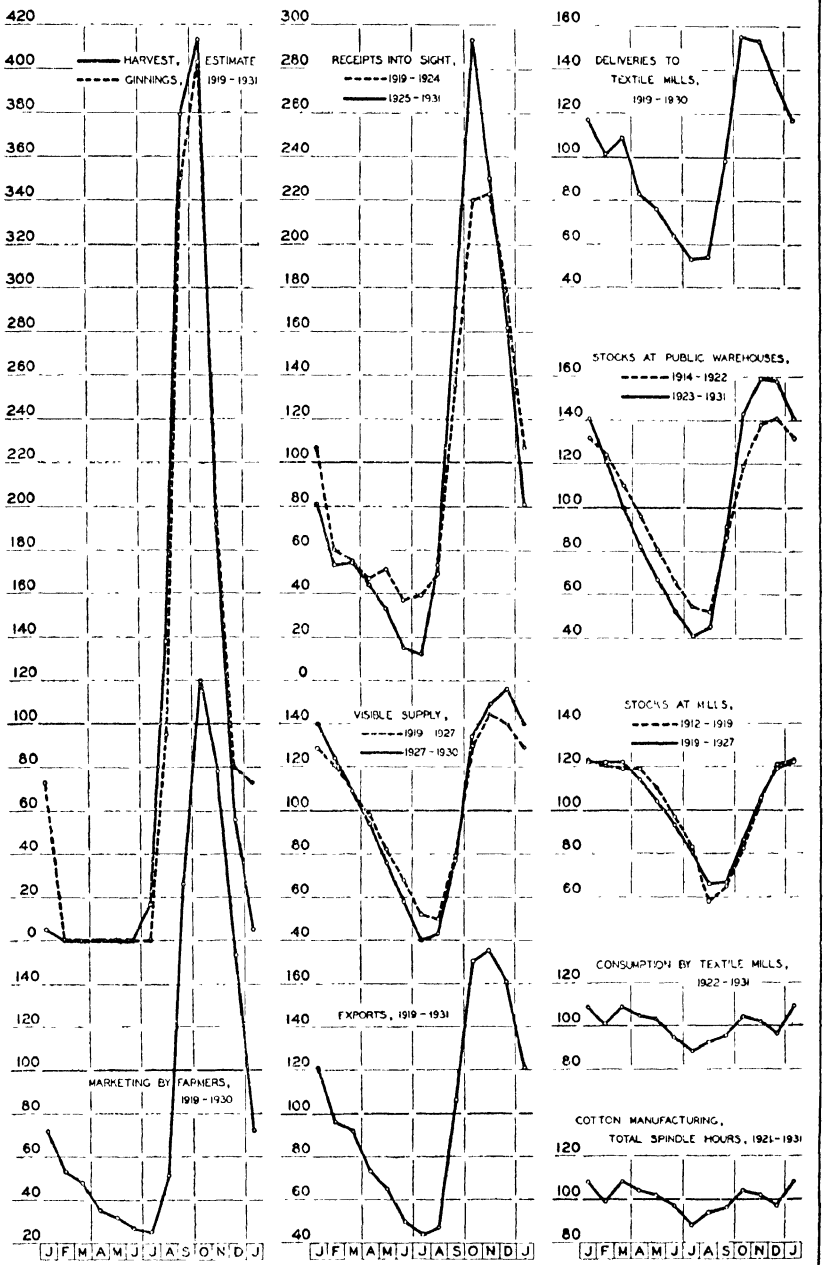


TABLE VI

AMPLITUDE OF SEASONAL VARIATIONS: COTTON AND COTTON GOODS

Series	Average Deviation	Range
RAW COTTON		
Harvest Estimate	120.3	413
Ginnings, 1919-31	108.6	403
Marketing by Farmers, 1919-30	76.2	255
Receipts into Sight, 1919-24	60.3	186
1925-31	75.9	281
Exports, 1919-31	38.8	131
Delivery to Textile Mills, 1919-30	28.4	102
Visible Supply, 1919-27	28.7	94
1927-30	35.3	116
Stocks at Public Warehouses, 1914-22	27.4	89
1923-31	37.0	118
Stocks at Mills, 1912-19	19.2	65
1919-27	18.0	56
Consumption by Textile Mills, 1922-31	5.7	21
Cotton Manufacturing, Total Spindle Hours, 1921-31	4.8	20
COTTON GOODS AND ACCESSORIES		
Production		
Cotton Textiles, 1926-31	6.2	34
Finished Cotton Goods, 1921-31	7.0	34
Fine Cotton Goods, New Bedford, 1922-30	5.2	26
Knit Underwear, 1924-31	6.6	27
Hosiery, 1923-31	4.3	25
Working Clothes, 1923-30	7.5	39
Artificial Leather, 1923-31	8.4	41
Fresh Water Pearl Buttons, 1922-31	7.1	32
Shipments		
Cotton Textiles, 1926-31	5.9	28
Finished Cotton Goods, 1921-31	5.8	27
Knit Underwear, 1920-31	11.2	38
Hosiery, 1924-31	8.2	32
Working Clothes, 1924-30	8.3	42

TABLE VI (CONTINUED)

Series	Average Deviation	Range
Artificial Leather		
Total, 1923-31	8.0	42
Light Goods, 1925-31	8.5	35
Heavy Goods, 1925-31	11.6	60
Elastic Webbing, 1922-31	6.6	32
Stocks		
Cotton Textiles, 1926-31		
Computed	4.6	18
Derived	4.7	20
Finished Cotton Goods, 1921-31		
Computed	2.1	10
Derived	3.8	16
Knit Underwear, 1924-31		
Computed	12.2	40
Derived	15.5	48
Hosiery, 1924-31		
Computed	3.5	13
Derived	5.4	17
Working Clothes		
Computed, 1923-27	5.2	17
Derived, 1924-30	3.0	12
Fresh Water Pearl Buttons, 1922-31	0.8	4
New Orders		
Cotton Textiles, 1926-31		
Computed	15.0	49
Derived	12.8	60
Finished Cotton Goods, 1924-31	8.0	34
Knit Underwear, 1924-31		
Computed	11.4	48
Derived	12.3	51
Hosiery, 1924-31		
Computed	8.6	39
Derived	9.8	47
Artificial Leather, Derived, 1923-31	10.5	40
Unfilled Orders		
Cotton Textiles, 1926-31	8.2	23
Finished Cotton Goods, 1924-31	10.0	42
Knit Underwear, 1924-31	9.5	28
Hosiery, 1924-31	3.7	16
Artificial Leather, 1924-31	8.8	30

TABLE VI (CONTINUED)

Series	Average Deviation	Range
WHOLESALE TRADE		
Sales		
Dry Goods Wholesalers, 1919-27	11.8	49
Cotton Goods Jobbers, N. Y. F. R. D., 1923-31	11.9	57
Cotton Goods Commission Houses, N. Y. F. R. D., 1924-28	6.3	26
Stocks held by Dry Goods Wholesalers		
Philadelphia F. R. D., 1924-31	3.9	20
Richmond F. R. D., 1925-31	5.0	25
Dallas F. R. D., 1924-31	6.8	39
SALES AT RETAIL		
Dry Goods Chain Stores, 1919-25	19.3	81
New England Department and Specialty Stores		
Cotton Dress Goods, 1923-25	29.4	117
1926-30	24 8	92
Aprons and House Dresses, 1923-25	29.2	114
1926-30	27.9	111
Waists and Blouses, 1923-25	22.8	79
Notions, 1923-25	11.2	63
1926-30	10.8	56
Knit Underwear, 1923-25	35.2	160
1926-30	32 2	185
Petticoats, 1923-25	28.0	185
Domestics, 1923-25	19.4	62
1926-30	24.2	108
Infants' Wear, 1923-25	28.2	138
1926-30	27.4	136
Handkerchiefs, 1923-25	74.2	484
1926-30	70 5	454
Cleveland Department Stores, 1924-25		
Cotton Dress Goods	30.8	131
Aprons and House Dresses	26.2	139
Waists and Blouses	23.6	105
Notions	9.6	62
Knit Underwear	37.9	168
Petticoats	29.3	189
Domestics	16.2	71
Infants' Wear	23.8	108
Handkerchiefs	72.8	481

The manufacturers of the highest grades ordinarily buy at an early date a larger proportion of their total supply than those using ordinary staple. The former wish to exercise a wider choice in their selection and also to make sure of an adequate quantity. The demand for long staple cotton is frequently so great that the manufacturer who delays is unable to obtain the quality which he desires, or can secure it only at a very high price.

The spinner of common grades gauges his purchases according to the course of the market; he buys early or late according to his judgment of the favorableness of price quotations. However, he usually obtains a large quantity during the harvesting season. . . . .

The cotton is shipped as soon as purchased and warehoused at the mills, which are provided with commodious storage rooms. The merchant does not have a warehouse of his own, and public warehouses in the northern cities are seldom utilized for storing cotton. Payment for the cotton is made ordinarily within three days after its receipt at the mill. Thus the northern manufacturers bear the burden of carrying a large quantity of raw cotton from the time that it is harvested till it is manufactured. . . . .

In the South there is wider variation in the practice of the manufacturers in buying their cotton. The few mills in that section which use long staple cotton purchase their supply early for reasons the same as those which influence the fine goods manufacturers in the North. But with the great majority of the southern mills, which manufacture coarse cloth, the practice depends upon the location, size, and financial strength of the individual mills. . . . .

While it is thus common for the southern mills to carry cotton for which they have not immediate requirements, the proportion bought during the season is probably less than in New England. The southern manufacturers do not obtain the cotton entirely from merchants, but frequently deal directly with the farmers, in a few instances sending out their own buyers through the district in which cotton suited to their needs is grown.[1]

This description of the seasonal aspects of manufacturers' purchases of raw cotton is confirmed by a comparison of two seasonal indexes: those for delivery of cotton to mills (derived from stocks held by mills and their consumption of cotton) and for cotton consumed in manufacturing. It is clear from this comparison that from September through December textile mills buy much more cotton than they consume; between January and April they buy an amount approximately equal to their monthly consumption; and from May to August they buy less than they consume. During 1919-31 stocks of raw

[1] M. T. Copeland, *The Cotton Manufacturing Industry of the United States* (Cambridge 1923) pp. 180-3. For discussion of cotton marketing see also Report of the Federal Trade Commission on *Cotton Trade* (Washington 1924) Part I, pp. 24-74.

cotton at mills were equal to 2.7 months' consumption. Hence, at their seasonal peak at the end of January, February and March, mills held stocks sufficient to satisfy their needs for more than three months.

3. Cotton Textiles

a. *Commodities Covered*

Unlike wheat, cotton is converted into a variety of products which find innumerable uses.

Every great industry is more or less dependent upon cotton. Railroads annually use the equivalent of several hundred thousand bales for air-brake hose, plush for car seats, for enameled ceilings that have a basis of cotton duck or other fabric. The cement industry transports its product today in cotton bags which took the place of barrels more than a quarter of a century ago when the low price of cotton attracted attention to its availability for this purpose. No one knows how many thousands of bales of cotton are employed in the construction of the modern skyscraper and well-built residence. Those who are observant will note that the asbestos cement covering around steam and hot-water pipes is held in place by light cotton duck.

The electrical industry today uses tens of thousands of bales of cotton for the insulation of copper wire. The automobile has become an important consumer of cotton. Tire fabric calls for hundreds of thousands of bales either of long-staple cotton for certain classes of fabric, or shorter staple which can be used in cord tires. Artificial leather, with cotton as a base, has become a competitor of hides in the upholstering trades, for automobile tops and curtains, and numerous other uses. The list might be extended into a veritable catalogue, but probably the most unique use to which this fiber is put is in the manufacture of 'synthetic ivory' for billiard and pool balls, imitation tortoise shell toilet articles, and similar products.

The use of cotton 'linters,' the short fiber obtained from cotton seed after passing through the gins, in the manufacture of rayon, or artificial silk, forms the basis of another great and growing industry.

Modern farm implements require vast amounts of cotton. Self-binding reapers and threshing machines call for quantities of heavy cotton goods for elevators and belts. It might almost be said that the great grain crops of the world today could not be harvested and marketed without the use of cotton.[2]

Many of these diverse uses are reflected in the series relating to the movement of such semi-manufactured cotton goods as bleached or dyed cloth or the coarser type of textiles, print cloth, sheetings and tobacco cloth. Also an interesting sample is afforded by artificial leather, whose ultimate use is not only

[2] See the Cotton Industry, by C. T. Revere, in *Representative Industries in the United States*, R. T. Warshow, Editor (New York 1928) p. 257.

for clothing but also in such an entirely different commodity as automobiles. But by and large, only cotton clothing is well represented in the data analyzed in this chapter, and in that sense the tracing of raw cotton in its flow into domestic use is incomplete. However, the channels omitted account for only a minor fraction of the crop consumed within the country.

A question may arise as to the propriety of classifying knit underwear, hosiery and artificial leather as cotton goods. However, cotton is the important raw material in all. According to the *Census of Manufactures: 1929,* of 8.8 million dozen shirts and drawers 7.2 million were cotton; and of 8.9 million dozen union suits 7.4 million were cotton. Of 111 million dozen pairs of hosiery produced, 33 million were all cotton, and in some 54 million cotton was used for tops, heels and toes; in addition, a great deal of cotton was mixed with silk, wool and rayon. In artificial leather gray cotton goods such as sheetings, drills, ducks, satins or moleskins are the base upon which nitrocellulose or pyroxylin preparations are spread either alone or in combination with some other materials.

b. *Production*

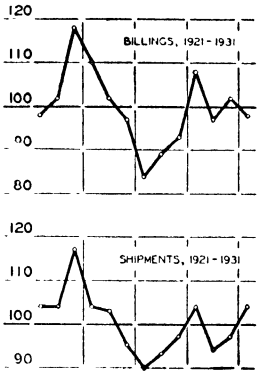
The seasonal amplitudes in output of specific types of cotton goods show no definite grouping. We might have expected the output of semi-manufactured goods to show a smaller seasonal amplitude than the production of manufactured commodities, since the former are further from the seasonally variable final demand. But the highest average deviation is in artificial leather which is a semi-manufactured commodity, and the lowest in hosiery which is a completely finished commodity. Differences in seasonality of final demand for the goods seem to be more important in determining differences in seasonal amplitude of production than differences in the distance from final demand. Thus, artificial leather shows large average deviations because of the importance of demand for the product by automobile factories, themselves bent upon satisfying a highly seasonal demand by ultimate consumers. Hosiery, on the other hand, is subject to rather continuous use and purchase by final buyers.

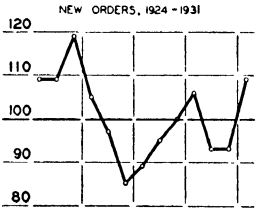
There is a substantial identity of pattern in the eight production indexes given on Charts 14, 15 and 16. In each, two seasonal peaks occur, the first uniformly in March, the second

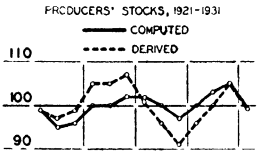
CHART 14

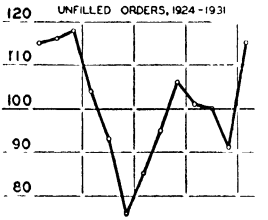
SEASONAL MOVEMENT OF COTTON MANUFACTURES

FINISHED COTTON GOODS

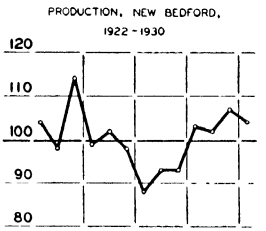




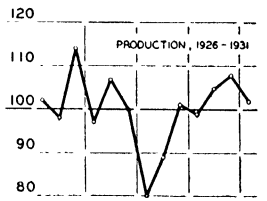


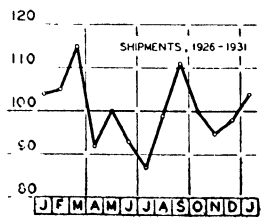


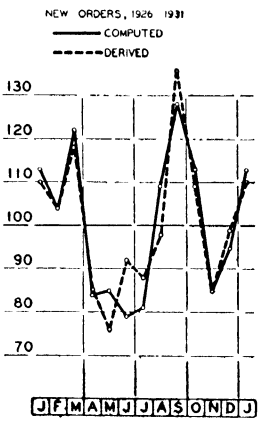
FINE COTTON GOODS

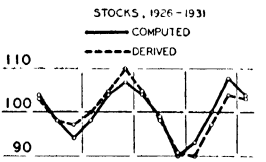


COTTON TEXTILES









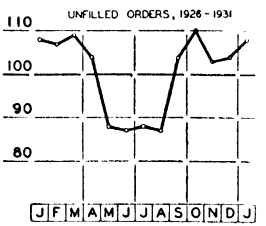
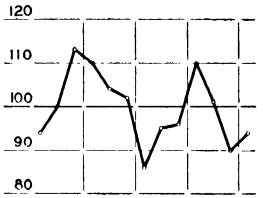
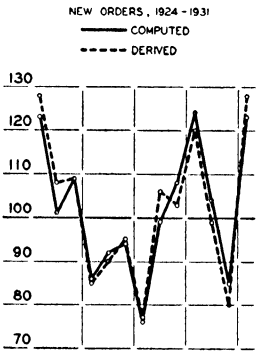


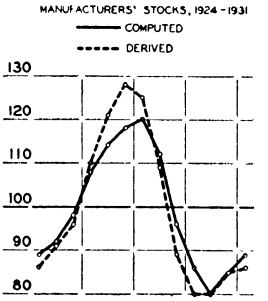
CHART 15

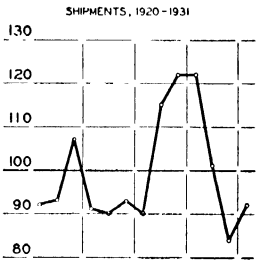
SEASONAL MOVEMENT OF KNIT UNDERWEAR AND HOSIERY

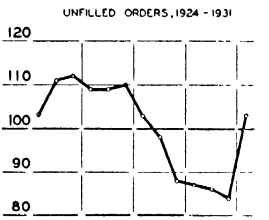
KNIT UNDERWEAR



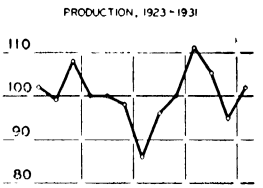


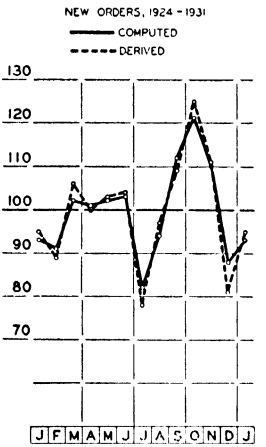


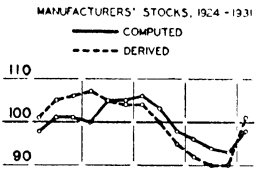


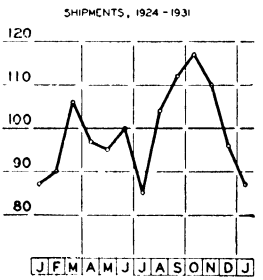


HOSIERY









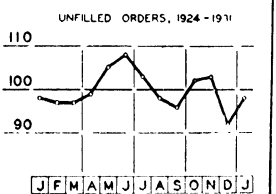
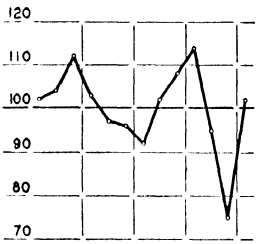


CHART 16

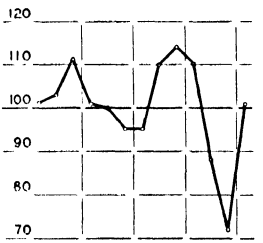
SEASONAL MOVEMENT OF WORKING CLOTHES ARTIFICIAL LEATHER AND ACCESSORIES

WORKING CLOTHES

NUMBER CUT, 1923 - 1930



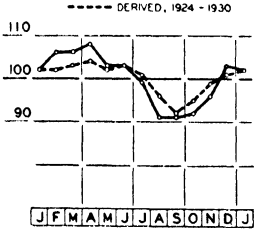
NET SHIPMENTS, 1924 - 1930



MANUFACTURERS' STOCKS

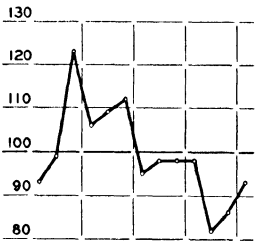
COMPUTED, 1923 - 1927

DERIVED, 1924 - 1930

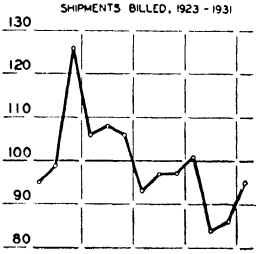


ARTIFICIAL LEATHER

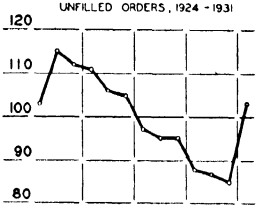
PYROXYLIN SPREAD, 1923 - 1931



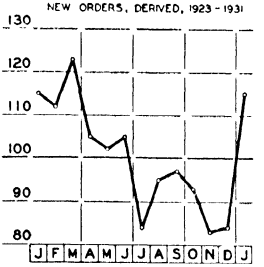
SHIPMENTS BILLED, 1923 - 1931



UNFILLED ORDERS, 1924 - 1931

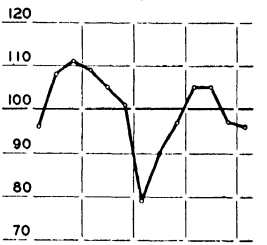


NEW ORDERS, DERIVED, 1923 - 1931

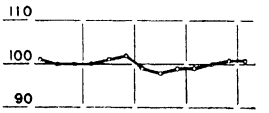


FRESH WATER PEARL BUTTONS

PRODUCTION, 1922 - 1931

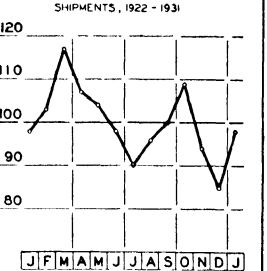


MANUFACTURERS' STOCKS, 1922 - 1931



ELASTIC WEBBING

SHIPMENTS, 1922 - 1931



in October in most series (finished cotton goods, knit underwear, hosiery, working clothes, buttons), in December in some (cotton textiles, fine cotton goods). The nature of this pattern suggests little similarity to the swing in the production of raw cotton but bears a distinct resemblance to the seasonal swings in wholesale and retail sales of cotton goods (and for artificial leather to that in automobile production). It appears clear that the variation in output of these goods is imposed by the seasonality in demand by final consumers, the divergencies in pattern arising from the diverse uses to which the various commodities are put.

c. *Shipments*

In the comparative amplitude of shipments and production a marked difference arises between the semi-manufactured and the completely manufactured commodities. Among the former, shipments (as measured by the average deviation of the seasonal index) of finished cotton goods and artificial leather are less variable seasonally than production. Among the completely manufactured commodities—underwear, hosiery and working clothes—on the contrary, shipments are characterized by seasonal indexes whose average deviations are appreciably larger than those for production. The reason may lie not only in the greater seasonality in the demand from manufacturers for the completely manufactured products but also in the willingness of the manufacturers in these fields to produce for stock. This statement is partly confirmed by the analysis below of producers' stocks of these various commodities.

The seasonal pattern in shipments is, in general, highly similar to that in production. Exceptions are found in cotton textiles and knit underwear. In the former the second peak in shipments is in September while in production it is in December. Obviously, some group of cotton textiles is produced for stock before the autumn, these stocks to be drawn upon during the summer and early autumn. In knit underwear the autumn peak in shipments is much more prominent than the spring peak, while the reverse is true of production. Here again producers accumulate stocks, as a result of spring activity, for use in autumn.

d. *Stocks*

Seasonal changes in stocks of finished goods held by producers are fully accounted for by the cumulative changes between the seasonal swings in production and shipments. This is clearly shown by the graphical comparison on Charts 14, 15 and 16 of the computed and derived indexes for stocks.[3]

The significance of seasonal variations in producers' stocks is best gauged when the average deviation of the seasonal index is combined with some measure of the importance of stocks as compared with production and shipments (usually the volumes of the latter are approximately equal). For the years covered by the seasonal indexes the ratio of stocks to monthly production was 1.4 for cotton textiles, 0.9 for finished cotton goods, 1.2 for knit underwear, 2.1 for hosiery and over 6.0 for buttons (the last is derived from a comparison of reported stocks with the Census data on production). Multiplying the average deviation of the seasonal index for stocks by the ratios just cited, we obtain the following rough measures of the importance of seasonal variations in stocks: 6.4 for cotton textiles; 1.9 for finished cotton goods; 14.6 for knit underwear; about 5.8 for buttons. The relatively small significance of seasonality in producers' stocks of finished goods, as indicated by these measures, emerges clearly when a similar measure is computed for raw cotton stocks held by mills; for the latter it is 48.6.

Because of the substantial similarity of pattern characterizing production and shipments, seasonal variations in stocks are due largely to differences between the seasonal amplitudes of production and shipments. When the swing in production is greater than that in shipments, stocks show a seasonal pattern similar to that in production and shipments. When, with similar patterns, production is seasonally less variable than shipments, stocks show a pattern inverted to that in output and outflow. A comparison of indexes in Charts 14, 15 and 16 affords at least partial support for this statement. The pattern in stocks of finished cotton goods is only partly similar to that in production and shipments, and that in stocks of cotton textiles is only partly inverted to that in output and

[3] For cotton textiles the original series for shipments is computed from production and stocks, not collected independently. Therefore the comparison of the two indexes for stocks has only a limited meaning. The same is true below of the derived index for new orders for the same group.

outflow. But in knit underwear and in hosiery stocks do show the inverted pattern that is expected; in working clothes the pattern is partly inverted; in all three, stocks are high in mid-summer, when both production and shipments are low, and are at trough in the autumn when both production and shipments are at seasonal peak.

e. *New and Unfilled Orders*

The seasonal swing in new orders is higher than that in production in each of the five comparisons that available data make possible. But the comparison with shipments yields somewhat different results. In the semi-fabricated group, such as cotton textiles, finished cotton goods and artificial leather, the amplitude of new orders is clearly in excess of that in shipments. There is a clear tendency for orders to be bunched at definite times of the year and for shipments to run at varying intervals behind receipts of new orders. In fully fabricated goods, such as knit underwear and hosiery, the seasonal amplitude of new orders is about equal to that of shipments. If the similarity in pattern between new orders and shipments is substantial, this approximate equality of seasonal amplitude makes possible the statement that either there is a constant time lag between the two (that is, a constant interval is consumed in filling orders throughout the year) or that orders are filled in the same month in which they are received.

The comparison of seasonal patterns in new orders and shipments does show a substantial similarity, not only in fully fabricated goods but also in semi-manufactured. The only notable exception appears in knit underwear, in which the spring peak in shipments is in March and the corresponding peak in new orders appears to be in January.

The seasonal changes in unfilled orders may clearly be interpreted as a cumulation of seasonal disparities between shipments and new orders. This is shown by the graphical comparison on Charts 14 and 15 of derived and computed indexes for new orders. In the semi-manufactured textiles that go primarily into clothing (that is, excluding artificial leather) unfilled orders are low in mid-summer. For such fully fabricated goods as underwear and hosiery the seasonal trough occurs in winter.

4. Sales at Wholesale

According to the *Census of Distribution: 1930,* 39 per cent of cloth converted by cotton manufacturers was billed to wholesalers; and since three-quarters of total cloth is converted by the cotton manufacturers themselves, this percentage is likely to hold for the total volume of finished cotton goods. Of knit goods (knit underwear and hosiery) 52.5 per cent was reported as sold to wholesalers; of men's work clothing, 30.7 per cent. Thus, a substantial proportion of semi-manufactured and manufactured cotton goods passes through the hands of wholesalers before it reaches retailers and final consumers.

Chart 17 presents seasonal indexes of sales by and stocks in the hands of dry goods wholesalers. While dry goods wholesalers deal also in some woolen goods and some mixed materials, it may be assumed that cotton goods form the bulk of their sales. Partial proof of this is found in the fact that when cotton jobbers are specifically segregated, the seasonal movements in their sales are almost identical with those in the sales and stocks of dry goods wholesalers.

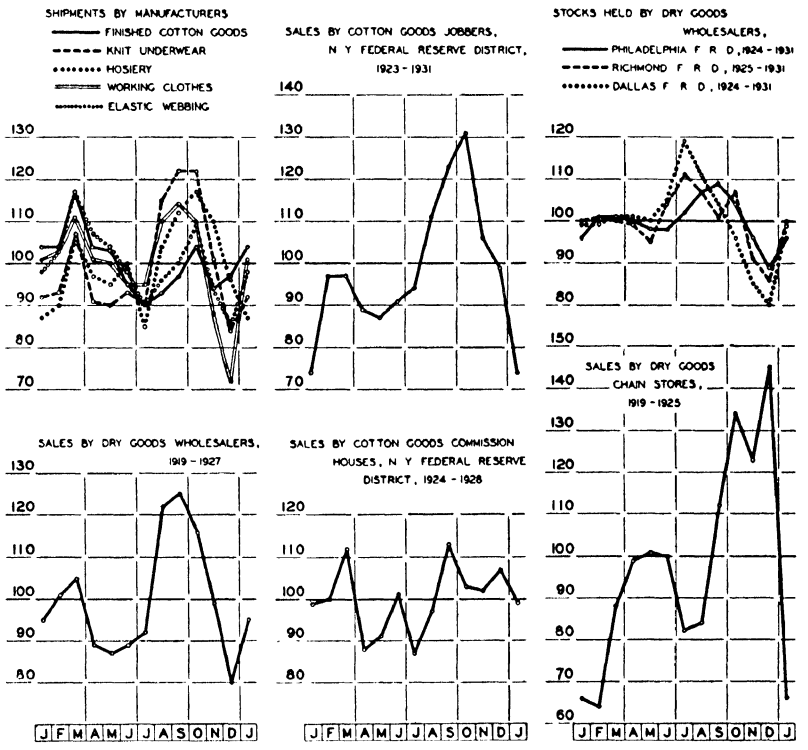
The chart presents also the indexes for shipments of all the commodities that leave the hands of cotton goods manufacturers and go, at least in large part, to the wholesalers. Although the indexes of the various goods differ in the standings for each single month, their general movement is more or less the same. There are two peaks, one in March and the other about October. The trough in all the series is in July; some have another trough in December.

While the movements of stocks in the three Federal Reserve districts are in broad correspondence, there seem to be a few genuine differences between Philadelphia on one hand, and Richmond and Dallas on the other. In the former, stocks are at peak in September and at trough in May, June and December. In the latter two, unmistakably, the peak in stocks is in July and the trough in May and December. This lead of indexes for Richmond and Dallas may be attributable to the much greater dependence of the wholesalers there upon agricultural crops. In Philadelphia the wholesalers prepare for the autumn buying by retailers who in their turn purchase mainly for December sales. In the southern states the bulk of retail buying is possible immediately after the crop is marketed, that is, the peak of the season comes much earlier. Another differ-

ence which is, on the whole, less established, is that of size. The amplitude of stocks is smallest in Philadelphia and largest in Dallas. This is as might be expected, since the Philadelphia

CHART 17

SEASONAL MOVEMENT OF COTTON GOODS IN WHOLESALE AND RETAIL TRADE



wholesalers are near the sources of their supplies and their need to prepare for the seasonal swings is much less pressing than that of the Dallas wholesalers.

The seasonal index for sales shows the two peaks that were seen so often above. It is clear in the case of wholesalers, however, that the March peak is minor and that the September

peak is the most important high point of the year's sales. This comparative standing of the two peaks was reflected at an earlier stage in the seasonal movements of the stocks.

5. Sales at Retail

No data are available on the proportion of goods bought by retailers from wholesalers. As far as cotton piece goods are concerned, a study for the year 1924 revealed that 89 per cent was bought from wholesalers.[4] It is not certain that department stores or dry goods chain stores (and they are covered by the data to be cited below) buy such a large percentage of their cotton goods from wholesalers, but undoubtedly they do buy from the latter a large portion of their supplies.

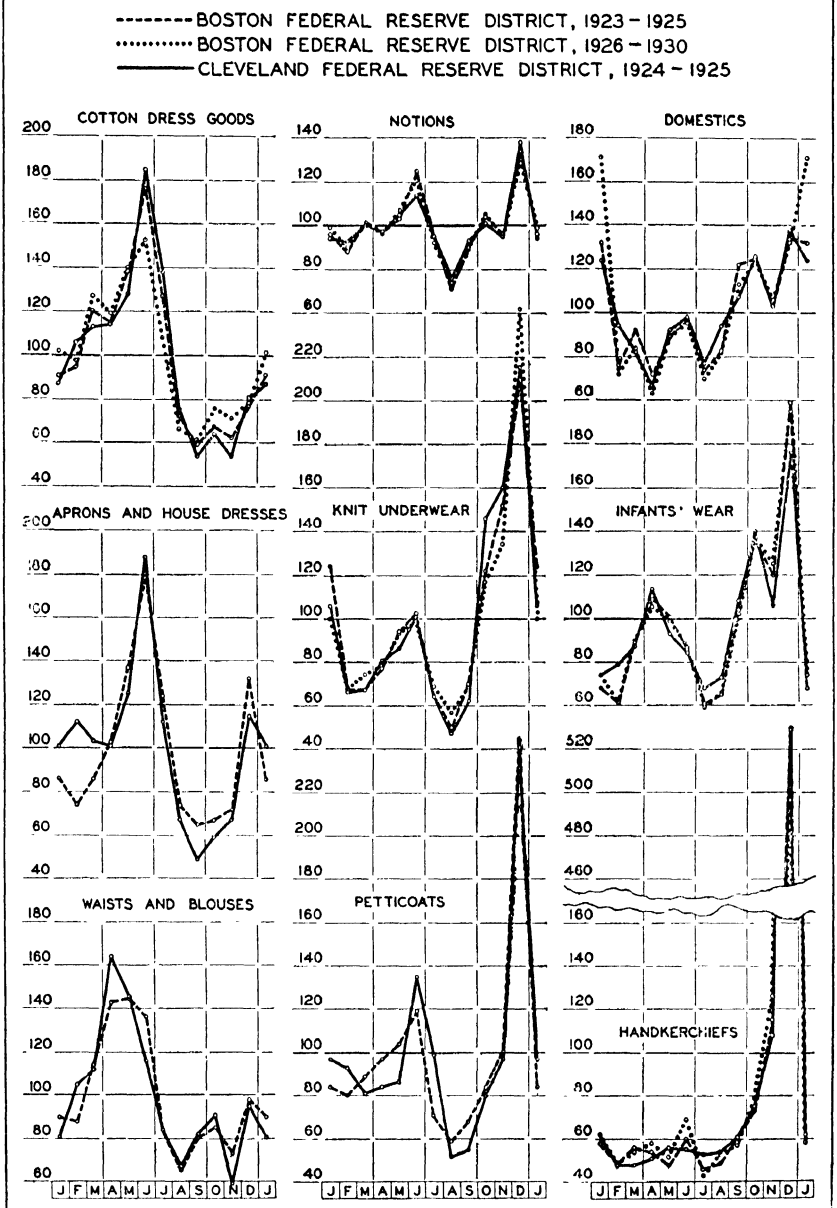
Most of the indexes that follow refer to sales by various departments of department stores. A question may be raised as to how far the fluctuations in sales by different departments of department stores reflect accurately the changes in sales by the various branches of retail trade. It might be suggested that neighborhood retail trade is less subject to seasonal swings than are department stores, which profit heavily from the holiday and seasonal trade. On the other hand, it may be said that department stores are financially more able to use advertising and special sales in order to increase the volume of business during the seasonally dull months. In the absence of definite testimony to the contrary, it may be assumed that the department stores show swings not materially different from the swings of trade in the corresponding branches of retail business as a whole.

The seasonal indexes for sales of the various commodities in the group differ considerably in standing for single months, but their patterns and amplitudes show some features in common (Charts 17 and 18). Simple cotton goods (such as cotton dress goods, aprons and house dresses, waists and blouses) have peaks about May or June and a much smaller rise in December. More expensive articles have a higher peak in December when holiday buying is done. But with this difference of the relative position of the peaks, the two-peak pattern is characteristic of all groups, domestics excepted.

[4] *Distribution of Textiles*, Harvard Bureau of Business Research, no. 56, p. 5.

CHART 18

SEASONAL MOVEMENT OF COTTON GOODS FROM DEPARTMENT STORES



The conspicuous feature of the retail seasonal indexes is their large amplitude. The average deviations for cotton goods proper (excluding notions) vary from 24 to 29 and the ranges from about 100 to 180. Total sales of dry goods chains show a smaller seasonal swing, chiefly because all commodities are included and the spread of their seasonal peaks and troughs through the year serves to cancel any outstandingly large deviations from the year's average. But even in this instance the swing is considerable.

Compared with all the seasonal indexes discussed above, variations in retail sales are slighter only than those in marketings of the crop by farmers and in raw cotton exports. The seasonal amplitude in raw cotton stocks at public warehouses is of about the same width, but all the other indexes show amplitudes much milder than those in retail sales.

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.

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

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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*

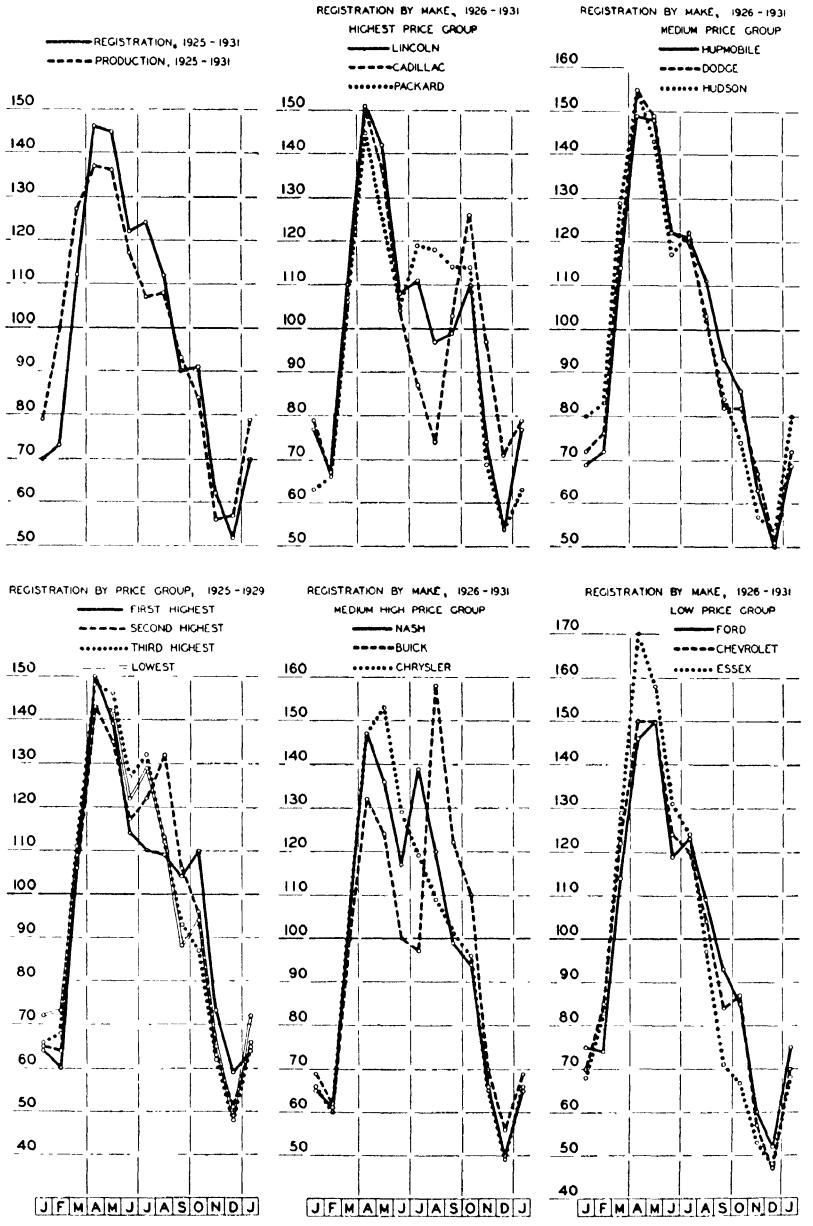
With the qualifications expressed by Mr. Ayres, a seasonal index of registrations of new cars is a reliable measure of the flow of automobiles to final domestic buyers. The index for registration of all new passenger cars (Chart 20) bears a striking similarity to that obtained for sales of General Motors 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.

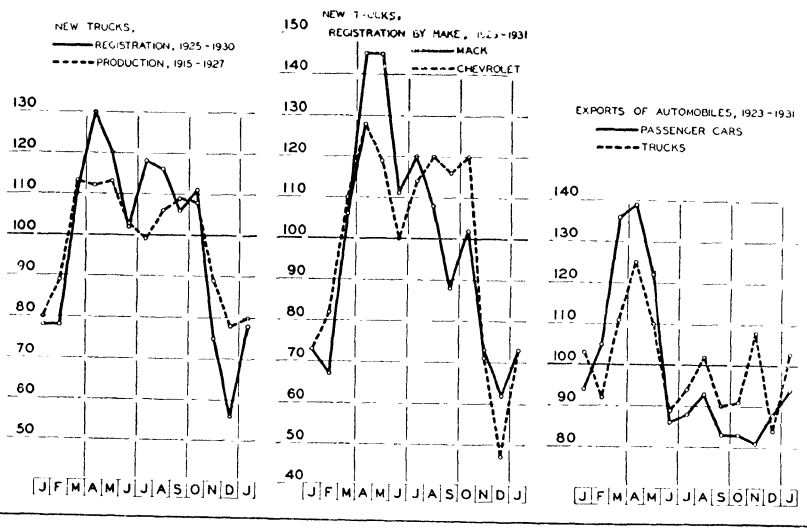
through the summer. The spring peak is attributable to the concentration in early summer of the initial phases of construction when heavy materials must be transported. In light trucks, which serve manufacturing industry, distributive trades and farmers, the continuing high level of registrations through 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*

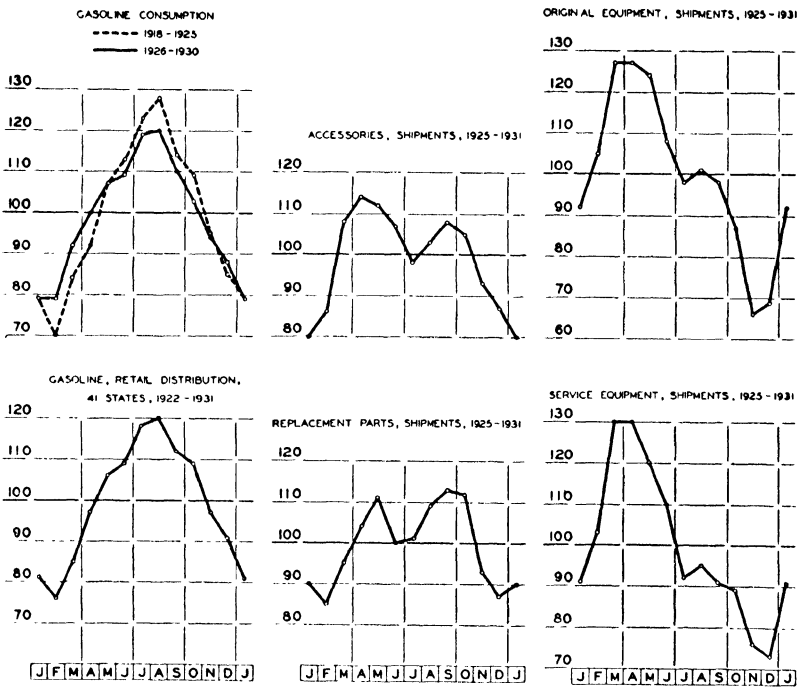
Following registration, consumption of gasoline is the next link in the chain of economic processes since it describes the use of the car by its final owner. Data are available on total consumption only, but since motorists use 85 per cent of total gasoline consumed,[5] the resulting index is a reliable 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*

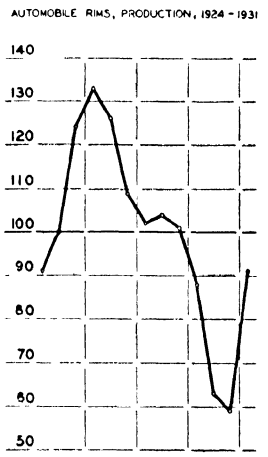
The contrast between the seasonality in shipments of replacement parts and accessories and that in movement of original and service equipment is the contrast between the use of the cars and the production or preparation for that use. Original equipment includes parts, accessories and other units shipped 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.

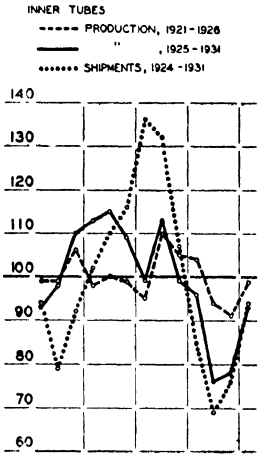
The production of rims also shows seasonal variations closely similar to those in passenger car production (Chart 23). The peak is in April, an autumn peak is lacking, and the amplitude is wide, although below that for car production. The commodity obviously belongs to that category of finished parts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

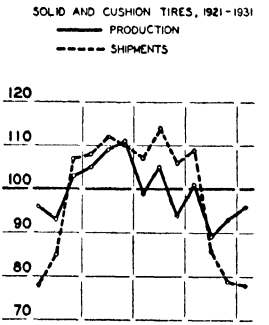
The indexes for production, shipments and stocks of tires tell a different story (Chart 23). Inner tubes and pneumatic casings, the tires that are used primarily on passenger cars, are subject not only to original equipment demand but also to replacement demand. Also, while the demand for solid and cushion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

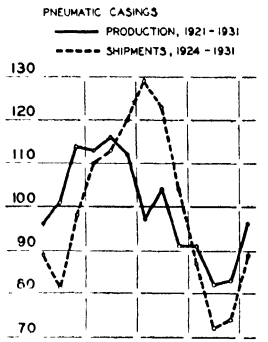
CHART 23

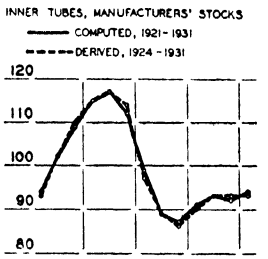
SEASONAL MOVEMENT OF AUTOMOBILE PARTS AND TIRES

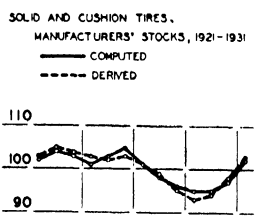


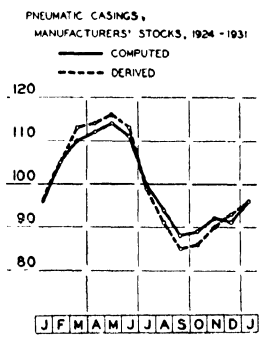


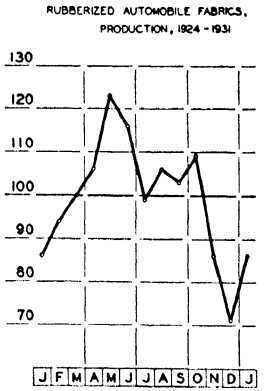












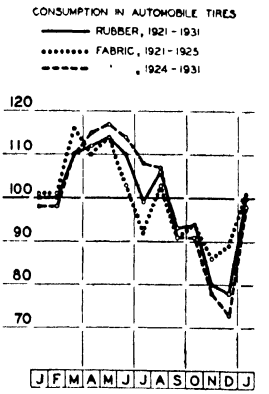


TABLE VIII

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*

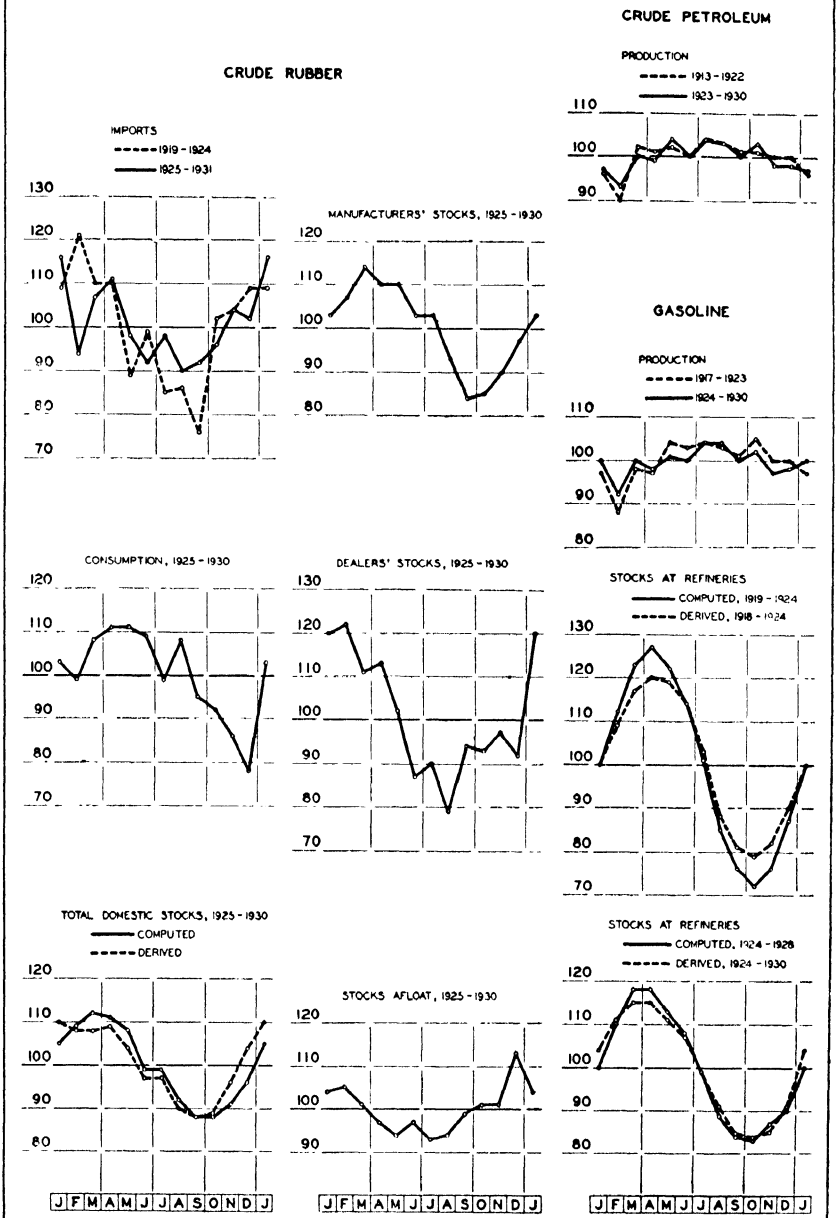
Of total rubber consumed in this country, of which all but a negligible fraction is imported, at least 80 per cent goes directly into tires and some additional fraction into rubberized automobile fabrics. Rubber imports, therefore, reflect almost the entire inflow of an important material directly related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

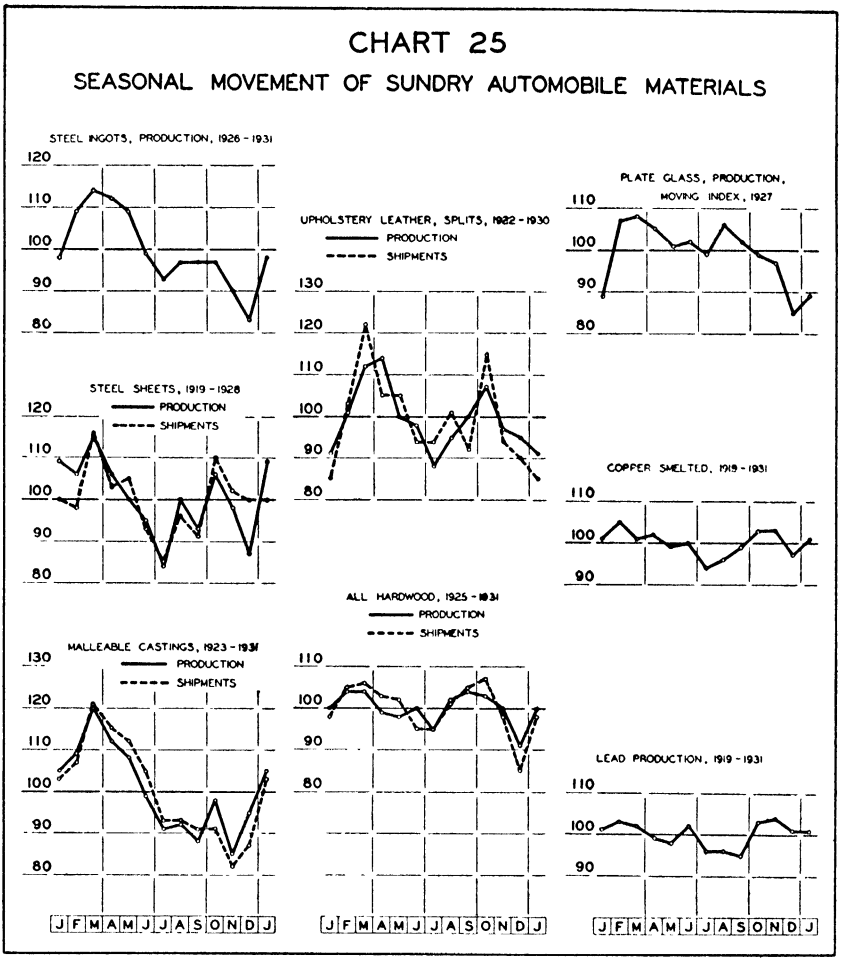
A large part of several other commodities is also absorbed in the production or operation of automobiles. Thus the industry used 29 per cent of total domestic production of steel sheets, 54 per cent of malleable iron, 32 per cent of nickel, 36 per cent of lead, 60 per cent of polished plate glass, 17 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



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.

CHAPTER VI

CONSTRUCTION
(Group IV)

GENERAL CHARACTERISTICS

Group IV covers industries in which the seasonal factors act most strongly not upon the supply of raw materials, nor upon the demand for the finished product, but directly upon the productive activity itself. Most of the industries comprising this group either carry on out-of-door activity or utilize natural elements whose availability changes with the season (inland water transportation). The most important division in this group is the construction industry and this is taken as an example for detailed analysis in this chapter.

a. *Causes of Seasonality in Construction*

The construction industry, defined most broadly, includes not only work on new and old buildings but also the construction of railways, roads, canals, sewers, subways, etc., all engineering projects that have for their final product a durable commodity or a system of commodities attached to a definite location. This great complex of industries, of fundamental importance in the economic structure of the country, has a more conspicuous seasonal problem, perhaps, than any other industry. Carried on mainly out-of-doors and dealing with materials affected by weather conditions, the process of construction is impeded by rains and low temperatures. The ground to be prepared for building is made harder by cold; the cement mixture used as adhesive for bricks can set well only in moderate temperature.

Recent technical progress has succeeded in overcoming many of these difficulties in respect of major types of buildings, such as large office buildings, industrial plants and large apartment houses, which require a year or more for comple-

tion.[1] Construction of smaller buildings still remains highly seasonal, however, and the laying of roads or highways in rigorous weather is well nigh impossible.[2]

Added to the purely climatic factor is the influence of customs established in the industry.

. . . . Some of the customs . . . . are: (1) inertia and habit in commencing building operations during the spring months; (2) common rental or leasing dates; (3) wage agreements procedure; (4) habits of doing repair work during the spring or fall; (5) the custom of encouraging more work through the character of advertising at the busiest seasons; (6) spring painting.

Other factors that affect the time of year at which building operations are undertaken are numerous, as the following examples show. There is building for seasonal needs, as in the case of schools, houses in summer resorts and winter resorts, construction of recreation facilities, farm buildings, and elevators for storage of crops, etc. The situation of farmers who wish to be assured of a good cash return from their crops before commencing construction is also to be allowed for. The commencement of buildings in autumn to be completed in the spring is sometimes discouraged by financial institutions when it appears that the period of construction is to be prolonged. Uncertainty in regard to wage scales and material prices also encourages scheduling of buildings for completion in the short-

[1] "During the war and immediately afterward many builders were compelled to carry on a large proportion of their work during the winter months in order to complete their projects within the time set by their contracts. They soon discovered that the cold weather, in itself, presented no physical obstacles which could not be overcome by means of more diligent supervision and a certain amount of protection of the work against snow and ice. Additional experimentation soon convinced them that even the operations which are most adversely affected by freezing temperatures, namely, the pouring of concrete and the masonry work on the exterior or the shell of the building, can easily be safeguarded by the simple device of heating the water and the aggregates in the process of mixing the concrete and by protecting the newly concreted section of the structure by means of canvas inclosures and artificial heat supplied by coke or oil-burning salamanders." Causes of Seasonal Fluctuations in the Construction Industry, *Monthly Labor Review*, September 1931, p. 7. For a good discussion of the possibility of winter construction see also *Seasonal Operation in the Construction Industries*, Report and Recommendations of a Committee of the President's Conference on Unemployment (New York 1924).

[2] "Highway work is unavoidably much more seasonal than building and certain other types of construction. Its great surface area and the impossibility of complete drainage make it impossible fully to overcome climatic effects or, except in minor degree, to protect the work from them as can be done when operations are concentrated in a small area. The work is almost entirely in a shallow surface stratum and is, therefore, affected to the maximum degree by wet and frost. Power machinery depends primarily on mobility for its effectiveness in this field, and mobility both of such equipment and of transportation units is seriously impaired by snow and mud." *Seasonal Operation in the Construction Industries*, pp. 150-51.

est possible time, which, as has before been shown, is a contributing factor in drawing additional workers into the building trades and consequently in accentuating unemployment during dull months.

There are also to be considered the lack of good management methods and the use of antiquated equipment, which prevent the carrying on of work at times when it would be practical if better methods were used. Finally, in the case of public works there is to be considered the legislative and administrative calendar of the federal, state, and local governments and the lack of discretion allowed administrative officers in scheduling the dates of commencement and completion of work under their jurisdiction.[3]

The measurement of seasonal variations in the industry and in the manufacture of related products becomes, then, of especial interest.

b. *Summary of Conclusions*

The detailed statistical analysis, whose main results are presented on Charts 26 through 33 and in Tables IX and X, indicates clearly the seasonal variablity of construction as well as the marked differences in amplitude among the various types of buildings and other construction projects. The swing ranges from relative mildness in commercial buildings to great width in public works and utilities and in the construction of roads.

If marked seasonality characterizes the process of construction as a whole, there are undoubtedly still greater seasonal variations in the consumption of separate construction materials, since each is consumed in a limited phase of the construction process. The task of supplying materials for such variable consumption falls not so much upon the contractors themselves as upon the dealers. While statistical data for purchases and sales by dealers are lacking (except for lumber in some districts), other information clearly shows that dealers bear a heavy burden in the task of filling the variable needs of contractors, as is vividly illustrated by the following quotation:

> The average contractor rarely carries a stock of materials in advance of current needs. His capital is usually limited; he has no suitable storage space even for non-perishable materials; and certain supplies vary so widely in size and shape that it would be impracticable to carry them in any event. So it becomes the dealer's function to provide materials as they are needed, either by filling his yards in advance of the busy season or by calling on the manufacturer when general activity increases in the spring.

The extent to which many progressive dealers equip themselves for efficient service is not fully appreciated. The larger yards are planned with great care and ample storage space is provided. Labor-saving devices of many kinds are in use. Cranes for handling steel and brick, continuous belt conveyors and bucket loaders for aggregates, and heavy-duty motor trucks are utilized. All such equipment is expensive. If it is kept operating, it minimizes handling costs and gets materials to the consumer when the latter's calls are most insistent. If it remains comparatively idle during some months, the heavy investment which it represents brings in no returns and the dealer suffers. . . . .

In the dull season so few sales of building materials are made that some dealers operate at an actual loss. Others are content to break even. The office organization must be held together and salaries paid; taxes and maintenance expenses go on; yard workers are let go; and the expensive mechanical equipment already referred to remains unproductive while the interest on the investment in it continues. Some dealers in the smaller cities meet the situation by handling coal and wood.

As the building season comes on and reaches its peak, stocks become depleted, manufacturers' deliveries are slowed up, transportation facilities become congested, and an actual shortage of supplies often occurs. As a result the dealer is unable to make prompt deliveries, and owners or contractors are obliged to wait while their expenses continue.[4]

But, as is shown by the marked seasonal swings that characterize shipments of construction materials by producers, dealers pass on a substantial part of the task of meeting variable demand to the manufacturers. The swings, while of lower amplitude than those in the consumption of the materials in actual construction, are still rather high. This is especially true of Portland cement and of some commodities that are made up in heavy units and are sent out directly to consumers for prompt installation (boilers and radiators). On the other hand, shipments of such materials as lumber show much lower seasonal amplitude than that which characterizes utilization in construction.

Differences among construction materials in seasonal variability of shipments seem to depend upon three factors: (1) the proportion in which the material is used for various types of construction, subject to seasonal disturbances of varying amplitude and pattern; (2) the proportion in which the material is consumed in new units, replacements, or uses other than construction; and the similarity or lack of similarity in the seasonal patterns of these diverse channels of consumption; (3) the number of intermediaries between the manufacturer and the final consumer. Where one or more links inter-

[4] *Seasonal Operation in the Construction Industries*, pp. 47, 49-50.

vene, these links, whether they be wholesalers or retailers or both, assume some of the burden of meeting the variable demand for construction materials and thus relieve the manufacturer by allowing him to ship at a much more even rate than he would were he to supply the final consumer directly.

Where shipments by manufacturers remain subject to marked seasonal disturbances, some part is passed back to the productive process. Generally, however, production of construction materials proceeds at a more even rate than shipments. Exceptions are observed in cases where definite seasonal factors influence production directly, as for example, in common brick and in some of the less important lumber species, such as western pine and California white pine.

Differences in seasonal variability of output of the several construction materials, in so far as they are not due to the disparate influence of climatic conditions on the output or to differences in the variability of shipments, arise from technical factors in the productive process. In some branches, as in boilers and radiators, it is profitable to produce for stock, maintaining productive activity at an even pace throughout the year. In others technical conditions of production make possible changes in volume at not too great expense (cement, asphalt). Output is then varied to meet, at least in part, fluctuations in demand and to prevent accumulation of excessive seasonal stocks.

Throughout, stocks serve in their usual capacity as buffers between production and shipments, between shipments and the needs of final consumers. Because of comparative lack of data on stocks held by links other than manufacturers, the analysis cannot be complete. As far as the data go, they show that the volume of stocks depends upon technical conditions of finishing the commodity for final use, and the differences in service rendered by intermediaries in supplying the variable needs of final consumers.

DETAILED COMMENTS

A. The Construction Industry

1. Permits and Contracts Awarded

By the very nature of the operations involved construction is scattered throughout the country and the statistical problem of measuring its volume adequately is not an easy one.

Continuous quantitative measurement is obtained only indirectly, in the series on building permits and on contracts awarded.

Building-permit figures represent the valuations placed upon construction jobs when permits are granted (or in a few cases when plans are filed) by the building departments of our towns and cities. They therefore include small structures as well as large and alterations as well as new construction. On the other hand, they do not cover construction carried on outside of city limits, and in some cities also, public works of certain types are not included because permits are not customarily required for such operations. The claim is made that the permit records are compiled by officials only as an incident to their administration of city building codes and that therefore the figures may represent either undervaluations or overvaluations. It is true that in the smaller cities and towns, the jobs are generally undervalued, but such tendencies are likely to persist and do not affect seriously the importance of the permit index as an indicator of changing trends in the building industry though they impair its value as a measure of construction volume.[5]

An investigation by the United States Bureau of Labor Statistics of the records of 19,310 buildings in ten cities for 1929 revealed that of the permits issued only one per cent was allowed to lapse. This small number constituted only 2.2 per cent of the estimated cost of all the buildings. Excavation was begun from six to thirteen days after the permit was issued; the interval was shortest for small dwellings and longest for public buildings. The average number of days which elapsed between starting excavation and completing a building ranged from ninety-eight for one-family frame dwellings to one hundred ninety-eight for public buildings. Of course, the larger buildings took more time than is represented by the averages for their group, as is indicated by the length of the construction interval when buildings are classified according to their estimated cost.[6]

Thus there is an interim of from three and a half to seven months between the issuance of the building permit and the completion of the structure. Since permits during recent years were at seasonal peak in March, actual ' production ' of buildings must have been at seasonal peak between July and No-

[5] W. C. Clark, The Construction Industry, p. 185, in *Representative Industries in the United States,* H. T. Warshow, ed. (New York 1928).

[6] See Elapsed Time in Building Construction, *Monthly Labor Review,* November 1931, pp. 15-24.

vember, a timing due partly to an attempt to complete buildings before the October leasing date but still more to the desire to avoid any burdens of construction during the cold months, December to February.

Contract figures are collected by field agents of a competent private statistical organization and are supposed to represent the contract price of construction actually started or definitely ready to start. When general contracts are not let, presumably estimates of cost are used. They do include large projects carried on outside the limits of cities and all public works, but they fail to cover most low-cost new buildings, practically all alteration work and construction in rural districts. . . . . contracts awarded perhaps represent for the area covered a more accurate total of construction volume already started or about to start. Permits issued, representing as they usually do an earlier stage in the construction process, are probably a slightly more sensitive barometer of changes in the trend of building activity.[7]

Total building contracts awarded show a seasonal pattern somewhat similar to that of permits. The peak occurs later, however, in either April or May, and the high levels last longer, extending through most of the summer. This difference may arise from the anticipatory character of permits and the awarding of contracts even after the actual launching of construction operations.

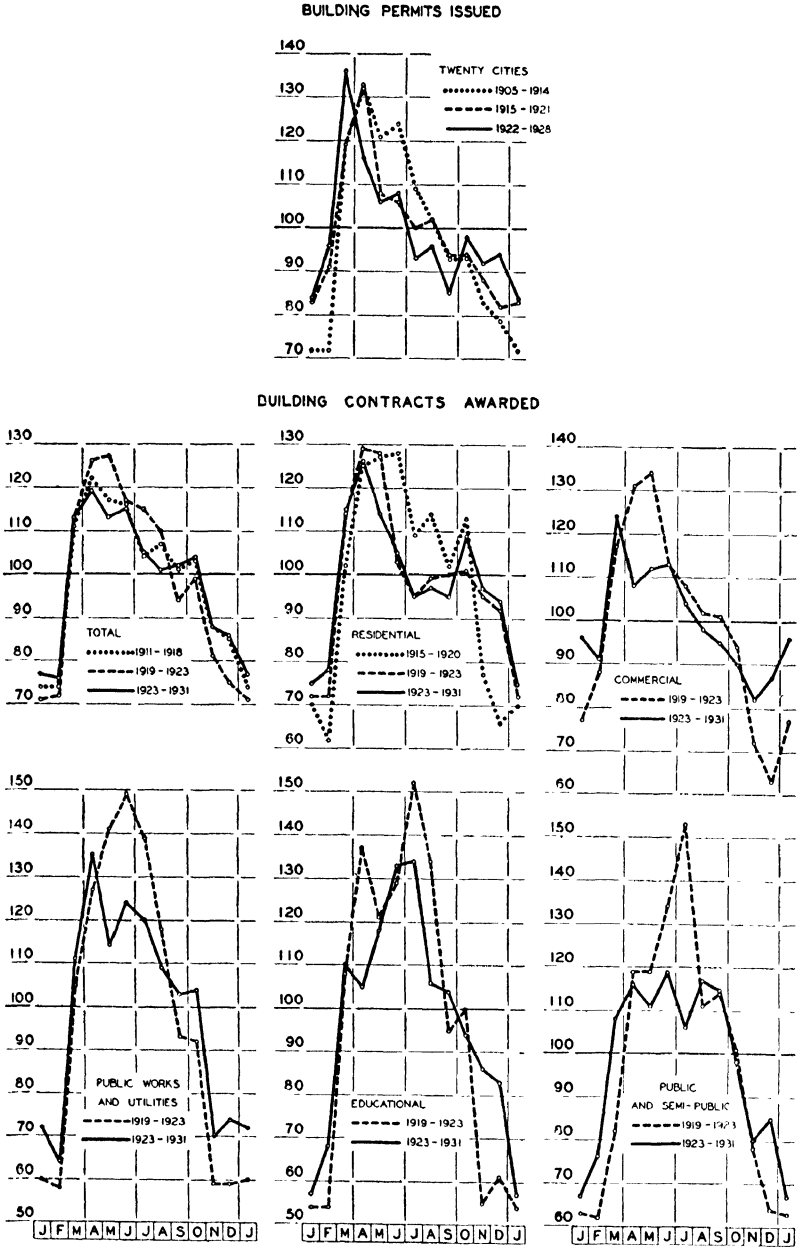
The various groups of building contracts show marked differences in the persistence of seasonal pattern. For industrial buildings no reliable seasonal pattern could be established. And, as Chart 26 shows, the stability of pattern is more marked in such groups as educational buildings and public works and utilities than in commercial or residential buildings (although in the latter the agreement of pattern is quite close for the last two periods).

Still more conspicuous are differences in amplitude. In buildings devoted to business use the seasonal swing is mildest. Thus, in industrial buildings no persistent seasonal variation could be found, and in commercial buildings the average deviation of the index during recent years is the smallest of all. Residential buildings have a somewhat higher seasonal amplitude. The two groups, "educational" and "public and semi-public," still cover buildings primarily; the former include schools, the latter, hospitals, churches, social and recreational, public and other institutional buildings. In both groups the swing is appreciable, owing largely to the seasonal character

[7] Clark, in *Representative Industries in the United States*, pp. 185-6.

CHART 26

SEASONAL MOVEMENT IN BUILDING PERMITS AND CONTRACTS



of the use of the structures, especially schools and some of the social and recreational buildings; and in the case of public buildings, the amplitude may be intensified by the formalities of the legislative and administrative calendar. But the most

TABLE IX

AMPLITUDE OF SEASONAL VARIATIONS: CONSTRUCTION ACTIVITY

Series	Average Deviation	Range
Building Permits Issued, 20 Cities, 1905-14	17.9	60
1915-21	11.3	51
1922-28	10.7	52
Building Contracts Awarded		
Total, 1911-18	13.3	48
1919-23	18.0	56
1923-31	12.1	43
Residential, 1915-20	20.4	66
1919-23	12.5	57
1923-31	11.5	51
Commercial, 1919-23	17.7	71
1923-31	10.2	42
Educational, 1919-23	30.2	98
1923-31	18.5	77
Public and Semi-Public, 1919-23	25.2	91
1923-31	15.5	52
Public Works and Utilities, 1919-23	29.8	91
1923-31	20.0	71
Federal Aid Highways		
Miles Completed, 1922-31		
Relative Deviations	36.2	122
Absolute Deviations	33.2	107
Miles Under Construction, 1922-31	4.8	15
Miles Initiated, Derived, 1922-31	39.0	126
Concrete Pavements, New Orders, 1923-31	32.9	107
Index of Construction Volume, 1924-31	20.7	62

marked seasonal swing characterizes contracts in the group of public works and utilities, largely because they cover such engineering projects as water-front developments, highways, bridges and lighting systems. Most of these projects are more susceptible than buildings to interference by inclement weather.

2. Construction of Roads

'Federal Aid' highways are improved roads built by states with federal aid, and in 1925 constituted about 45 per cent of total mileage built by states. Total mileage of these Federal Aid highways under construction shows a persistent but mild seasonal pattern (Chart 27). Its mildness is due to the fact that the index is a very large cumulative total of mileage begun.

The seasonal movements in mileage under construction, with peak months from July to October inclusive, seem to suggest a lag behind the construction indexes discussed above. The cumulative character of the series accounts for such timing, since if construction begins on a high level in early summer, it continues at high levels all summer. The cumulative total of such a seasonal will have a peak at the end of the summer and a trough *following* the low winter months, that is, in February or March.

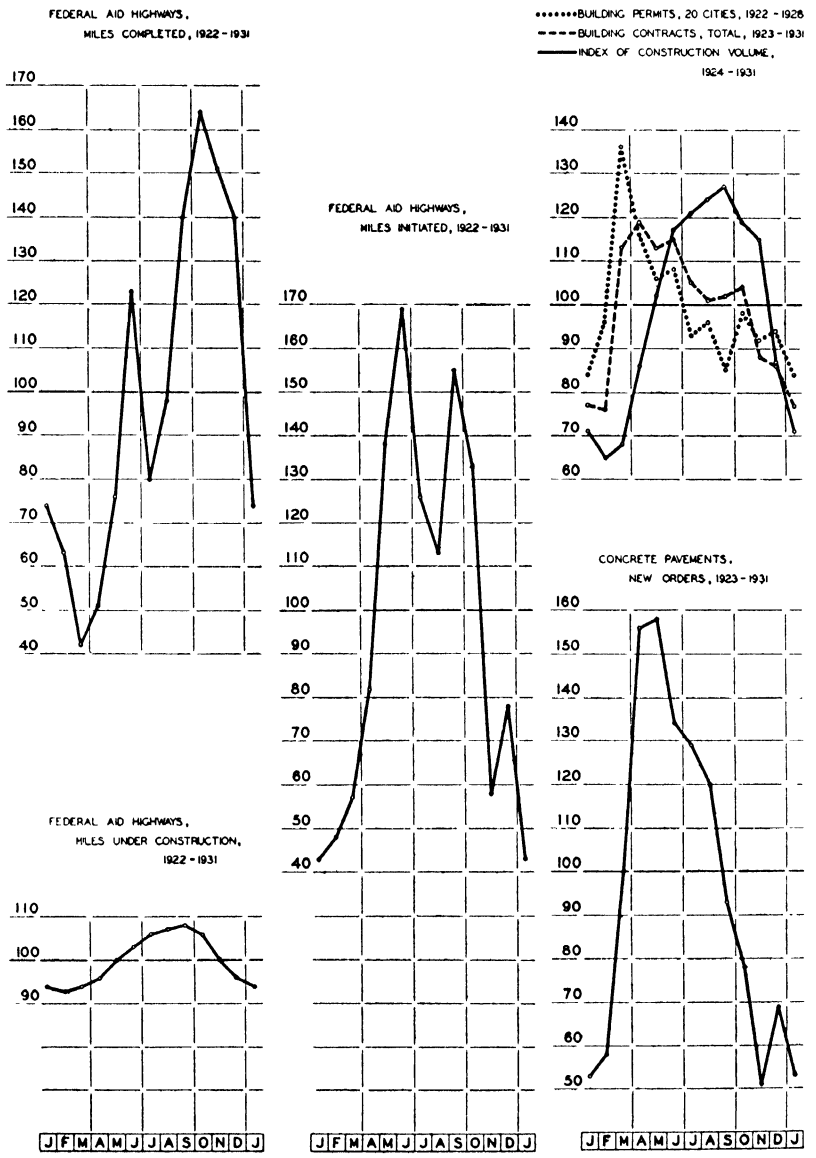
The index for mileage completed bears out these suggestions. Because of its small absolute size, two seasonal indexes were computed for this series: one, by averaging absolute deviations from a twelve-month moving average; the other, by averaging relative deviations. The seasonal swing, computed either way, is much wider than that for mileage under construction. This large difference can be explained by the fact that during the period covered total mileage under construction is 15.4 times that completed in an average month.

The difference between the seasonal pattern in mileage completed and any of those described earlier in this chapter is striking. There is a minor peak in June but the index rises (with a break in July) to a major peak in October, dropping to a trough in March. The late peak in mileage completed is within the time range indicated for the completion of buildings, the peak in which, as was noted above, lies between July and November.

From the indexes for roads completed and roads under construction it is possible to derive a seasonal index for mileage of roads initiated, upon the obvious assumption that, on the average, the number of miles initiated is equal to the number of miles completed. Such a derived index, presented in Chart 27, shows that: (1) Seasonal variations in the number of miles initiated are wide. (2) The direction of movement

CHART 27

SEASONAL MOVEMENT IN GENERAL CONSTRUCTION, HIGHWAYS AND PAVEMENTS



corresponds to that of the patterns encountered heretofore. The major peak is in June, the secondary peak in September. The very low months are November to February inclusive. (3) There is an interesting relation between the two peaks in miles begun and miles completed. The major peak in miles initiated (June) may be related to the major peak in completion (October). This indicates an average time span of construction of either four or sixteen months. If the minor peak in miles initiated (September) be associated with the minor peak of completion (June), then the period of construction is either nine or twenty-one months. Judging by ratio of miles under construction to miles completed, we may suggest that roads begun in early summer are likely to be finished at the end of the building period of the next year, that is, in October, while roads begun at the end of summer may have to wait two winters for completion early in the second summer after they were begun.

A partial substantiation of the derived index for mileage of highways initiated is found in the seasonal index for new orders for concrete pavements which cover primarily roads, from 60 to 70 per cent of total area; the remainder cover streets and alleys. The peak in new orders is in May, a month prior to the peak in mileage initiated, and there is similarity even in the small peak in December. The amplitude of new orders is also large, although somewhat below that in miles of highway initiated.

3. Total Construction

The index of construction activity, compiled by the Associated General Contractors of America, purports to represent actual installations, in contrast to contracts let. The index is a simple average of structural steel bookings, common brick bookings, Portland cement shipments, loadings of sand, gravel and stone, shipments of face brick and of enameled sanitary ware. To allow for lag between the factory and the construction job, the index computed from these data for a particular month is given as the construction index for the following month.

On Chart 27 the seasonal swing for this index of construction volume is plotted, together with the seasonal indexes for the two other important construction indicators: building per-

mits and contracts awarded. The chart presents an interesting sequence of peaks and troughs. The peak in permits is in March, in contracts in April, in the volume of activity in September. There is a somewhat less regular sequence of troughs. In permits two troughs occur: one in September, the other in January; both contracts and volume of activity are lowest in February. Seasonal movements seem to be smallest in permits, about the same in contracts and much wider in the volume of activity. The validity of this last showing may be doubted, since the construction index is a simple arithmetic mean of the various series of shipments. In such an average the most variable indexes are likely to receive the heaviest weight.

B. Construction Materials

1. Portland Cement

The consumption of Portland cement for various uses in 1926 was estimated to be as follows: [8]

Use	Percentage
Public and Commercial Buildings	26.0
Houses (exclusive of rural)	8.5
Paving and Highways	27 5
Sidewalks and Private Driveways (exclusive of rural)	5 5
Small Town and Farm Uses	18.0
Railways	5.5
All other	9.0

Thus about one-third is utilized in paving, highways and sidewalks, another third in buildings, and about one-fifth for small town and farm purposes. We might expect then to find rather large seasonal variations in the consumption of cement and in all the series which describe activity directed toward providing the supply.

Shipments of Portland cement do show marked seasonal swings, with a peak in August and high levels from May through October (Chart 28). These fluctuations are passed on to cement production. Weather affects cement output also directly, and not only through its influence on the rate of construction, but it is the indirect influence that is obviously greater.

[8] Estimate by the engineers of the Portland Cement Association, reprinted in *Mineral Resources of the United States, 1926*, II, 319, from *Concrete*, May 1926.

CHART 28

SEASONAL MOVEMENT OF CEMENT, ASPHALT, SAND AND LIME

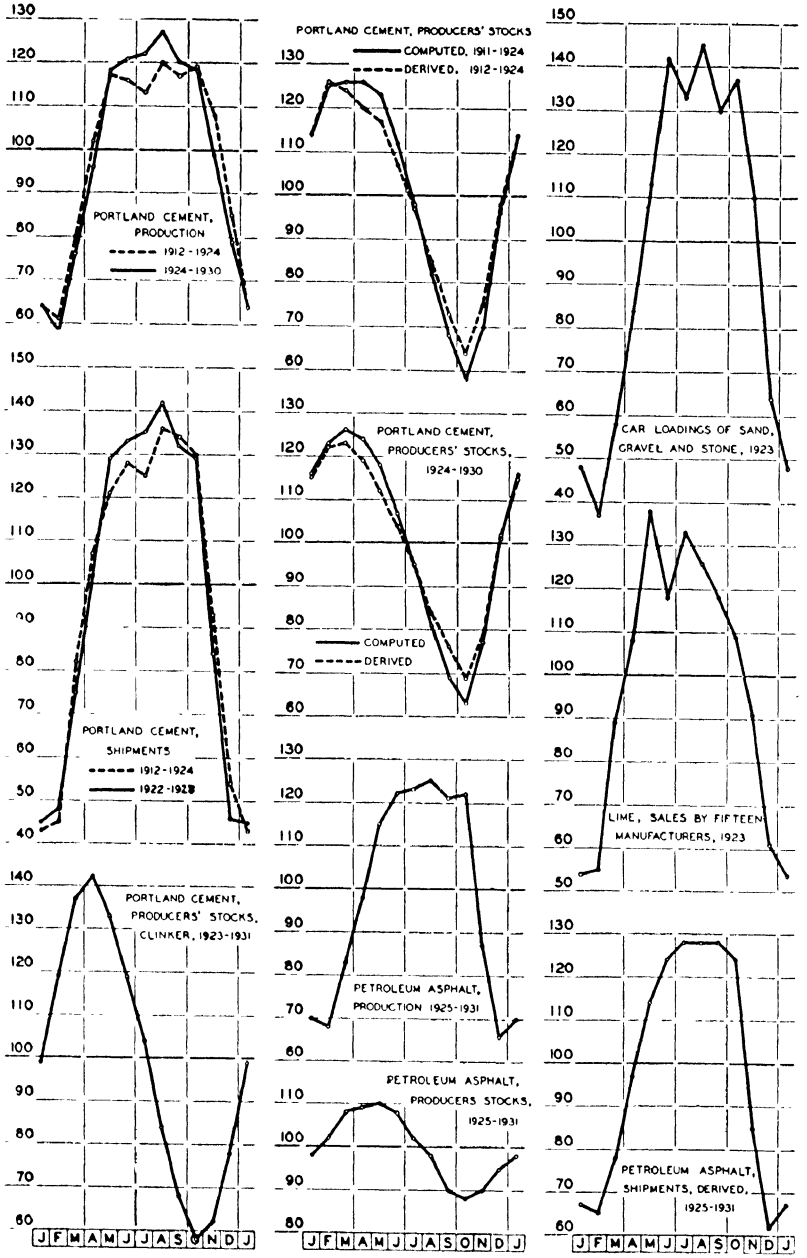


TABLE X

AMPLITUDE OF SEASONAL VARIATIONS: CONSTRUCTION MATERIALS

Series	Average Deviation	Range
CEMENT AND ASPHALT		
Portland Cement		
Production, 1912-24	18.5	59
1924-30	21.2	69
Shipments, 1912-24	30.3	93
1922-28	33.7	97
Producers' Stocks		
Computed, 1911-24	21.2	68
1924-30	19.2	63
Derived, 1912-24	18.0	62
1924-30	16 2	54
Producers' Stocks, Clinker, 1923-31	25.4	84
Asphalt (Petroleum)		
Production, 1925-31	21 3	59
Producers' Stocks, 1925-31	6.7	22
Shipments, Derived, 1925-31	24.3	66
BRICK AND TILE		
Common Brick		
Shipments, 1924-31	14 7	53
Unfilled Orders, 1921-31	9.8	39
New Orders, Derived, 1924-31	19.4	89
Producers' Stocks, 1921-31		
Burned	13 5	46
Unburned	16 6	57
Production, Derived, 1924-31	27.2	94
Face Brick		
Production, 1923-31	12.2	50
Shipments, 1923-31	23.7	86
Producers' Stocks, 1923-31		
Computed	7.7	24
Derived	7.5	24
Unfilled Orders, 1923-31	12.9	47
New Orders, Derived, 1923-31	22.9	83
Floor and Wall Tile		
Production, 1924-31	5 2	22
Shipments, 1924-31	9.7	35
Producers' Stocks, 1924-31		
Computed	3 4	13
Derived	2 8	10

TABLE X (CONTINUED)

Series	Average Deviation	Range
LUMBER		
Lumber, Total Cut, F. R. B. Index, 1919	7.3	28
1925–27	4.3	16–17
1929	4.7	16
Southern Yellow Pine		
Cut, 1917-23	4.5	21
1923-31	3.5	15
Shipments, 1922-31	5.6	23
New Orders, 1922-31	4.9	20
Mill Stocks, 1922-29		
Computed	1.2	5
Derived	0.9	4
Western Pine		
Cut, 1917-24	29.5	91
1924-31	21.6	74
Shipments, 1921-31	10.4	35
Mill Stocks, 1922-31		
Computed	3.2	11
Derived	3.5	11
Lumber Sales by Retail Yards		
Minneapolis, F. R. D., 1920-31	35 5	110
Chicago, F. R. D., 1926-31	19.1	68
Kansas City, F. R. D., 1926-31	11.4	48
Lumber Stocks at Retailers		
Minneapolis, F. R. D., 1922-31	5.7	21
Chicago, F. R. D., Derived, 1927-31	2.8	8
Kansas City, F. R. D, 1926-31	2.2	8
Lumber Sales at Wholesale		
Minneapolis, F. R. D., Derived, 1922-31	19.3	78
Chicago, F. R. D., 1927-31	12 5	41
Kansas City, F. R. D., Derived, 1926-31	10.1	42
Maple Flooring		
Production, 1923-31	4 8	15
Shipments, 1924-31	12 6	51
Producers' Stocks, 1923-31		
Computed	6.4	20
Derived	9.4	29
New Orders, 1923-31	6.8	38

TABLE X (CONTINUED)

Series	Average Deviation	Range
STEEL ROOFING AND PAINT		
Fabricated Structural Steel		
Shipments, 1924-31	7.3	28
New Orders, 1922-28	5.3	26
Dry Roofing Felt		
Production, 1923-31	11.6	40
Producers' Stocks, 1924-31	6.2	26
Shipments, Derived, 1924-31	12.1	42
Prepared Roofing, Shipments, 1920-23	13.9	52
1928-31	20.8	68
Paint, Varnish and Lacquer Products, Sales, 1928-31		
Industrial	10.7	40
Trade	18 5	85
Total	14.8	61
RADIATORS AND BOILERS		
Radiators		
Production, 1925-31	9.0	39
Shipments, 1925-31	28 3	104
Producers' Stocks		
Computed, 1926-31	12.9	41
Derived, 1925-31	12.6	41
New Orders, 1926-31	27.4	95
Cast Iron Boilers		
Production, 1925-31		
Square	10.2	60
Round	11.2	63
Shipments, 1925-31		
Square	33.8	129
Round	26.8	114
Square Boilers, Producers' Stocks		
Computed, 1926-31	10.8	37
Derived, 1925-31	10.5	34
Round Boilers, Producers' Stocks		
Computed, 1926-31	8.8	28
Derived, 1925-31	8.6	29

TABLE X (CONTINUED)

Series	Average Deviation	Range
SANITARY WARES		
Shipments		
Baths, 1917-24	9 4	34
1924-30	13.5	47
Lavatories, 1919-24	5.8	24
1924-30	10 6	42
Sinks, 1919-24	6 6	25
1924-30	10.5	36
Producers' Stocks		
Baths, 1919-24	22 4	78
1924-30	9 5	32
Lavatories, 1919-24	9 2	33
1924-30	5 2	20
Sinks, 1919-24	10.8	37
1924-30	7 5	27
Production, Derived		
Baths, 1919-24	6 1	24
1924-30	7 8	33
Lavatories, 1919-24	6 2	37
1924-30	7 2	32
Sinks, 1919-24	6 3	34
1924-30	8 0	42
New Orders		
Baths, 1918	41 9	158
1924	7 0	31
1930	25 5	80
Lavatories, 1918-30	7 2	32
Sinks, 1918	26 9	95
1924	7.1	31
1930	19.2	63

Large as the seasonal swings in cement production are, they are of appreciably lower amplitude than those in shipments. The disparity is taken care of by seasonal variations in stocks held by producers. These seasonal variations can be freely interpreted as a cumulated discrepancy between the seasonality of production and shipments, as is shown by the graphical comparison on Chart 28 of the computed and derived indexes for stocks. The similarity of the two is close for each of the periods covered.

In connection with the changes in seasonal amplitude from period to period, an interesting question arises. Seasonal variations in both production and shipments were wider during 1924-30 than during 1912-24. Stocks, on the contrary, had a narrower amplitude of seasonal variations between 1924 and 1930 than from 1911 to 1924. How is it possible that stocks which serve to supply large seasonal demand in months when production cannot cope with it should show a narrower seasonal swing in the period when shipments show a wider seasonal swing?

Two explanations are possible: first, although both production and shipments increase in seasonal amplitude, the absolute discrepancy between them may diminish. This does not appear to be true, however, for if we summate the production-shipments discrepancies without regard to sign, we obtain 162 for the period 1912-24, and 158 for the period 1924-30, an insignificant difference. The second explanation, more plausible in the present instance, is the relative increase in the stocks retained by manufacturers, reflected in the change in the stocks-shipments ratio from 1.29 for the period 1912-24 to 1.49 for 1924-30. Arithmetically, this tends to reduce the discrepancy between production and shipments when translated into an index of stocks. Economically, it means that the relative seasonal variation in stocks necessary to meet the fluctuations in shipments can be smaller.

2. Petroleum Asphalt

Asphalt, like Portland cement, is used in the construction of both roads and buildings. There are two varieties produced, 'petroleum asphalt' and 'native asphalt and related bitumens', but the former is of so much more importance than the latter that attention can be directed to it alone.

In 1929 about 1.7 million short tons of petroleum asphalt, or over 40 per cent of total output, went into paving in the form of either asphalt or flux; about 1.5 million tons, or slightly less than 40 per cent went into roofing and waterproofing.[9] Data on petroleum asphalt, therefore, reflect activity in what is almost exclusively a construction raw material.

A question arises in connection with the conspicuous seasonality of petroleum asphalt output which is clearly shown

[9] *Mineral Resources of the United States, 1929,* II, 532-3.

in Chart 28. It was pointed out in Chapter V that the refining of petroleum, that is, the production of gasoline, shows a very mild seasonal. How can a mild seasonal characterize the output of the main product and a very marked seasonal that of the by-product?

The answer seems to be that after the gasoline and other light fractions of petroleum have been distilled off, it is at the discretion of the producer to determine the relative proportion of asphalt and fuel oil that shall be made from the crude. Hence, during the summer months, when the demand for asphalt is above the average, a larger proportion of asphalt and a smaller proportion of fuel oil is made, while during the winter months the proportions are reversed.[10]

In view of this control by producers over the amount of asphalt to be turned out, it is not surprising to find that producers' stocks are on the average very small and that the seasonal swing characterizing them is quite mild. The average ratio of stocks to production during recent years was 0.8, that is, the refineries did not keep stock in excess of a month's output. Whatever stocks are kept are adjusted in preparation for demand. They are high in spring, just preceding the summer and autumn demand, and very low from September to January.

From the indexes for stocks and production a derived seasonal index for asphalt shipments can be computed (Chart 28). The seasonal patterns in shipments and in production are quite similar, except that shipments remain on a high level from July through September instead of reaching a peak in July, as does production. But shipments, like production, are high from May to October and low from December to March inclusive. It is significant that shipments of asphalt show more of a seasonal swing than does production. This difference between the two indexes may be accepted as indicative of their actual relation, despite the fact that the index for shipments is derived. The numerous applications of the checking scheme have proved the method of derivation to be quite reliable, especially for conspicuous seasonal variations.

[10] See Asphalt and Related Bitumens, by A. H. Redfield, in *Mineral Resources of the United States, 1928,* II, 400.

3. Brick and Tile

a. *Common and Face Brick*

The interesting feature of seasonal variations in the flow of brick is the contrast between the common and face varieties (Chart 29). Shipments of both show wide amplitudes, but that for face brick is materially wider than that for common brick. The difference appears to arise from the more restricted use of face brick. As it is utilized primarily for surfacing of buildings, demand for it is more concentrated during limited periods of the year. The patterns in shipments of the two kinds are similar, except that in common brick there is an additional peak in November. The latter may be due to a spurt of activity by common brick mills before some close for the winter, and before the closing of the navigation season.

There are no monthly data for production of common brick, but seasonal indexes for output can be reliably inferred from a comparison of the seasonal measures for shipments and manufacturers' stocks of burned brick. Besides the precision of results usually obtained in numerous derivations of this type, an additional check upon the derived index for production is found in a comparison with the seasonal swing for unburned brick stocks (Chart 29). Since unburned brick is the semi-finished product of common brick plants, the seasonal movements in their stocks may be expected to show fair similarity in pattern to those in production of burned brick. Such correspondence is found.

The seasonal swing in common brick output is much wider than that in face brick, although shipments of the former are characterized by a narrower amplitude than shipments of the latter. This difference is explained by the present technical state of the industry which makes common brick production much more subject to weather conditions than face brick production. The industry is carried on chiefly in small, local plants and still depends upon water transportation. Only a few plants are equipped to run continuously through the year and many close for the winter.[11] Face brick, on the other hand, is a more expensive product turned out by better equipped plants.

[11] *Seasonal Operation in the Construction Industries*, p. 167.

But production of face brick does not entirely escape the influence of weather conditions which affect the ease of obtaining clay and, in some degree, transportation facilities. Indeed, because of these climatic influences upon ease of production, the seasonal pattern in output of both kinds of brick differs appreciably from that in shipments. In both the peak in output occurs after the peak in shipments, and in both there is an appreciable difference in seasonal amplitude between output and outflow. Hence, in both, seasonal variations in stocks play a considerable rôle in making possible the disparity between production and shipments (see computed and derived indexes for stocks of face brick on Chart 29). In both groups stocks are of considerable volume, the ratio during recent years to monthly production or shipments being 2.4 for common and 3.0 for face brick. In both, stocks are large in winter as a result of accumulated production at high levels in the summer and autumn, and low in late spring and in summer; shipments rise earlier than output, forging ahead of the latter as early as December in common and March in face brick.

Seasonal variations in new orders and shipments are highly similar. In common brick the similarity extends to month-to-month changes in the seasonal index (Chart 29). In face brick the primary seasonal peak and trough in new orders precede those in shipments by one or two months.

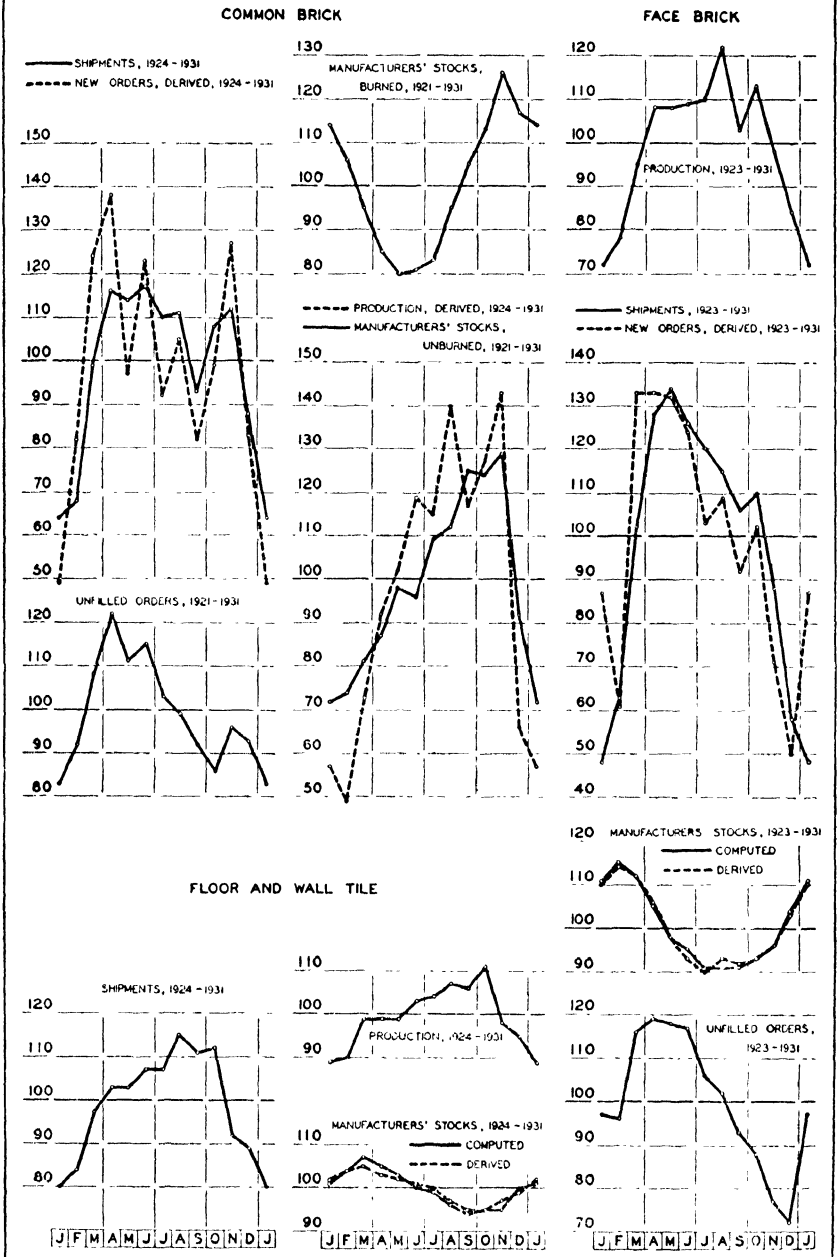
b. *Floor and Wall Tile*

While the primary seasonal peak in shipments of common brick is in June and of face brick in May, that in floor and wall tile shipments is in August, a reflection of the later timing of floor and wall laying operations as compared with that of utilization of brick. The seasonal amplitude is also materially narrower than that in brick, possibly because the laying of tiles is done in the shelter of the completed structure and therefore does not have to be carried through within the limited period of weather favorable to outdoor operations.

The seasonal swing in production is of still narrower amplitude than that in shipments. Here again there is the curious lag of production behind shipments; the primary seasonal peak in the former is in October, again because of the influence of weather on conditions of production. Here again seasonal

CHART 29

SEASONAL MOVEMENT OF BRICK AND TILE



variations in stocks intervene to account for the seasonal disparity between production and shipments (see the computed and derived indexes on Chart 29). And again stocks are large as compared with monthly shipments, the ratio during recent years being 2.5.

4. Lumber

Lumber is the most important construction material, constituting one of the chief materials in a wooden building and a major item of cost in other types of buildings and structures.

Even if brick is used, a six-room house, according to the investigations of the Division of Building and Housing, takes three-fifths the amount of lumber required for frame construction. Furthermore, in building with brick, concrete, and steel, much wood goes into scaffolding and frames. Some systems of concrete construction require more wood than would be the case if wood were the permanent material, and require larger timbers to support the concrete in the process of construction than would the building itself if it were all of wood. It is estimated that 15 per cent of the cost of the concrete construction is lumber.[12]

This statement refers primarily to softwood lumber, of whose total output about 70 per cent is used in construction.[13] Hardwoods furnish only about 6 per cent of the lumber required in building construction of all classes.[14]

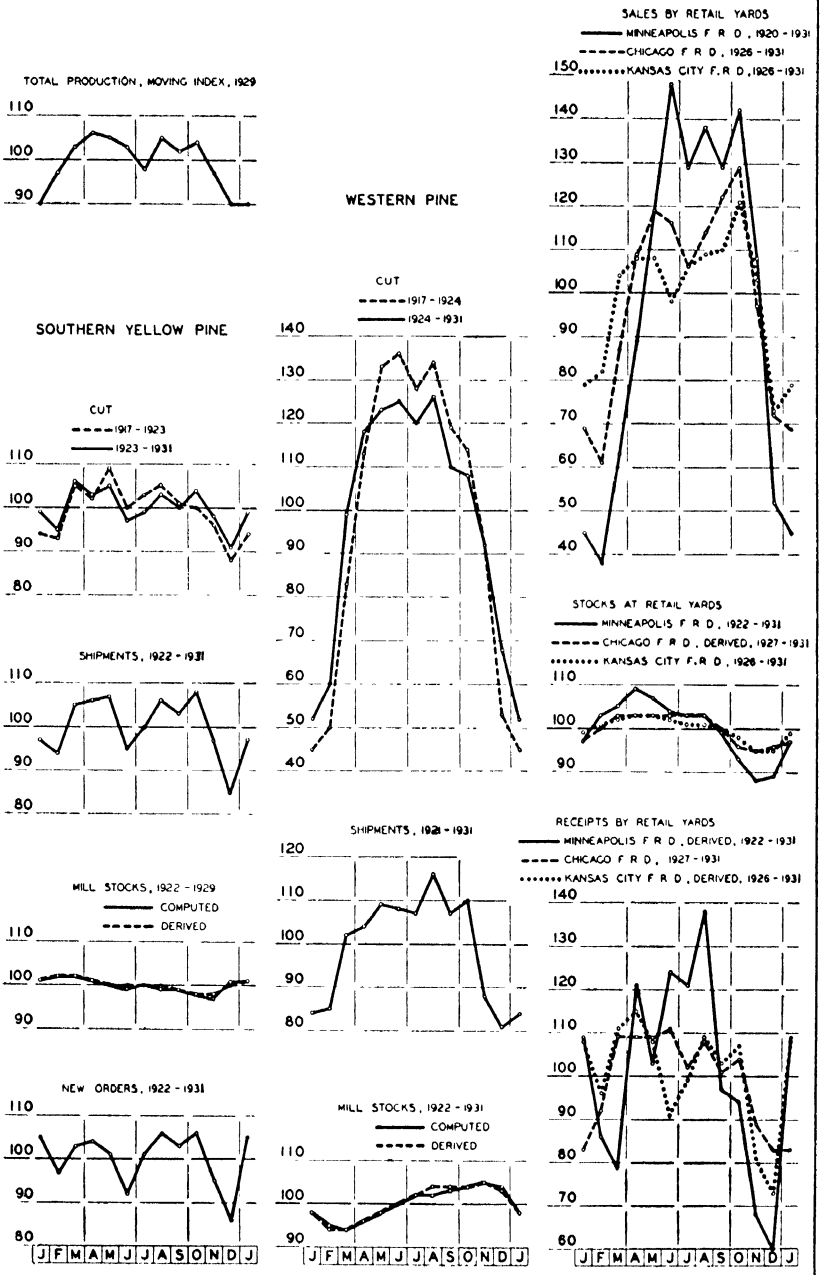
a. *Softwood Lumber*

From the standpoint of seasonality in production, softwood lumber may be divided into two groups. The first, at present the more important, includes southern yellow pine and Douglas fir, and is produced in states characterized by mild weather through the year. Thus, of southern yellow pine, which accounts for over 40 per cent of total output of softwood lumber, about 70 per cent comes from Louisiana, Mississippi, Texas, Alabama and Florida, and another 25 per cent from Arkansas, the Carolinas, Georgia and Virginia. It is not surprising therefore to find a very mild seasonal swing in the production of this lumber species (Chart 30). The second group, which includes, among other species, western yellow pine and white

[12] Timber: Mine or Crop, Department of Agriculture, *Yearbook 1922*, p. 137.
[13] *Seasonal Operation in the Construction Industries*, p. 165.
[14] R. C. Bryant, The Lumber Industry, in *Representative Industries in the United States*, p. 494.

CHART 30

SEASONAL MOVEMENT OF SOFTWOOD LUMBER



pine, is produced in states with severe winters which interfere considerably with felling and cutting. Of the most important species in this group, western pine, which accounts for about 9 per cent of the country's output, about 78 per cent is cut in Oregon, California, Nevada, Idaho and Washington. Severe or rainy winter weather in the forest areas of these states is the factor that accounts for the conspicuous seasonal swing in production shown on Chart 30.

Shipments, a stage nearer construction demand for the product, show much less marked discrepancies in amplitude than production. True, shipments of western pine, like output, are subject to a wider seasonal swing than shipments of southern yellow pine. But the smaller difference in amplitude of shipments than in production indicates the limited character of the influence which diverse natural conditions of production exercise upon the seasonality of shipments. Thus, outflow of southern pine is seasonally more variable than output, while outflow of western pine is seasonally less variable than output. In respect to pattern there is an essential similarity between the two stages of commodity flow, and a fairly substantial similarity between the two species.

The seasonal disparity between production and shipments is cumulated into seasonal variations in mill stocks (see computed and derived indexes on Chart 30). These variations are rather mild, but only in southern pine does the mildness arise from small absolute discrepancies between production and shipments. In western pine the relative seasonal swing is greatly reduced by the large volume of stocks. The ratio of mill holdings to monthly shipments amounted during the recent period to 2.6 for southern pine and to as high as 6.8 for western pine.[15]

Because of the different relationship between the seasonal amplitudes of production and shipments in the two lumber species, there is a different relationship between the seasonal patterns characterizing stocks and production or shipments. For southern yellow pine the pattern in stocks is on the whole inverted to that in production and shipments. In western pine the two are correlated positively, the pattern in stocks lagging somewhat at the peak and trough.

[15] For an interesting discussion of stock holdings by lumber mills see R. C. Bryant, *Lumber, Its Manufacture and Distribution* (New York 1922), pp. 275-6.

Seasonal variations in lumber shipments are on the whole rather mild. It seems clear that these indexes of lumber shipments by mills do not reveal fully the seasonal swing that is characteristic of lumber consumption by the construction industry. The latter is shown much more precisely in the movement of lumber through the stages nearest final consumers, namely, wholesalers and retailers.

The regional data available on sales of lumber by retail yards, while yielding indexes varying considerably in amplitude from district to district, do indicate the greater seasonality of these sales as compared with that of shipments by mills (see Chart 30 and Table X). The seasonal amplitude of sales by retail yards in the Kansas City district, the smallest of all, is still appreciably in excess of that of southern yellow pine shipments and somewhat larger than that of western pine shipments.

The seasonal swing in retail sales of lumber is also wider than that in sales by wholesalers. District by district, the comparison shows larger average deviations for the former than for the latter, the most appreciable difference being in the two indexes for the Minneapolis Federal Reserve district, where retail sales show the widest seasonal swing.

This, of course, points clearly to stock holding by retail yards and seasonal variations in these stocks. The stock indexes for each of the three districts show a peak in the spring and a trough in late autumn, an obvious adaptation to the peak sales during summer and early autumn (Chart 30). The seasonal variations in stocks are of narrow amplitude, but stocks are quite large in comparison with monthly sales. During recent years the ratios for the two districts for which data are available were 8.0 in Minneapolis and 7.2 in Kansas City; these are the highest ratios we have so far encountered.

b. *Hardwood Lumber: Floorings*

The analysis of seasonal variations in maple floorings, the most important construction product in the hardwood group, suggests the following comments (Chart 31):

(1) The seasonal swing in the production of maple floorings, like total softwood lumber output, has a narrow amplitude; but it shows an entirely different pattern, with a trough instead of a peak in summer. This is possibly because the raw material, maple, is supplied during the summer, and the manu-

facturing production of flooring must wait upon cutting and seasoning.

(2) Shipments are characterized by a much more conspicuous swing than output, of a pattern similar to that in shipments of floor and wall tile. The similarity is to be expected in view of the probably identical timing of the construction operations utilizing flooring and tiles. Seasonal variations in stocks are naturally of a pattern inverted to that in shipments. These variations are appreciable when the ratio of stocks to monthly shipments during the recent period, 2.6, is considered.

(3) The index for new orders shows a strange pattern, although it is somewhat similar to that in shipments. Judged by the unsatisfactory seasonal correction that it introduces into the original data, this measure for new orders does not appear reliable.

5. Structural Steel, Roofing Materials and Paint

a. *Steel*

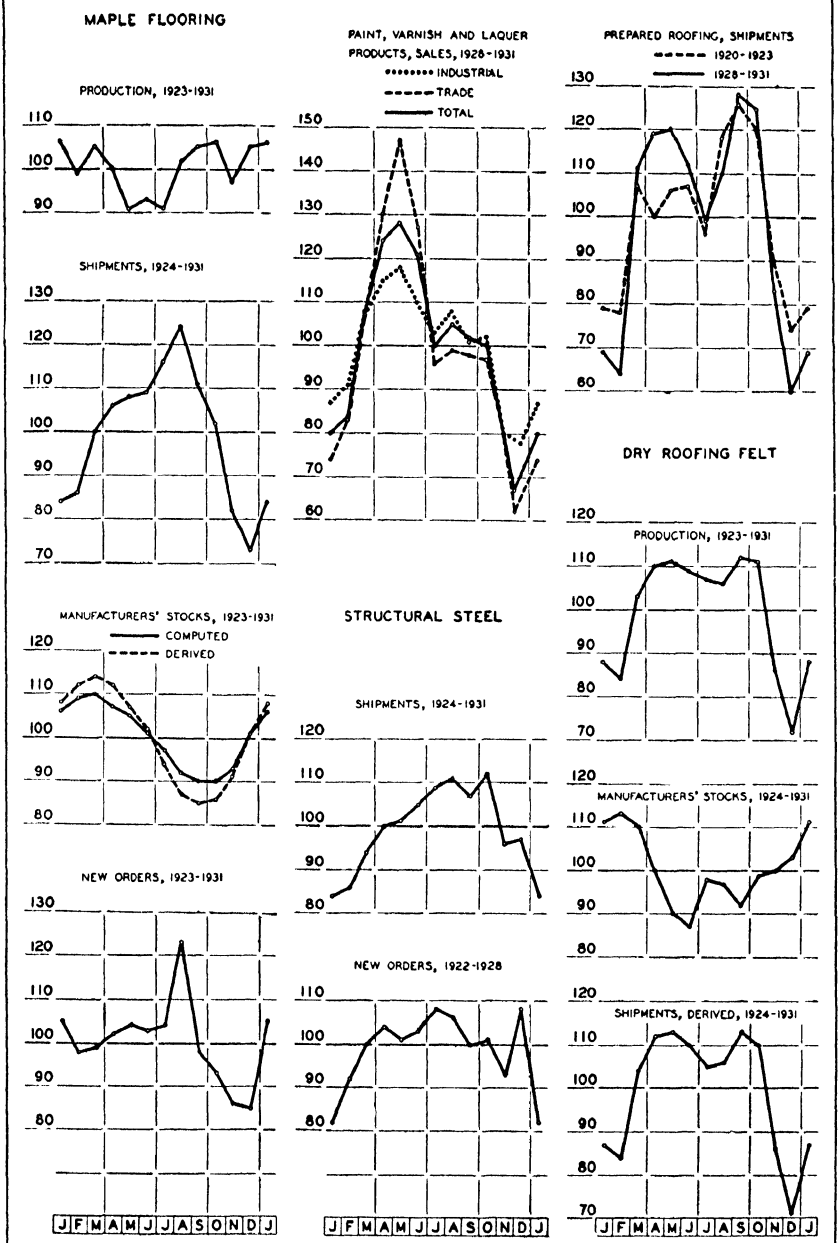
The seasonal patterns of both shipments and new orders of structural steel are in line with similar patterns for other construction materials, except possibly for the curious second peak in new orders in December (Chart 31). Also, the lag of the peak in shipments behind that in new orders is in agreement with results of other similar comparisons. The new element in the present case is the narrower amplitude of the swing in new orders, an exception to the generally observed wider seasonal amplitude of new orders as compared with shipments.

The reasons for this exception may be: (1) Shipments of structural steel are arranged so that delivery will be near the time of utilization in the construction operations. This policy, which developed from the difficulty of storing the bulky product, would, because of the seasonality of construction operations, bunch shipments in certain months; (2) Water transportation facilities may be utilized for shipments of such heavy products as structural steel, with consequent limitation upon the period favorable to shipments. Neither of these factors is, of course, of similar influence upon new orders.

The mildness of the swing in the latter, as compared with that in orders for other construction materials, may be attributable to the use of steel primarily for construction projects

CHART 31

SEASONAL MOVEMENT OF FLOORING, STEEL, ROOFING AND PAINT



which, because of their magnitude and the expense of delay, tend to be carried out at a relatively even rate throughout the year. Moreover, orders for steel, with their precision in specification and timing, are less subject to the influence of customary dates than are orders for commodities in which cancellation is a more accepted practice.

b. *Roofing Materials*

The interesting feature of seasonal variations in the production and shipments of roofing materials is the seasonal pattern, which, in contrast to those for other construction materials, has two peaks, one in May and the other in September (Chart 31). The reason apparently lies in the extensive utilization of roofing materials both for renovation of existing buildings and for new construction; a considerable part is consumed also in summer buildings. Most renovation, as well as work on summer buildings, is done in the spring, while the demand for roofing materials for new, year-round buildings is at peak in the autumn.

Another notable feature is the closeness with which production of dry roofing felt adjusts itself to shipments. The ratio of producers' stocks to monthly production is only 0.2, which means that holdings average about 5 days' output.

c. *Paint*

The use of paint chiefly for renovation and repairs accounts for the preponderance of the spring peak in sales by manufacturers.[16] While sales do not decline below the annual average until November, the greater use of paint in the spring renovation of buildings, perhaps augmented by demand on the part of the automobile and transportation trade and agriculture, causes higher levels in April, May and June than prevail in the autumn as a result of use in connection with the completion of new buildings.

Seasonal patterns of sales to industrial consumers and to the trade are very similar, but the amplitude of the former is markedly milder than that of the latter. The difference may arise from two sources: (a) the greater seasonality of the demand which is satisfied by the trade, since industrial consumers, in contrast to private consumers, find more continuous

[16] ". . . . more than 75 per cent of all painting work is performed on existing structures." *Seasonal Operation in the Construction Industries*, p. 175.

use for paint and lacquer products throughout the year; (b) the purchasing policy of the trade, which buys heavily in the spring, and in the winter lets stocks run low, even in relation to the diminished demand.

6. Radiators and Boilers

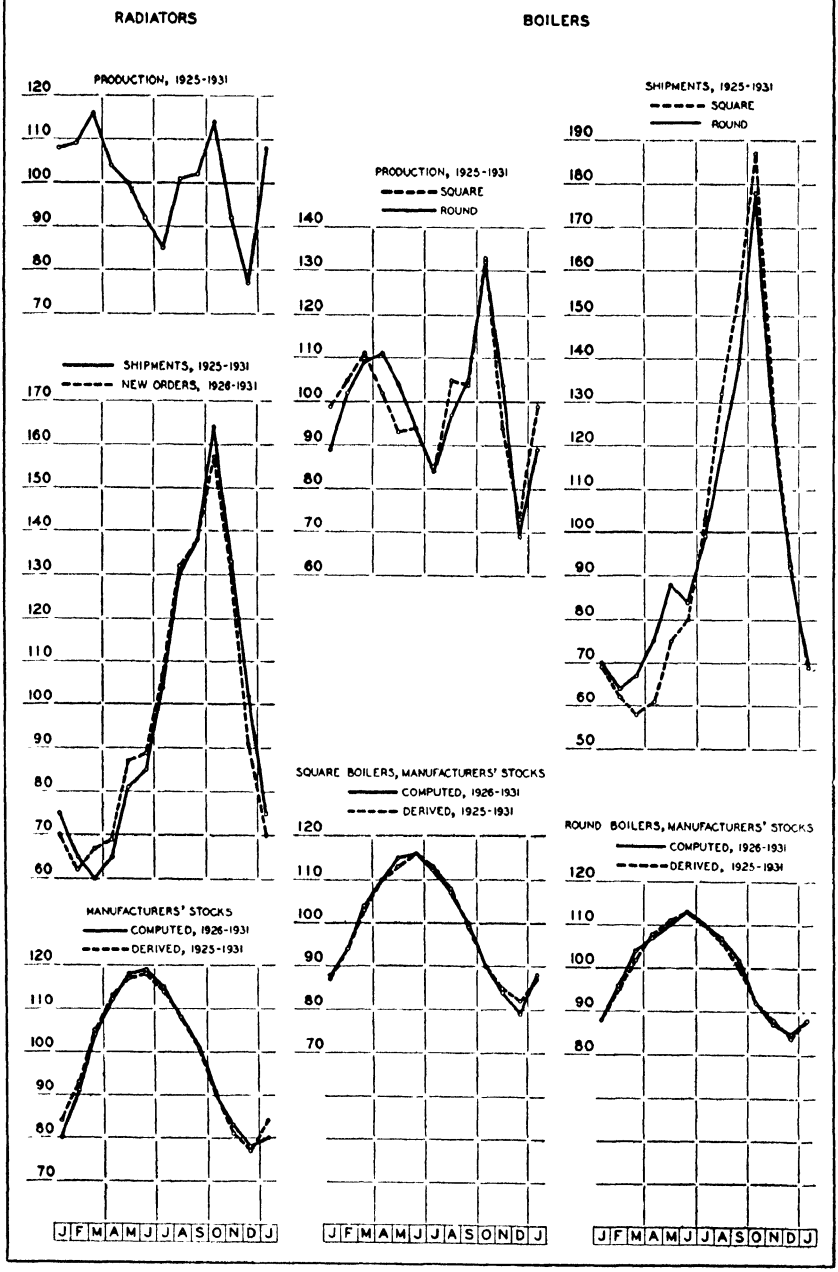
The strikingly wide amplitude of shipments of both radiators and boilers is clearly shown on Chart 32. Similarly wide amplitudes were found above in the shipments of Portland cement, asphalt and face brick. But the conspicuous character of the swing in these was attributable to the fact that a large proportion of the product is utilized in such seasonally variable outdoor operations as construction of roads or work on the surface of buildings; radiators and boilers, on the other hand, are used primarily in connection with buildings and where installation takes place in the shelter of a structure, even though the latter may not be entirely completed.

The reasons for the wide seasonal amplitude of shipments in the present example must, therefore, be sought elsewhere. The following tentative explanations may be suggested: (1) For radiators and boilers, still more than for structural steel, there is an incentive for arranging shipments so as to have the products arrive shortly before the time of installation. Since radiators and boilers are bulky and susceptible to deterioration from exposure, the possibility of storage by contractors is rather limited. Moreover, shipments, as in the case of steel, are generally direct from manufacturer to final consumer. (2) The patterns of both replacement and original demand for the product are approximately the same, the peak in both occurring shortly before the advent of cold weather.

The variation in production is quite different from that in shipments in respect of both amplitude and pattern. The amplitude is much narrower, the average deviations running less than half those for shipments (Table X). The pattern, while retaining a conspicuous high point in October, shows another in March or April, which for radiators is even higher. The double-peak pattern in the output of radiators and boilers is similar to that characteristic of several other branches of manufacturing production and is partly a statistical result of the variation in the number of working days in the month, partly a result of the vacation letdown during the summer. It

CHART 32

SEASONAL MOVEMENT OF RADIATORS AND BOILERS



is true, though, that the seasonal amplitude in production of this particular group of commodities is wider than that for most other branches of manufacturing.

The difference in pattern and amplitude between output and shipments is an expression of the producers' policy of keeping manufacturing processes comparatively free from disturbance by the seasonality of purchases on the part of the construction industry. This seasonality is reflected largely in stock holdings, and we do find marked seasonal variations in manufacturers' stocks, the latter cumulating during winter and spring to a peak at the end of June, and declining to a trough at the end of December. The volume of stocks is also large, the ratio to monthly shipments during the recent period amounting to 4.7 for radiators and 5.9 each for square and round boilers. Multiplying these ratios by the average deviations of the corresponding seasonal indexes, we obtain the following approximate measures of significance of seasonal change in stocks: 61 for radiators, 58 for square boilers and 52 for round boilers. These measures are greater than for any stocks of construction materials discussed in this chapter, not excluding even lumber holdings by retail yards.

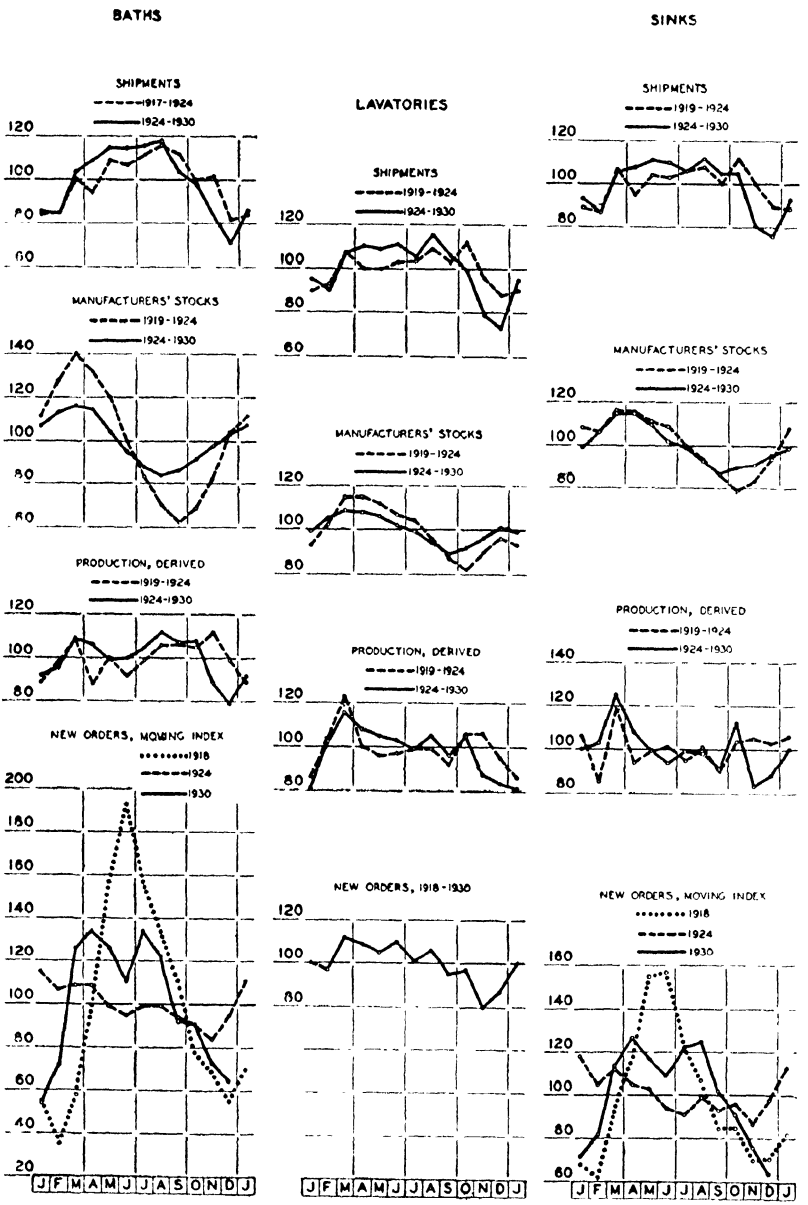
7. Sanitary Wares

Shipments of such sanitary wares as baths, lavatories and sinks are subject to rather mild seasonal variations, as construction materials go (Chart 33). The reason is that these products are used in connection with buildings only, and that two of them, sinks and lavatories, are used in residential, public and all business buildings. Shipments of baths, used in residential buildings primarily (including hotels), show period by period wider seasonal amplitudes than those of sinks and lavatories (Table X).

Although data on production are lacking, seasonal indexes can be derived from those for shipments and manufacturers' stocks. The measures thus obtained cannot be relied upon for a close study of the pattern, but the fact that the amplitudes are generally narrower than those characterizing shipments appears significant. The comparison in Table X indicates that only for baths in the early period is the average deviation in production in excess of that for shipments. The greater stability of output as compared with shipments, when the pro-

CHART 33

SEASONAL MOVEMENT OF BATHS, LAVATORIES AND SINKS



duction process is free from seasonal disturbances of its own, is true also for this group of construction materials.

The changes from period to period in the seasonal amplitude of production, shipments and producers' stocks of sanitary wares are quite similar to those observed for Portland cement. As in the latter, the swing in production and shipments has widened in amplitude from the first to the second post-War period; the seasonal amplitude of stocks held by manufacturers has narrowed from the earlier to the later period; the change is due largely to the rise in the ratio of stocks to monthly shipments. This ratio increased between the earlier and the later periods from 0.8 to 1.4 for baths, 1.2 to 2.2 for sinks, and 1.2 to 1.9 for lavatories.

Temporal changes are, however, most marked in seasonal variations of new orders. Only for lavatories is it possible to establish a constant seasonal swing in new orders. For baths and sinks moving seasonal indexes have to be computed. Chart 33 presents indexes for each of these groups for three years, chosen to illustrate the influence of changing business conditions upon the seasonal variation. Thus in 1918 new orders for baths showed an enormous seasonal swing. The peak occurred in June, that is, about two months before the peak in shipments, while the trough was in February. This was a year of uncertain business conditions when building activity was in a cyclical trough. The few orders made were placed shortly before the commodity was required for use, consequently during the out-of-season months the volume of orders was very small.

The seasonal movement of new orders for baths in 1924, a peak year in building activity, was markedly different. Orders were highest in January, declining to a trough in November. Thus, under conditions of accelerated construction activity orders were given as early as possible, the peak preceding the peak in actual installation by about six or seven months. In addition, orders were not reduced as drastically as in 1918 during out-of-season months. As a result, the average deviation is much smaller than that for 1918.

The seasonal pattern for 1930 resembles that for 1918. Since 1930 was a year of low levels of construction, following a marked cyclical decline, orders again show a rather large seasonal variation.

The moving seasonal index for new orders of sinks changed almost exactly as did that in orders for baths (Chart 33).

CHAPTER VII

ECONOMIC ELEMENTS OTHER THAN PRODUCTION AND TRADE

GENERAL CHARACTERISTICS

Preceding chapters deal almost exclusively with seasonal variations in the flow of commodities. This flow was measured in quantity volume except in respect of the distributive trades, where for lack of data on quantity volume recourse was had to data measuring the dollar volume of activity. But a vast area that is also pervaded by periodic swings, in part because of the integration of the economic system, was left unexplored. It is clear, for example, that if the flow of raw materials to the market is uneven, not only stocks but also the prices paid for the materials and the volume of credit necessary to sustain the flow from one economic stage to the next will reflect these fluctuations in supply. It is evident, further, that seasonal variations in manufacturing activity induce corresponding swings in employment and in the volume of wages paid. Moreover, fluctuations in these other economic processes may arise from seasonal factors of their own. Such series as dividend and interest disbursements, volume of speculation on security exchanges and some banking statistics reflect persistent seasonal swings arising from the custom of terminating financial operations on certain dates, setting aside the summer months for vacations, etc.

This chapter is a brief survey of seasonal variations in the numerous elements of our economic system other than production and trade. It draws primarily upon seasonal measures computed in the analysis carried on at the National Bureau of Economic Research in preparation for Professor Mitchell's forth-coming volume on Business Cycles, supplementing them with indexes found in other published studies. The discussion touches upon the seasonality of wholesale and retail prices, deals with a few general indexes of production, trade, credit

and speculation, presents measures of seasonality in the flow and distribution of incomes from property, and ends with a detailed consideration of seasonal variations in employment and payrolls in manufacturing industries.

Such a brief survey reveals the pervasiveness of seasonal variations and indicates that not only industry and trade but also almost all other aspects of economic activity are affected by these periodic disturbances. Prices, volumes of credit, savings and speculation, failures and earnings of commercial enterprises, employees' incomes and their opportunities for work—all show traces of the recurrent influence of climate and convention. In some of these aspects of activity the effect of seasonal factors is direct; in others it is imposed by the presence of seasonal variations in some related economic process. The integrative ties of the economic system pass on the seasonal disturbances from the point of their origin, but the similarity in seasonal pattern and amplitude that could consequently be expected is qualified by the differences in the conditions that determine and modify the rate of change in the various types of economic activity.

DETAILED COMMENTS

1. Prices

In a market that affords no possibility of advance buying in periods of abundant supply to prevent a price rise in periods of reduced supply, prices fluctuate violently with variations in the supply of commodities. This is generally the situation in the markets of perishable goods. Since most fruits and vegetables cannot be kept in stock they must be sold at once. Their prices consequently show marked seasonal swings.

Most raw materials, however, can be stocked. Seasonal fluctuations in current supply are therefore discounted in the knowledge that the excessive amount flowing in during a given month will be absorbed by continued consumption in the face of a reduced supply during the succeeding months. Moreover, stock-carrying is facilitated by the presence of produce markets. All seasonal raw materials that can be sufficiently well graded to admit of being handled in homogenous units—wheat, corn, cotton, to name the most conspicuous examples—

have commodity exchanges, on which industrial consumers and distributors share with speculators the risk involved in keeping the commodity in stock or of deferring actual purchase into the future. While, owing to the cost of maintaining stocks, seasonal variations occur also in the price of raw materials so held, they are much milder than variations in the current supply. The seasonal swings in prices tend to be largest at the stage at which the sellers are least able to carry stocks, that is, in prices paid to farmers.[1]

In the numerous finished products subject to seasonal demand, seasonal variations in price undoubtedly occur, as is shown by the ' after-season bargains ' in retail trade. But statistical information concerning prices of finished commodities, especially at retail, is not easily available, and what may be found does not reflect with sufficient sensitiveness the actual price movements.

However, average seasonal variations of some magnitude, of which a few are presented on Chart 34,[2] can be established in both wholesale and retail prices. These variations in prices may be compared with the seasonal swings characterizing the supply of the commodity, represented by output or shipments; and the seasonality of wholesale and retail prices for the same commodities may be compared.

a. *Supply and Prices*

The comparison of seasonal variations in wholesale prices with those in output or shipments indicates a negative correlation of pattern. Thus the seasonal peak in wheat prices is in May, a month after the trough in receipts at primary markets. The trough in prices is in the month when fresh wheat flows abundantly from the fields. The same inverse correlation pre-

[1] Where the total supply tends to fall short of total demand, relatively little stocking is done even in the months of seasonally active supply. Prices consequently exhibit marked seasonal variations. A striking illustration in this connection is the conspicuous seasonality of the *free* prices for agricultural products in Soviet Russia. These seasonal swings are much wider than were those for the same prices in pre-War Russia. See A. J. Grintser, Commodity Prices, pp. 255-61, in *Seasonality and Seasonal Variations in Industry and the National Economy*, by the Bureau of Economic Analysis of the Supreme Economic Council and of the Soviet of Syndicates of the U. S. S. R. (Moscow 1930).

[2] Since the first draft of this chapter was completed, seasonal measures for prices of several commodities have been computed. They are given in Appendix I but could not be added to Chart 34. The following discussion and Tables XI and XII are based upon the seasonal indexes for all the price series analyzed.

CHART 34

SEASONAL MOVEMENT OF COMMODITY PRICES, WHOLESALE AND RETAIL

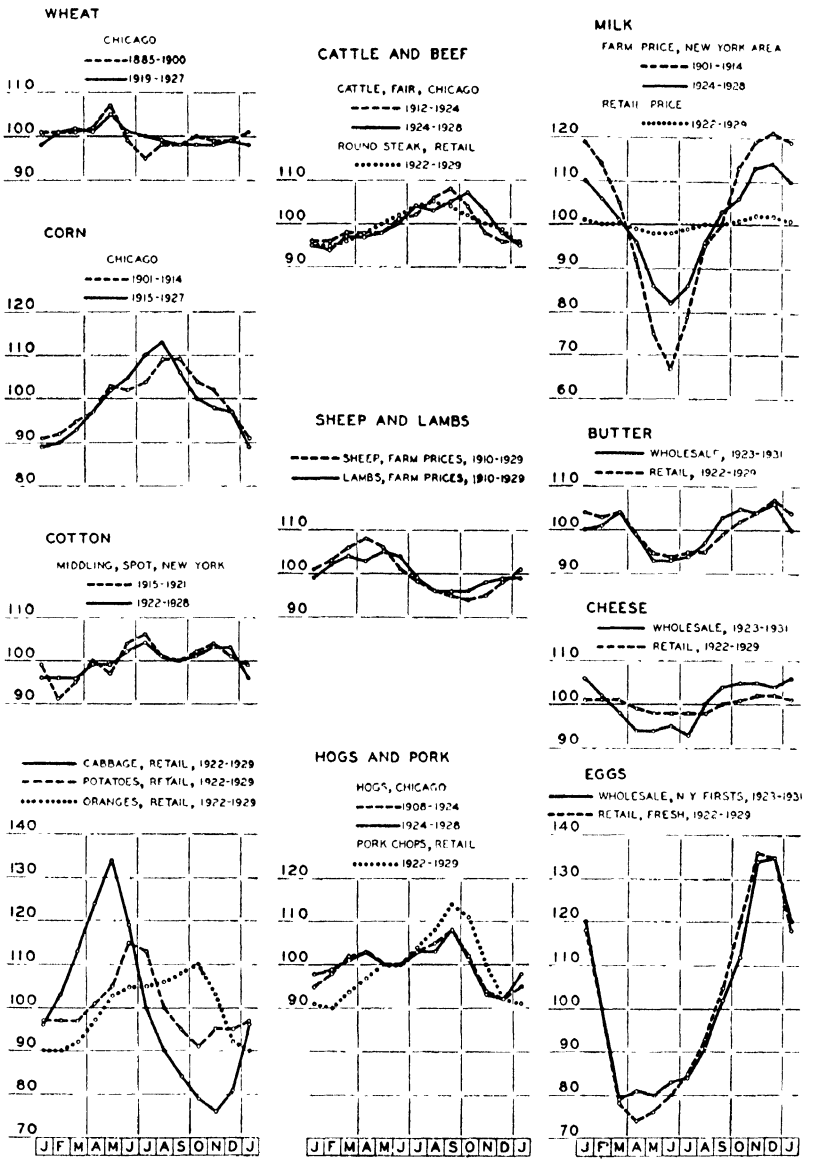


TABLE XI

AMPLITUDE OF SEASONAL VARIATIONS

SUPPLY AND PRICES OF SELECTED COMMODITIES

Commodity	Period Covered by Index	Average Deviation	Range
Wheat, Receipts at Primary Markets	1920-24	36.8	138
	1925-31	51.7	181
Wholesale Price, Chicago	1918-27	1.7	7
Flour, Production	1924-31	7.8	29
Wholesale Price, Minneapolis	1924-31	1.2	6
Corn, Receipts at Primary Markets	1920-30	22.7	81
Wholesale Price, Chicago	1915-27	6.0	24
Cotton, Receipts into Sight	1925-31	75.9	281
Price, Spot, Middling, N. Y.	1922-28	2.3	8
Cattle and Calves, Receipts at Primary Markets	1923-31	13.2	63
Wholesale Price, Chicago (per 100 lbs.)	1924-28	3.6	13
Sheep and Lambs, Receipts at Primary Markets	1923-31	21.6	97
Farm Prices of Sheep	1910-29	4.1	14
Farm Prices of Lambs	1910-29	2.9	9
Hogs, Receipts at Primary Markets	1923-31	13.3	58
Wholesale Price, Chicago (per 100 lbs.)	1924-28	3.1	16
Wholesale Price of Lard, Chicago	1922-30	2.5	9
Daily Deliveries per Dairy, N. Y. District	1922-30	15.3	58
Prices Paid to Farmers, N. Y.	1924-28	8.9	32
Butter, Factory Production	1923-31	21.2	74
Wholesale Price, Chicago	1922-29	6.8	22
Cheese, Factory Production	1920-31	23.1	86
Wholesale Price, Chicago	1923-31	4.3	13
Eggs, Receipts at Primary Markets	1925-31	41.9	149
Wholesale Price, N. Y., Firsts	1923-31	17.1	56
Oranges, Carlot Shipments	1924-26	39.3	118
Wholesale Price, Chicago	1920-30	13.5	46
Potatoes, Carlot Shipments	1920-31	16.3	102
Wholesale Price, Chicago	1918-30	10 9	42
Cabbage, Harvest	.....	96.5	485
Carlot Shipments	1924-26	30.7	167
Retail Price	1920-29	15.6	58
Coffee, Imports	1920-30	8.3	28
Wholesale Price, N. Y.	1921-31	1.7	9

TABLE XI (CONTINUED)

Commodity	Period Covered by Index	Average Deviation	Range
Anthracite Coal Output *	1925-31	3.1	...
Composite Wholesale Price	1927-31	1.5	5
Bituminous Coal Output *	1925-31	6.1	...
Composite Wholesale Price	1924-30	3.2	9

* The arithmetic mean of average deviations of the moving seasonal index computed by the Federal Reserve Board.

vails in respect of corn, cotton, livestock, dairy products, eggs, poultry and vegetables.

The apparent exception in the case of the retail price of potatoes, which reaches its seasonal peak in June and July coincident with the peak in shipments of early white potatoes, seems obviously to be due to the difference between grades of a commodity. Early white potatoes sell at much higher prices than late potatoes, whose shipments are at peak in October and November (winter white potatoes are preponderant). Similarly, the existence of several grades of meat may account for the exceptional movement of the price of cattle, the stock marketed immediately after the close of the grazing season being priced higher than that marketed at the end of the winter.

In respect of amplitude supply is characterized by much wider seasonal swings than price. This is true without exception of all commodities for which Table XI assembles the appropriate measures. The difference is especially conspicuous in respect of durable raw materials but is present even in such perishable raw materials as fresh milk, eggs and cabbage.

The wider amplitude of the seasonal swing in supply is partly attributable to the fact that the series analyzed reflect only output or shipments, while actual market supply includes also the available stocks of the commodity. Previous seasonal analysis of commodity stocks would lead us to expect that the variation in total supply would be smaller than that in production or shipments only, since stocks are likely to be at seasonal trough by the time the peak in output or shipments is reached. But the swing even in total supply must be of wider amplitude

than in prices, in view of the discounting on the market of the temporary surpluses and deficiencies in commodities that are described by seasonal variations.

b. *Wholesale and Retail Prices*

The patterns of seasonal variations in wholesale and retail prices of the same commodity are essentially similar (see comparisons on Chart 34). Of thirteen commodities for which such comparisons are possible (see Table XII) only one, bananas, shows essential divergence of pattern in the two types of prices. In some commodities, like lard and anthracite

TABLE XII

AMPLITUDE OF SEASONAL VARIATIONS

WHOLESALE AND RETAIL PRICES OF SELECTED COMMODITIES

Commodity	Period Covered by Index	Average Deviation	Range
Flour			
Wholesale, Minneapolis	1913-23	4.0	18
	1924-31	1.2	6
Retail, Minneapolis	1914-23	2.8	10
	1924-30	2.0	7
Beef			
Wholesale, Cattle, Chicago	1924-28	3.6	13
Retail, Round Steak, Selected Cities	1922-29	2 8	10
Pork			
Wholesale, Hogs, Chicago	1924-28	3.1	16
Retail, Pork Chops, Selected Cities	1922-29	6.1	24
Lard			
Wholesale, N. Y. C.	1911-15	1.8	8
	1916-21	4.5	19
	1922-31	2.5	9
Retail, N. Y. C.	1911-15	1.5	7
	1916-21	3.0	11
	1922-30	1.7	6
Bacon			
Wholesale, Chicago	no seasonal variation		
Retail, Sliced, Chicago	1912-16	1.8	7
	1919-26	2.3	9
	1927-30	1.7	5
Milk			
Prices Paid to Farmers, N. Y. District	1924-28	8.9	32
Retail, Selected Cities	1922-29	1.1	4

TABLE XII (CONTINUED)

Commodity	Period Covered by Index	Average Deviation	Range
Butter			
Wholesale, N. Y. C.	1911-15	7.9	29
Chicago	1916-21	6.8	22
	1922-29	6.8	22
Retail, Chicago	1911-15	6.0	21
	1916-21	5.8	21
	1922-30	4.8	17
Cheese			
Wholesale, Chicago	1923-31	4.3	13
Retail, Selected Cities	1922-29	1.4	4
Eggs			
Wholesale, N. Y. C.	1923-31	17.1	56
Retail, Selected Cities	1922-29	19.1	62
Oranges			
Wholesale, California, Chicago	1920-30	13.5	46
Retail, Chicago	1919-30	5.1	23
Bananas			
Wholesale, Jamaica No. 9, N. Y. C.	1921-26	7.8	30
Retail, N. Y. C.	1920-30	2.2	8
Prunes			
Wholesale	no seasonal variation		
Retail, N. Y. C.	1921-29	1.0	3
Potatoes			
Wholesale, Chicago	1913-17	8.8	34
	1918-30	10.9	42
Retail, Chicago	1913-21	11.1	41
	1922-30	9 2	41
Coffee			
Wholesale, Rio No. 7, N. Y. C.	1913-17	4.8	18
	1921-31	1.7	9
Retail	no seasonal variation		
Anthracite Coal			
Wholesale, N. Y. Harbor	1921-28	1.9	5
Composite	1927-31	1.5	5
Retail, N. Y. C.	1923-31	2.2	7
Composite	1927-31	1.4	5
Bituminous Coal			
Wholesale, Composite	1924-30	3.2	9
Retail, Composite	1924-31	2.7	8

coal, there is a slight tendency for the pattern in retail prices to lag behind that in wholesale, but in the others the correlation is synchronous. It should be noted, however, that for one commodity, coffee, wholesale prices showed a significant seasonal swing while retail prices did not, and in two others, bacon and prunes, retail but not wholesale prices evidenced seasonal variations. The comparative amplitude of seasonal variations in the two types of prices is brought out clearly in Table XII.

In most commodities the seasonal swing in wholesale prices is of wider amplitude than in retail. This difference is most marked in raw milk, oranges, bananas and coffee, commodities in which the retail price is subject to a considerable inertia and is not likely to change unless under pressure from a marked shift in the supply-demand relationship. On the other hand, in a few commodities the retail price is most sensitive to seasonal disturbances (pork, bacon, prunes), while in others the difference in amplitude does not appear significant (potatoes, eggs, flour, anthracite coal).

Since most commodities do show a wider swing in wholesale than in retail prices, and since the patterns of the two are essentially similar for almost all commodities analyzed, we may infer that middlemen's margins are also subject to seasonal variations, of a pattern inverted to that of prices. This inference is predicated upon the assumption, which is not a great departure from reality, that middlemen's operating expenses are quite constant seasonally. That similar variations are characteristic of distributors' margins in several other commodities is suggested by the discussion.

2. Volume of Business Activity

Chapters III through VI deal with seasonal variations in separate branches of industry and trade. Before studying the seasonality of the volume of credit it is important to consider seasonal disturbances in production and trade, each taken as a whole.

Manufacturing production, as represented by the Federal Reserve Board indexes, shows a peak in the spring and autumn (March and October), and troughs in July and Decem-

ber (Chart 35).[3] The seasonal movement in the production of minerals is substantially different. Activity is at a high level during the summer and autumn, reaches a peak in September and October, and is at a low level from December through March. Since bituminous and anthracite coal together have a weight of 48 per cent in the total index, the pattern reflects the high level of activity in coal mining during the summer and autumn in preparation for winter demand. Total industrial production, which combines manufacturing production and the output of minerals, reflects primarily the seasonal variations in the former since it is much more important.

Just as there are spring and autumn peaks in manufacturing activity, so there are spring and winter peaks in consumers' demand. The considerable swing in demand is reflected in the seasonal index of retail trade. The influence of the Christmas holiday is especially conspicuous.

The pattern of the seasonal swing in sales by wholesalers follows that of manufacturing activity, but the pattern suggests that changes in sales at wholesale are preparatory to the seasons in consumers' buying. For this reason the autumn peak in sales by wholesalers is much more conspicuous than the spring peak.

The foreign trade of the United States traces seasonal patterns very different from those of domestic trade. Imports reach their peak in late winter and early spring, reflecting principally the seasonal pattern of crude rubber and cane sugar imports. Exports reach a peak in the autumn, reflecting primarily the movement of the agricultural crops out of the country. The difference between the seasonal patterns in imports and exports reveals an appreciable seasonal variation in the balance of trade. Both imports and exports are low in midsummer, their seasonal patterns resembling in this respect those of manufacturing activity and domestic trade.

Series on bank debits form the most comprehensive index of the total dollar volume of business activity, reflecting not only a large fraction of domestic and foreign trade, of sales by manufacturers and mining companies, but also wage and

[3] This, and the following seasonal indexes for mineral and total industrial production, were obtained by dividing the uncorrected index of production for 1925 by the corrected index.

salary payments, movements from hand to hand of agricultural raw materials, rent payments, speculative activity, flow of payments to governments, and many other specific streams. The series, separated into two groups, one for New York City and the other for all cities outside New York, serve as evidence of the persistent and appreciable seasonal variations in business activity at large.

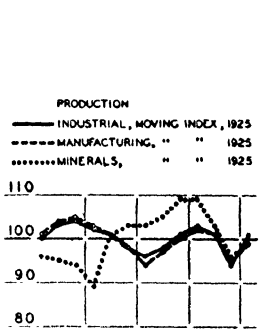
The indexes on Chart 35 show a definite recurrent swing in bank debits, and as the two indexes for New York City indicate, the pattern persists from one period to the next. There are in both series clearly defined troughs in mid-summer and in February, and peaks in the spring and at the end of the year. The seasonal indexes for debits in New York City and in the cities outside are so similar that the correspondence can be traced from month to month. The amplitudes of the seasonal indexes are not very wide, but since the series combine so many divergent streams and the opportunity for cancellation of different seasonal patterns is so great, these amplitudes appear significant.

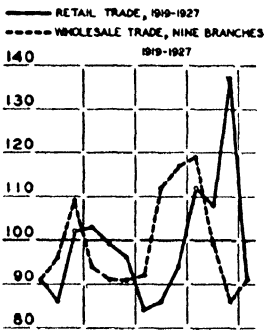
The other indexes on Chart 35 also cover data that reflect business at large. Postal receipts are a good index of personal and business activity in so far as they reflect changes in communication, and to a smaller extent, in transportation (parcel post). The resulting seasonal pattern is very similar to that observed in bank clearings, retail and wholesale trade, and most of the manufacturing activities—a spring peak in March and a winter peak in December, together with a pronounced trough in July. The indexes for the three periods show a remarkable persistence of pattern.

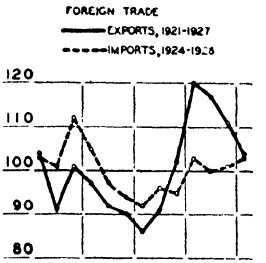
Cars loaded with revenue freight, like postal receipts, measure changes in business activity at large as these are reflected in changes in transportation activity. However, they show much slighter traces than postal receipts of the influence of such conventional factors as determine seasonal peaks and troughs in retail trade. Manufactured goods constitute the largest part of the important groups of miscellaneous freight and merchandise in less than car lots. Since these groups, as well as agricultural crops, show high levels in the autumn, the single prominent seasonal peak in car loadings that occurs in October seems understandable. The trough occurs in

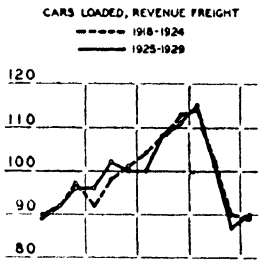
CHART 35

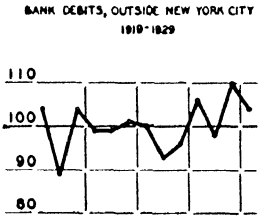
SEASONAL MOVEMENT OF PRODUCTION AND TRADE

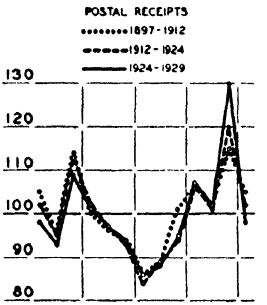


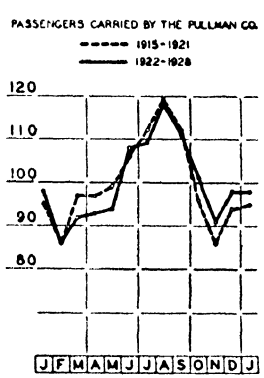


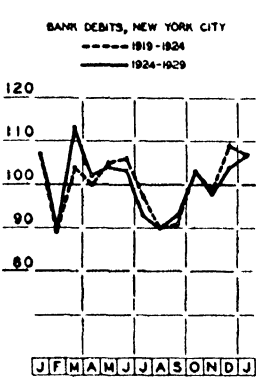


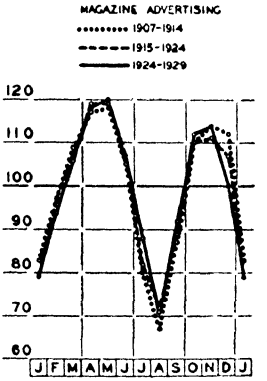












January, after the peak movement of goods to wholesalers and retailers, and after the crops have been moved.

Passenger transportation, as reflected in Pullman Company records, shows a seasonal peak in August. This is an interesting and significant coincidence with the seasonal pattern of gasoline consumption (see Chapter V) which also rises to a peak then. Obviously people on vacation travel mostly in August and in the immediately preceding and succeeding months. The troughs in November and February are largely accounted for by the secondary vacation and holiday movement in December and January. Were it not for the holidays in these two months, passenger transportation would fall off gradually to a long plateau-trough during the winter.[4] In both car loadings and passenger transportation the indexes for the successive periods show a clear persistence of seasonal pattern.

Magazine advertising shows the two-peak pattern characteristic of trade and manufacturing activity in general. But both the spring and the autumn peaks are later than usual, the former occurring in May, the latter in November. The spring peak in advertising may be attributable to the combined influence of the automobile and summer goods seasons. The autumn peak in advertising comes exactly midway between the October peak in wholesale trade and manufacturing and the December peak in retail trade. This midway pattern may be accounted for either by the influence on advertising of wholesale trade, manufacturing and retail trade, or by the dominance of retail trade. In the latter case the peak in advertising might be expected to precede somewhat, as it does, the actual peak in sales, since advertising is used in preparation for the expected upturn in consumers' demand in December.

At any rate, the seasonal swing in magazine advertising is quite appreciable, as are the swings in all the other series. Thus, for the recent period, roughly 1922 to 1929, the average deviation of the index is 8.2 for postal receipts, 12.7 for magazine advertising, 6.3 for cars loaded and 7.9 for passengers carried, measures which are larger than those in many branches of manufacturing activity.

[4] See discussion in The Stability of Railway Operations, by Julius H. Parmelee in *Business Cycles and Unemployment* (National Bureau of Economic Research 1923) pp. 213-17.

3. Credit, Currency and Speculation

Seasonal variations in the volume of credit and currency are small, partly because the seasonal indexes are percentages of huge totals, partly because of the addition in these totals of many different seasonal movements. But though small in amplitude, the seasonal swings are so similar from series to series that little doubt need be entertained as to the significance of the indexes.

Total loans by reporting member banks afford the best estimate of the volume of commercial credit. The seasonal index shows low levels during the first half of the year, high levels in the autumn and winter, with a peak in November and December (Chart 36).

The total volume of money held by the Federal Treasury, the banks and the public, shows a similar pattern with high levels during the autumn and winter, a peak in December and low levels during the first half of the year. Of this total volume of currency in circulation Federal Reserve notes form the most elastic part. Their seasonal index repeats the pattern traced by total money in circulation but has an appreciably wider amplitude and defines more clearly the exact date of the seasonal peak, which occurs in December, and of the trough, which falls in June.

These swings in credit and currency are determined primarily by seasonal variations in the distributive trades and industry, especially in the former, and they cause like fluctuations in the volume of credit advanced by the Federal Reserve system.

> The more fluctuating of . . . . currency demands arise out of (1) retail trade, where hand-to-hand money is extensively used both by the public in making purchases and by merchants in furnishing change; (2) payroll requirements; and (3) agricultural prosperity in those sections of the country where banking facilities are limited, or the banking habit has not become fully developed. The public demand for currency varies, accordingly, with the activity of retail trade and fluctuations in retail prices, with the state of industrial employment and the level of wage rates, and with the prosperity of those regions, largely agricultural, where the banking habit is not fully developed.
>
> These several sources develop a characteristic seasonal movement in currency demand. During the late spring and early summer when retail trade is inactive, and industrial employment is seasonally low, currency returns from the public to the banks, since a smaller amount in the

aggregate is required for pocket money, for till money in retail establishments, and to provide for industrial payrolls. As the banks have no use for excess currency above their own till money needs, they deposit this return flow of currency in their reserve balances at the reserve banks where it adds to the supply of reserve funds and becomes available for reduction of borrowing at the reserve banks. During the fall and winter, on the other hand, from late harvesting time on, when both retail trade and industry are more active, a larger volume of currency is withdrawn from our banking institutions to meet wage payments in harvesting, industrial payrolls, and the till and pocket money requirements of retail trade. This movement draws an increasing amount of currency into circulation from August until the year-end holidays. To obtain this currency non-member banks draw on their member bank correspondents, and member banks draw on the reserve banks where the withdrawal is charged against their reserve balances, and, in the absence of new supplies of reserve funds from other quarters, results in an increase in borrowing at the reserve banks. This borrowing is usually liquidated in January when the demand for currency slackens as industry and retail trade in that month become relatively inactive.[5]

How the Federal Reserve system assists in providing funds that can be used by commercial banks in meeting the seasonal peak in the demand for currency is revealed not only by the index for the volume of Federal Reserve notes in circulation but still more clearly by the changes in the volume of bills discounted and of bills bought in the open market. Bills discounted show seasonally high levels throughout the second half of the year, declining sharply from December to February, that is, during the months when the demand for currency falls off rapidly (Chart 36). The rise in bills bought in the open market during the second half of the year is explained by the greater volume of bills in the market, reflecting additional agricultural and commercial transactions. It is usually the policy of the Reserve banks to buy all bills offered, and so to adjust their rates to market rates as to assure sales to themselves in fairly large volume. Then as the supply of bills falls off after December, holdings decline drastically to a trough in August.

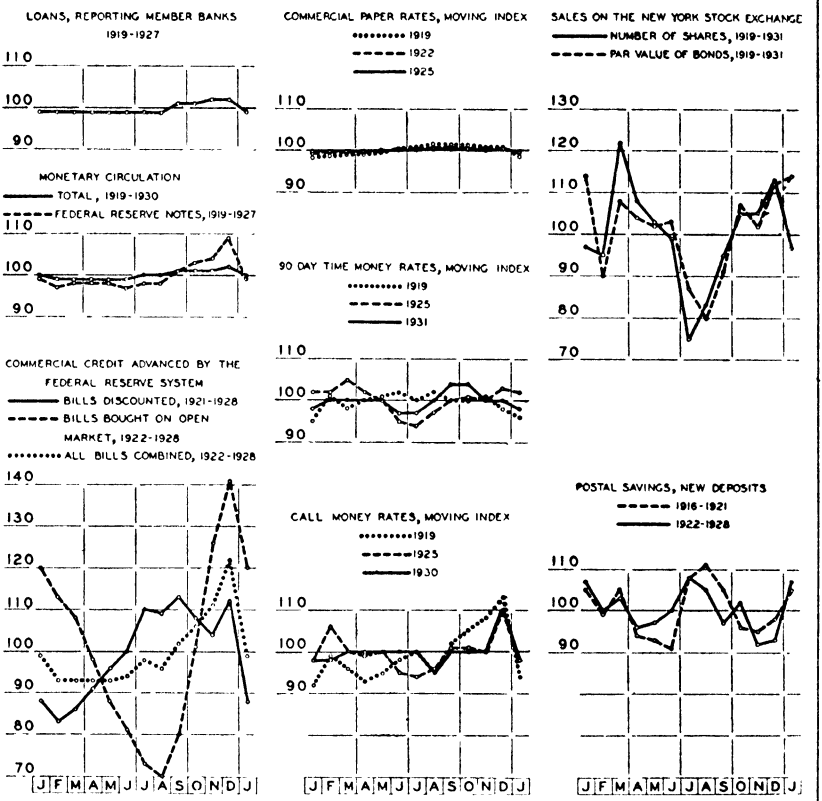
How closely the credit activity of the Reserve system follows the seasonal demands for currency is revealed by the combined seasonal index of bills discounted and bills bought (the former with a weight of 2, the latter with a weight of 1). While this combined index still omits purchases of govern-

[5] Winfield W. Riefler, *Money Rates and Money Markets in the United States* (New York 1930) pp. 137-8.

ment securities (a third form of Reserve bank financing), it represents the bulk of the system's credit. Its seasonal pattern is almost an exact replica of that in monetary circulation,

CHART 36

SEASONAL MOVEMENT OF CREDIT, INTEREST RATES AND SPECULATION



characterized by low levels during the first half of the calendar year, a peak in December and rapid decline thereafter. The seasonal amplitude is, naturally, more appreciable, if only for the reason that it measures relative changes in a much smaller absolute amount than is formed by money in circulation.

In view of this close adjustment of seasonal variations in Federal Reserve credit to those in business demand for currency, it is not surprising to find that the price of commercial credit in the private market has usually varied very little seasonally and recently not at all. Moving seasonal indexes computed by Dr. Frederick R. Macaulay for commercial paper rates (60 to 90 day, prime, one or two signature) show no seasonal changes after 1925 and very mild variations between 1919 and 1925. The seasonal pattern, when visible, shows the expected low levels during the first half of the calendar year and high levels during the second half.

While rates on commercial paper evince no seasonal changes after 1925, rates on 90 day time paper (collateral) continue to have marked seasonal variations. Dr. Macaulay's moving seasonal indexes, presented on Chart 36, indicate a peak in the spring and in the autumn. The reason for this persistence of the seasonal element in rates on time loans may be twofold: collateral time paper is not discountable at the Federal Reserve banks, and with the general growth in the volume of security collateral paper between 1924 and 1930 the seasonal peaks in the general demand for credit exercise a pressure on the supply that is not entirely cancelled by the Reserve banks' credit policy.

The seasonal indexes in call loan rates reflect activity on the stock market as well as general seasonal changes in supply and demand on the credit market. The rates are low in midsummer and in January, and high in December. But while the March and April levels of stock sales are higher than those of November and December, call money rates are higher in winter than in spring, obviously because of the greater general demand for credit during the winter and the greater relative supply of credit during the spring.[6]

The other indexes on Chart 36 present an interesting contrast between seasonal patterns in speculative activity and those in investment by small savers. The data on speculative activity are the number of shares and the par value of bonds sold on the New York Stock Exchange. In these, in spite of a very sharp cyclical swing and very prominent minor move-

[6] For an extensive discussion of the seasonal variations in call money rates, number of shares sold and stock prices, see Richard N. Owens and Charles O. Hardy, *Interest Rates and Stock Speculation* (New York 1925) Chapter II, pp. 18-41.

ments, the seasonal patterns are definite. Both indexes show the mid-summer lull which is characteristic of so many aspects of business activity and is obviously a reflection of vacations and the dull state of general business. In bond sales the most prominent peak is in January, while in stock sales there are two peaks, one in March, the other in December, the latter probably due to liquidation sales for income tax reports. The reasons for the former and for a January peak in bond sales are not clear.

The seasonal pattern in new deposits on postal savings accounts is strikingly different. Persistent from period to period, it may be taken to be representative in spite of its small amplitude. The two troughs in this seasonal pattern, one in April and the other in November-December, correspond to the peaks in retail sales. The greater expenditures entailed during these months obviously prevent any accumulation of savings. Similarly, the mid-summer peak occurs when trade is dullest. The winter peak in January and partly in March appears to be a result of greater earnings during winter months unaccompanied by greater expenditures.

Thus in the various aspects of financial activity, in the volume of credit and open market operations of the Reserve banks, in speculative activity, in the surplus available for savings deposits, distinct, and in most instances, highly persistent seasonal patterns reflect primarily the short-time swings in trade and production as a whole. Other types of swings, however, result rather from conventional terminal dates in accounting and discharge of claims and are most manifest in series relating to disbursements of incomes from property and to profits and losses in business enterprises.

4. Disbursement and Flow of Incomes from Property

Both in dividend and interest payments the quarter months stand out prominently as four peaks: January, April, July and October (Chart 37). In dividend disbursements January is by far the highest peak, especially during the period 1922-30, and while July is somewhat higher than the other two quarter months, there is not the same difference between them as there is between these three quarters and January. In interest payments January and July are almost equally high, this feature being especially marked in the recent period.

These seasonal patterns obviously result from the conventional practice of paying dividends and interest quarterly or semi-annually and have little connection with any seasonal swings in the production of these incomes. It is not surprising to find then that these conventions exercise some influence upon the seasonal patterns in bank debits. The reason that for the latter, in contrast to production and trade, the low month is August instead of July and that January is so high may lie in the custom of satisfying claims and disbursing certain types of income in July and January.

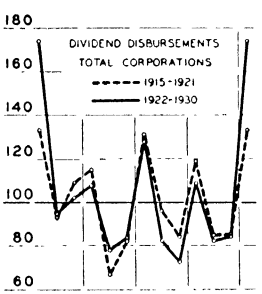
Similar conventional factors largely determine seasonal changes in business failures. The indexes for the number of failures, both in manufacturing and trading concerns, have their peak in January, the month in which the balance is struck and in which many corporations have to satisfy creditors' claims. For trading concerns the number of failures is also high during the preceding and succeeding months, December and February, while for manufacturing concerns the level is about the same throughout the year, except in September, when the seasonal trough occurs in both series, probably because it is not a claim month but occurs during the busy season when enterprises may profit from an increased volume of business.

It is probable that the swing in the number of failures in manufacturing is much less appreciable than that in trading because of the greater seasonal synchronism of various branches of trade and greater similarity of their conventional settling dates. As greater variety of branches and of trading habits may be expected among manufacturing concerns, the large amount of cancellation of divergent seasonal movements may produce a milder swing in the total.

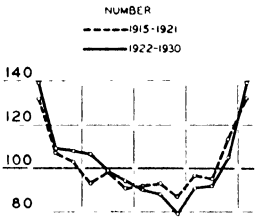
This difference in seasonal amplitude between manufacturing and trade is smaller in respect of liabilities of failed concerns. Apparently the average volume of liabilities per failing concern is greater during the months when many failures occur than during the months when fewer concerns fail. Smaller concerns fail during months which do not coincide with fixed settling dates perhaps because the larger concerns obtain credit in the form of bonds or other settled obligation with fixed dates for discharging claims. This is especially true of manufacturing concerns, in which for that reason the

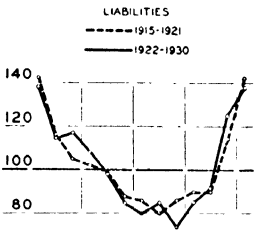
CHART 37

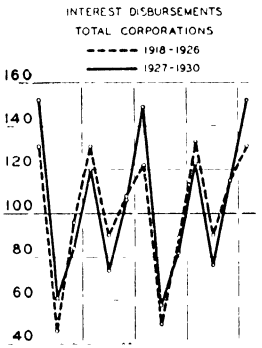
SEASONAL MOVEMENT OF DISBURSEMENTS, FAILURES AND INCOME



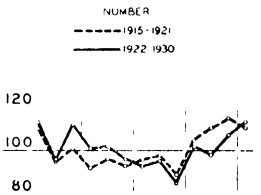
TRADING FAILURES

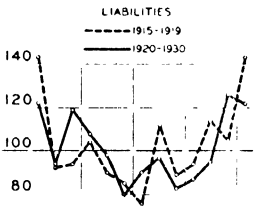




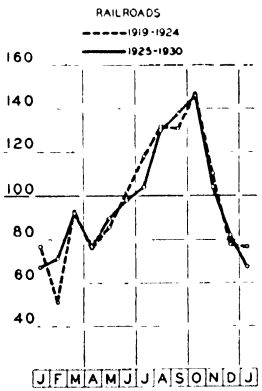


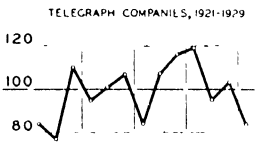
MANUFACTURING FAILURES

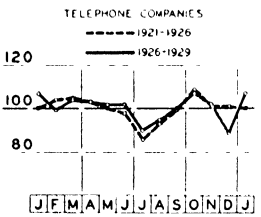




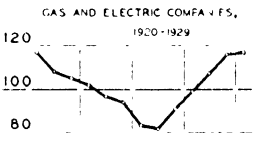
NET OPERATING INCOME

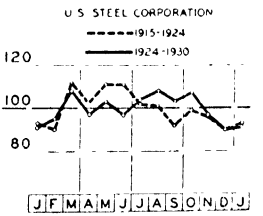






NET EARNINGS





seasonal swing in liabilities is much wider than the seasonal swing in the number of failures.

That seasonal changes in the payment of dividends and interest, and in failures, are not determined by the effects on net earnings of swings in actual volume of economic activity seems obvious from a direct comparison of the two. Moreover a direct proof of the statement is afforded where data on actual monthly net earnings are available. Seasonal swings in these net earnings correspond very well to those in the volume of activity although they sometimes lag slightly. They show no similarity, however, to the variations in the disbursements of dividends (or interest) and in failures.

Thus the series for net operating revenue of railroads yields a seasonal index which is an almost exact copy of the patterns in car loadings of revenue freight (compare Charts 35 and 37). For each the peak occurs in October and the trough in January. The amplitude is considerably wider in operating revenue than in car loadings because the average base to which these seasonal changes are related is much smaller in the former than in the latter. But the similarity of movement is a clear indication of the influence of the original swing in volume of activity.

The same would be true of the other indexes, were data available on the volume of activity. For telegraph companies the index of net operating revenue suggests the two-peak pattern characteristic of wholesale business and manufacturing: a peak in the spring, a trough in July and a higher peak in October. This is a pattern that might be expected in an industry whose services are used primarily for business purposes. The conventional elements have little influence, except possibly on the June peak which may be caused partly by wedding and graduation seasons.

For telephone companies the pattern is materially different. Here the mid-summer trough is more pronounced, probably owing to the absence of people on vacation. Similarly, the December trough seems to be a complement of the travel peak during December, just as the summer trough is the complement of the peak in the movement of passengers. The peak in October may reflect the peak in regular business or the moving season and charges for new installations. The latter may

also explain to a certain extent the high levels during May and June. By and large, seasonal variations in net revenues of telephone companies are quite mild and are in accord with the presumable fluctuations in the total volume of business.

Climatic rather than conventional factors affect gas and electric companies. During the summer the need for lighting is obviously small; also, on account of the general mid-season lull in activity, the power supply for industrial purposes is less in demand. Moreover, less gas is used in heating and cooking, for cold foods are more generally consumed and many city dwellers move beyond the limits of gas range installation. Exactly the opposite happens in winter. The pattern in net operating revenues of gas and electric companies thus appears to be in close correlation with the probable influence of climatic factors. It has a considerable seasonal swing, whose pattern might be expected to show a rather high degree of persistence.

The seasonal pattern in the net earnings of the United States Steel Corporation during 1915-24 is similar to that for ingot production between 1926 and 1931. The change in the pattern in earnings during the later years may possibly be due to a decline in the relative importance of such materials as automobile or structural steel among the products of the company. If this conjecture is true, it would help to explain the reappearance of the autumn peak in earnings and the dwindling importance of the spring peak.

5. Employment and Payrolls

To measure seasonality in employment and payrolls in order to observe the effect of short-time fluctuations in volume of activity upon the stability of opportunity to work and enjoy income, data are, fortunately, easily available. In its study of employment in manufacturing industries the Federal Reserve Board computes seasonal indexes for a number of industries. The data which it assembles on payrolls had to be analyzed to enable us to determine the characteristic seasonal patterns. Of the many measurable branches of industrial activity, only those were selected for which measurements of the seasonal swing in production were available.

CHART 38

SEASONAL MOVEMENT OF EMPLOYMENT, PAYROLLS AND PRODUCTION IN FOOD PRODUCTS

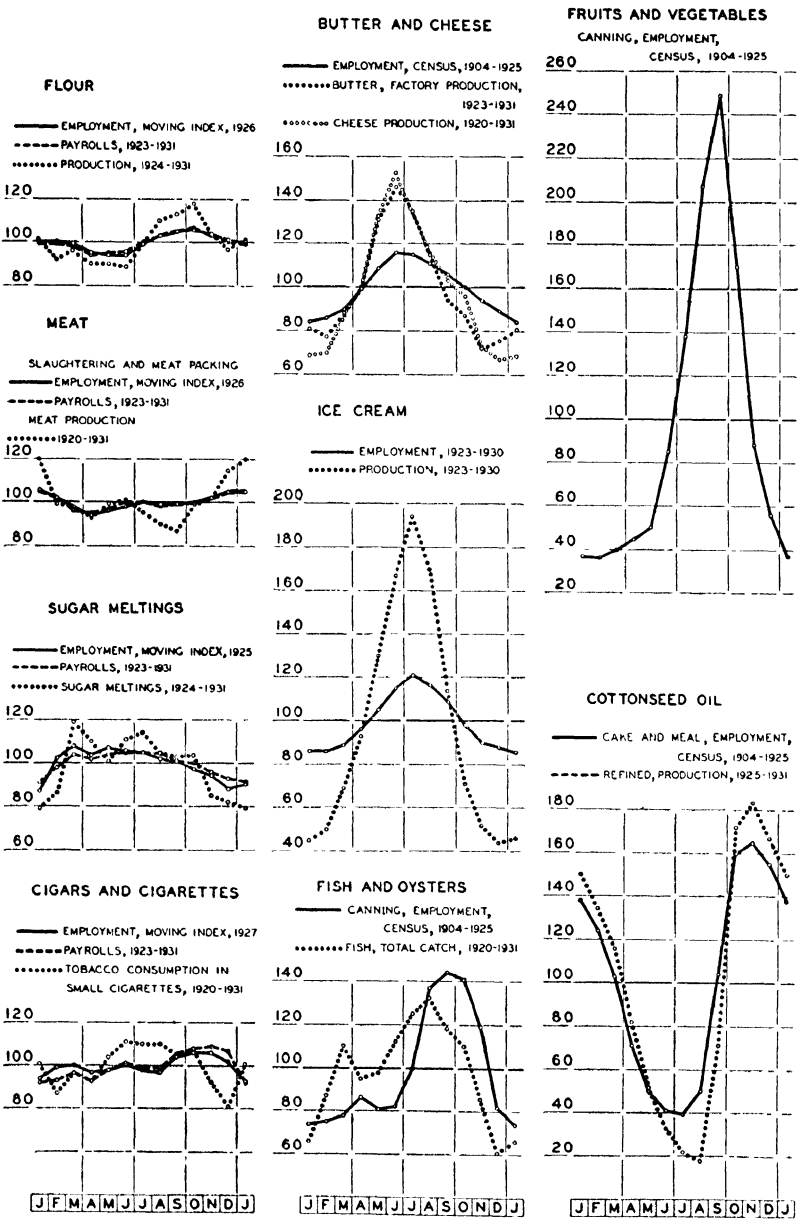
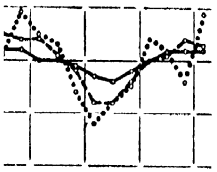


CHART 39

SEASONAL MOVEMENT OF EMPLOYMENT, PAYROLLS AND PRODUCTION IN TEXTILES

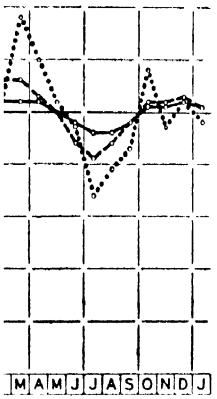
OTTON GOODS

EMPLOYMENT, MOVING INDEX, 1928
PAYROLLS, 1923-1931
RAW COTTON CONSUMPTION BY TEXTILE MILLS, 1922-1931



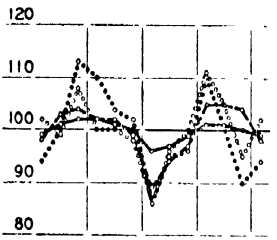
IISHED COTTON GOODS

AND FINISHING
- EMPLOYMENT, MOVING INDEX, 1926
- PAYROLLS, 1923-1931
) COTTON GOODS
, PRODUCTION, 1921-1931



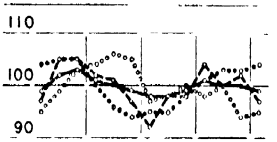
HOSIERY AND KNIT GOODS

EMPLOYMENT, 1919-1930
PAYROLLS, 1923-1931
KNIT UNDERWEAR, PRODUCTION, 1924-1931
HOSIERY, PRODUCTION, 1923-1931



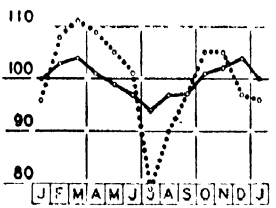
SILK

EMPLOYMENT, 1919-1930
PAYROLLS, 1923-1931
BROAD LOOMS, ACTIVITY, 1922-1931
NARROW LOOMS, ACTIVITY, 1922-1931



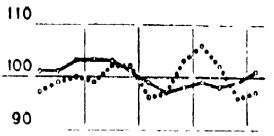
BUTTONS

EMPLOYMENT, CENSUS, 1904-1925
FRESH WATER PEARL, PRODUCTION, 1922-1931



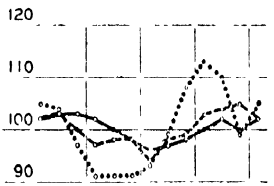
WOOLEN GOODS

EMPLOYMENT, CENSUS, 1904-1925
SPINDLE HOURS ACTIVE, 1921-1931



WORSTED GOODS

EMPLOYMENT, CENSUS, 1904-1925
PAYROLLS, WOOLEN AND WORSTED GOODS, 1923-1931
SPINDLE HOURS ACTIVE, 1921-1931



CARPETS AND RUGS

EMPLOYMENT, 1919-1930
LOOM HOURS ACTIVE, 1924-1931

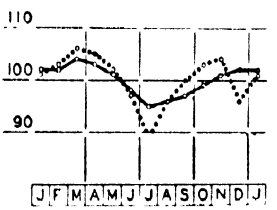


CHART 40

SEASONAL MOVEMENT OF EMPLOYMENT, PAYROLLS, PRODUCTION AND SALES IN CLOTHING, SHOES AND MISCELLANEOUS

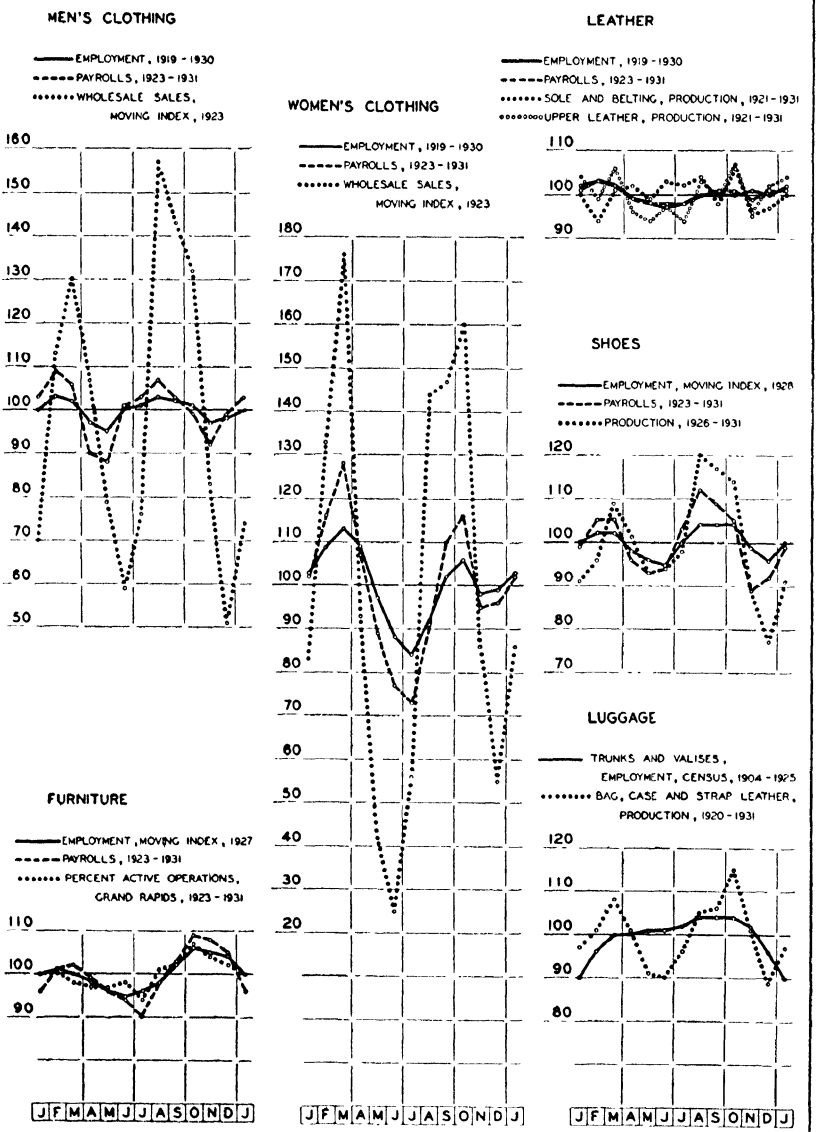


TABLE XIII

Amplitude of Seasonal Variations

Manufacturing Production, Employment and Payrolls

		Average Deviation	Range
FOOD PRODUCTS			
Flour	production, 1924-31	7 8	29
	employment, 1923-30	3 1	12
	payrolls, 1923-31	3.1	13
Meat	total production, 1920-31	6.5	33
	employment, 1923-30	2.4	10
	payrolls, 1923-31	2.4	10
Sugar	meltings, 1924-31	11.2	40
	employment, 1923-30	4.6	17
	payrolls, 1923-31	4.0	14
Tobacco	mfd. and snuff consumption, 1920-30	5.6	28
	employment, 1923-30	2.2	11
Tobacco	cigarette consumption, 1920-31	8.2	30
	employment, 1923-30	2.7	12
	payrolls, 1923-31	4 9	17
Butter	factory production, 1923-31	21.2	74
	employment (butter, cheese and dairy), Census	9 6	32
Ice Cream	production, 1923-30	45 8	150
	employment, 1923-30	11.2	35
Fish	total catch, 1920-31	17.8	71
	canning (fish and oysters) employment, Census	23 6	70
Fruits and Vegetables	carlot shipments		
	apples, 1920-31	81.5	408
	peaches, 1918-31	131 0	422
	tomatoes, 1918-31	68.7	277
	string beans, 1924-26	85.6	329
	canning, employment, Census	60.5	212
Cottonseed, Refined Oil	production, 1925-31	53.7	165
	employment, cottonseed oil meal and cake, Census	41 5	126
TEXTILES AND LEATHER PRODUCTS			
Cotton	consumption, 1922-31	5.7	21
	employment, cotton goods, 1923-30	2.3	9
	payrolls, 1923-31	3.7	13
Finishing and Dyeing	billings, 1921-31	7.0	34
	employment, 1923-30	2 0	7
	payrolls, 1923-31	3.8	15

TABLE XIII (CONTINUED)

		Average Deviation	Range
Knit Goods	underwear production, 1924-31	6.6	27
	hosiery production, 1923-31	4.3	25
	employment, 1923-30	1.5	6
	payrolls, 1923-31	4.0	16
Buttons	fresh water pearl production, 1922-31	7.1	32
	employment, Census	2.5	10
Woolen Goods	spindle activity, 1921-31	2.6	10
	employment, Census	1 8	6
Worsted Goods	spindle activity, 1921-31	6.6	22
	employment, Census	2 0	7
	employment, woolen and worsted, 1923-30	2.3	9
	payrolls, woolen and worsted, 1923-31	2.8	11
Carpets and rugs	loom activity, 1924-31	3.8	17
	employment, 1923-30	2.6	9
Silk	broad loom activity, 1922-31	3.6	11
	narrow loom activity, 1922-31	3 1	12
	employment, 1919-30	1.1	5
	payrolls, 1923-31	3.1	13
Leather	production, sole and belting, 1921-31	2.9	12
	production, upper, 1921-31	3.8	13
	employment, 1919-30	1.3	6
	payrolls, 1923-31	1.4	5
Shoes	production, 1926-31	10.2	43
	employment, 1923-30	2.6	10
	payrolls, 1923-31	6 3	23
Men's Clothing	wholesale sales, 1923	30.3	106
	employment, 1919-30	2 1	8
	payrolls, 1923-31	5.3	21
Women's Clothing	wholesale sales, 1923	43.3	151
	employment, 1919-30	7.0	29
	payrolls, 1923-31	13.2	55
Bag, Case and Strap Leather	production, 1921-31	6 2	26
	employment, trunks and valises, Census.	3.1	14
	AUTOMOBILES AND RELATED PRODUCTS		
Automobiles	passenger car production, 1919-25	13.2	42
	employment, 1919-24	3.8	15
	passenger car production, 1925-31	21.9	81
	employment, 1925-30	4.1	18
	payrolls, 1923-31	8.6	35

TABLE XIII (CONTINUED)

		Average Deviation	Range
Tires	consumption of rubber, 1921-31	9.0	36
	employment, 1923-30	2.5	9
	payrolls, 1923-31	5.3	23
Glass	polished plate glass production, 1923-31	4 8	24
	employment, 1923-30	2.6	10
	payrolls, 1923-31	3.2	12
Gasoline	production, 1924-30	2.2	12
	employment, 1923-30	1.1	4
	payrolls, 1923-31	1.2	5
	CONSTRUCTION MATERIALS		
Lumber	total production, 1920-29	5.6	21
	employment, sawmills, 1923-30	2 4	8
	employment, mill work, 1923-30	1.2	4
	payrolls, sawmills, 1923-31	3.8	15
	payrolls, mill work, 1923-31	2.4	11
Portland Cement	production, 1919-24	17.6	55
	employment, 1919-24	5.2	18
	production, 1924-30	21.2	69
	employment, 1925-30	4 8	16
	payrolls, 1923-31	6.8	25
Brick and Tile	common brick production, 1924-31	27.2	94
	face brick production, 1923-31	12.2	50
	floor and wall tile, production, 1924-31	5 2	22
	employment, 1923-30	6 4	21
	payrolls, clay products, 1923-31	4.8	20
Structural Steel and Iron	shipments, structural steel, 1924-31	7.3	28
	employment, structural iron, 1923-30	1.9	6
	payrolls, structural iron, 1923-31	2.6	11
Paving Materials	asphalt (petroleum) production, 1925-31	21.3	59
	paving materials, employment, Census	16.8	48
Steam Fittings	radiators, production, 1925-31	9 0	39
	boilers (round and square) production, 1925-31	9.8	61
	employment, 1923-30	1.8	7
	payrolls, 1923-31	3 4	19
Steel Ingots	production, 1919-31	5.9	23
	employment, 1923-30	1.2	4
	payrolls, 1923-31	4 2	14
Furniture	per cent active plants, Grand Rapids district, 1923-31	2.7	13
	employment, 1923-30	2.8	11
	payrolls, 1923-31	4.6	19

Charts 38 through 42 present the numerous comparisons thus made possible. For each industry one or two indexes of seasonal variation in production, employment and payrolls are given. For some industries not covered in the Federal Reserve Board's analysis seasonal indexes of employment were taken from a study of Census data by Dr. Parker J. Bursk.[7]

We may consider in detail a few sections of Chart 38, on which the indexes for the various groups of food products are assembled, to indicate the type of results obtained. In flour, clearly, the swing in both employment and payrolls follows closely that in flour production. For each the trough occurs in the late spring and the peak in October. Each has an amplitude distinctly smaller than that in production. The two measures of amplitude in production are 7.8 and 29; in employment (the Federal Reserve Board computes a moving seasonal and we are taking the mean average deviation and the mean range for 1923-30) they are 3.1 and 12; for payrolls, they are 3.1 and 13.

A somewhat similar showing may be observed in slaughtering and meat packing, in which the index of production is for total meat (pork, mutton, lamb, beef and veal). For this series also, the Federal Reserve Board computed moving seasonal indexes of employment; and again we have computed the seasonal index of payrolls for 1923-31. As in the case of flour the particular employment index taken for graphical comparison is for a year which in its seasonal amplitude may be considered typical for the entire period. Again the pattern of production is quite similar to those of employment and payrolls, the only difference being that the latter do not show as clearly as does production a trough in August and September. But here again the seasonal amplitudes of employment and of payrolls are substantially smaller than that of production.

This similarity of pattern and marked difference in amplitude may be observed in most of the comparisons presented on the charts. As to the similarity in pattern only two exceptions appear to be significant: (1) for manufactured tobacco and snuff the seasonal pattern in employment does not follow that of production; (2) employment and payrolls in

[7] *Seasonal Variations in Employment in Manufacturing Industries,* Study XIV in the series of Research Studies (Industrial Research Department, Wharton School of Finance and Commerce, University of Pennsylvania, Philadelphia 1931).

the total glass industry have an autumn peak in October-November while production of plate glass has its peak in August. This, however, may be due to the difference in the coverage of the series (Chart 41).

In respect of seasonal amplitude an exact comparison can easily be made. For the series whose seasonal indexes are presented on the charts Table XIII presents the average deviations of the seasonal indexes and the ranges.

The testimony of this long table is quite unequivocal; in respect of all industries except two: fish canning and furniture, the seasonal amplitude of production is wider than that of payrolls; and in all industries except flour, meat, sugar and clay products, the seasonal amplitude of payrolls is wider than that of employment. Since thirty-five industries are studied, it is evident that the exceptions are few.

The reason that seasonal variations in employment appear milder than those in production seems rather clear. Since the data on employment measure the number of people on the payroll, they reflect changes in total employment only. As long as a man is employed by an enterprise, even though he may be absent on vacation, or on sick leave, or not working full time, his name is retained on the payroll. On the other hand, overtime work is not reflected in the data. Hence, series on employment are likely to under-estimate short-time fluctuations in the labor of the working force and therefore tend to show milder seasonal swings than actually characterize its activity.

This argument is based upon the assumption that seasonal variations in the number of hours worked are associated positively with those in total employment. That this is actually so may be seen from the similarity of seasonal pattern in employment and in payrolls, the latter reflecting not only the number of people employed but also the number of hours they work. This relation holds with one interesting qualification. In several industries December payrolls often tend to rise while employment declines.[8] And in other industries payrolls do not show such a decline in December as is evident in employment. Obviously, the dispensation of bonuses or holiday pay may be of some influence in causing a discrepancy between

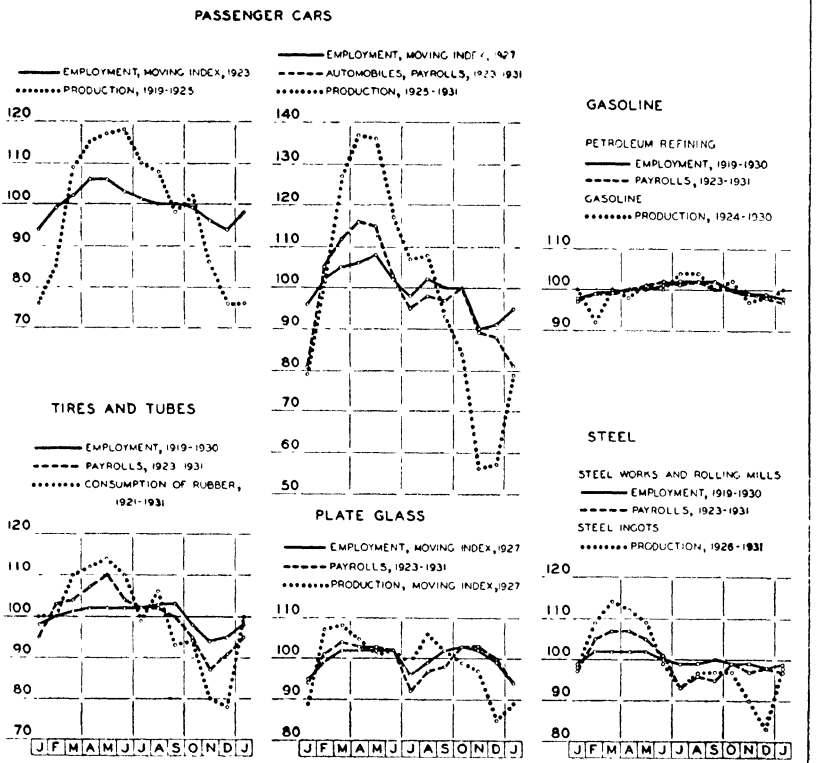
[8] See, *e.g.*, the indexes for knit goods, worsted goods and leather on Chart 40, and for structural iron on Chart 42.

payrolls and employment, a discrepancy which is due not only to the generally larger amplitude of the former.

But if payrolls do reflect rather precisely the actual amount of activity of the industry's working personnel, why should

CHART 41

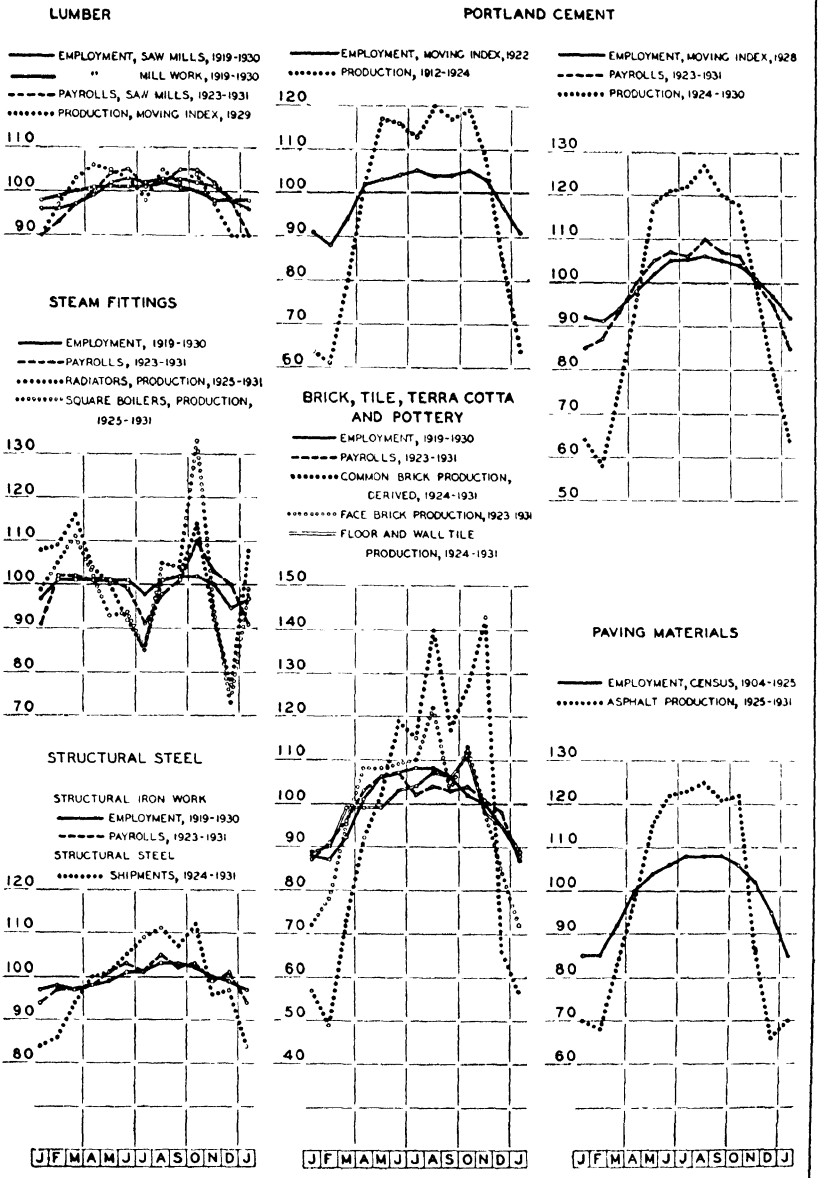
SEASONAL MOVEMENT OF EMPLOYMENT, PAYROLLS AND PRODUCTION IN AUTOMOBILES AND RELATED PRODUCTS



they show a milder seasonal swing than production? How is it possible to produce much more in one month than in another and not have labor cost rise proportionately? The difference may arise partly from the fact that payrolls are reported for shorter periods than production—the payroll period ending nearest the 15th of the month, while production is reported for

CHART 42

SEASONAL MOVEMENT OF EMPLOYMENT, PAYROLLS AND PRODUCTION IN CONSTRUCTION MATERIALS



the entire month. The following factors, however, appear more important: (1) in the seasonally slack months the workers may be less actively engaged even during the hours when they are on the job; vice versa, in the seasonally busy months the workers may be more actively and productively engaged during the hours when they are on the job; (2) some parts of the finished commodities may be produced more steadily throughout the year than are the completed units themselves; or various subsidiary jobs, not directly related to the final product, may be performed primarily in the seasonally slack months, while in the seasonally busy months all energies are concentrated on turning out the finished product.

The actual situation is probably a combination of both possibilities. There is little doubt that pressure for completion of work must be more intense in the seasonally busy months and that there is less tendency to waste time. Also, many enterprises, either as a far-sighted policy or as a matter of month-to-month adaptation, concentrate some work that has little direct relation to final output during the months of slack demand and slack production. The ascertainment of the exact form assumed by such stabilization of work would involve a study of individual establishments that is outside the scope of the present analysis.[9]

Moreover, while the series cover wage-earners, exclusive of salaried employees, it is highly probable that a few white collar workers are actually included, unknown to the Bureau of Labor Statistics, which, with several state agencies, collects the original data. Although the number of white collar employees so reported must be very small, as compared with the number of wage-earners, that is, plant operatives and maintenance men, still, the inclusion of their salaries tends to dampen the seasonal swing in payrolls.

Looking at the exceptions to the generalizations suggested by the table, we find that in two series the seasonal swing in production was milder than the corresponding swings in employment and payrolls: fish canning and furniture. In canning, this may be the consequence of the series compared. Comparison is made not between fluctuations in labor activity and fluctuations in the output of that labor, but between fluc-

[9] Such an analysis is given in Edwin S. Smith, *Reducing Seasonal Unemployment* (New York 1931).

tuations in labor activity and in the supply of the raw material which goes only in part into canning and has many other uses. In furniture the production series covers only a part of the Grand Rapids district, while the indexes of employment and payrolls are supposed to be representative of the country as a whole.

In four industries the seasonal amplitude of employment appears to be larger or at least equal to that of payrolls: flour, meat, sugar and clay products. Also, in glancing over Table XIII we find several industries: gasoline, leather, glass, structural iron and worsted goods, in which, while payrolls do show a wider seasonal amplitude than employment, the difference is rather small. In steel ingots, most textiles, clothing, shoes, furniture and automobiles, on the contrary, the greater seasonal variability of payrolls as compared with employment is rather conspicuous.

Two possible explanations of this different showing of industries may be suggested: (1) In some industries the seasonal patterns in total employment and in hours worked may differ. Thus, for example, if the summer peak in industry is concomitant with a tendency to allow vacations or with a recurrent competitive pull of other industries, the period of seasonally smaller employment will overlap with periods during which more hours are worked. Whether this is the case in such industries as flour production or sugar meltings could be established only from a more intensive study of the working calendar of these branches of productive activity. (2) In many industries operation is continuous, that is, is carried on through the twenty-four hours of the day. In other industries, while operation is not carried on continuously day and night, only one shift, of rigidly fixed duration, is possible. As a result, the number of hours worked will be equal to the number of people employed multiplied by a certain constant factor, and the seasonal swings in employment and in payrolls should be of the same amplitude. Thus, sugar meltings, gasoline production and structural iron might fall under this category. On the other hand, in textiles and automobiles overtime work can be introduced with facility.

PART III

The Variability of Seasonal Movements

CHAPTER VIII

REGIONAL ASPECTS

GENERAL CHARACTERISTICS

Part II discusses the seasonal problem in various groups of industry and trade, utilizing data on the flow of commodities in the country as a whole. Such data obviously give no indication of the variety of seasonal swings which in combination make up a single pattern. Among other sources of such variety concealed by any series that covers so wide a territory as the United States, regional differences are undoubtedly important.

A seasonal index for total production of any commodity may be interpreted as a measure of the burden imposed by seasonality on labor engaged in the industry, on capital funds needed to facilitate actual work and on the industries supplying the raw materials; but only upon the assumption that labor is perfectly mobile, that capital funds flow freely from locality to locality, that enterprises engaged in supplying the essential raw materials cater to the wide-spread market of the country. Only such an assumption justifies the algebraic addition of a high seasonal month in one region to a low seasonal month in another region to produce the index for the country as a whole. However, it is difficult to assume that the factors involved in the production and flow of commodities—labor, capital, materials—are perfectly mobile.

This chapter presents, therefore, for commodities whose movement has been measured for the entire country indexes for much smaller territorial units, usually states. The analysis is limited by the volume of data easily available but they seem to be sufficient to illustrate several types of regional variability.

To ascertain the mobility of productive factors among the various parts of this country is a task to be fulfilled only by dint of intensive study of the country's economic and social regions. To this task a purely statistical analysis of seasonal variations can contribute but little. But it can, using series for territorial units smaller than the country (for example, states or Federal Reserve districts), serve to illustrate the diverse types of regional variations in seasonality and to suggest their scope.

The tentative conclusions of such an analysis, presented in this chapter, may be summarized as follows:

1. In those industries in which climatic factors directly determine the timing of the seasonal swing, regions show divergent seasonal patterns and amplitudes (wheat marketings, Portland cement shipments). An assumption of nonmobility in the productive factors involved would lead to the conclusion that the seasonal index for the country as a whole under-estimates the magnitude of the seasonal burden.

2. In several instances where activity is directly influenced by climate the seasonal patterns still show considerable persistence from region to region (butter production, gasoline consumption). In these instances variations in seasonal amplitude are appreciable and tend to reflect the regional differences in the severity of seasons.

3. The seasonal behavior of manufacturing and distributive activity does not show great regional diversity, owing partly to the origin of seasonal swings in manufacturing industry in variations of the number of working days in the month, summer vacations, etc., and of those in retail trade in holidays. Thus for both groups the seasonal factors are conventions of such character as are likely to be similar throughout the country. If differences in seasonal behavior appear they tend to be reflected in disparate seasonal amplitudes; the seasonal pattern persists. Such differences in seasonal amplitude are likely to be associated with variations in manufacturing and merchandising practice from one region to another.

DETAILED COMMENTS

1. Wheat Marketing by Farmers

Seasonal changes in wheat marketing by farmers are imposed by inexorable climatic factors which may differ in severity and timing from region to region. The data reveal clearly that the totals for the country conceal appreciable variations in the seasonal amplitude and in the timing of their constituent parts.

The essential features of the typical seasonal swings in marketing in various states are presented in Table XIV; the states are divided into six groups on the basis of their showing.

TABLE XIV

WHEAT MARKETING BY FARMERS, PRINCIPAL WHEAT-PRODUCING STATES

TIMING AND AMPLITUDE OF SEASONAL VARIATIONS IN EACH STATE

State	Timing		Amplitude	
	Peak	Trough	Average Deviation	Range
Kansas	July	June	46.6	173
Nebraska	July	June	39.4	143
Maryland	August	June	56.1	197
Virginia	August	June	44 9	155
North Carolina	July	January	36.1	124
Indiana	July	June	70.6	315
Colorado	August	June	69.9	243
Missouri	July	April-May	69.5	264
Illinois	July	June	68.3	301
Iowa	August	June	61.5	242
Oklahoma	July	March	60.3	321
Ohio	July	June	49.0	175
New York	September	July	41 0	129
Michigan	September	June	34 2	104
Pennsylvania	August	April	29.8	135
Oregon	September	June	107 2	394
Washington	September	June	102.3	424
Idaho	September	April	80 9	317
Montana	October	July	75.6	243
North Dakota	September	July	66.4	224
South Dakota	September	April, July	58.8	209
Minnesota	September	July	52.7	191
California	August	April-May	96.9	386
Kentucky	July	April	85.1	374
Texas	July	May	66 8	307

The seasonal indexes grouped as above are presented graphically on Chart 43.

Among the factors which determine both the timing and amplitude of the seasonal movement in marketing the following may be suggested: (a) the degree to which winter or spring wheat is the predominant type grown; (b) the degree to which wheat in general is the predominant crop; (c) the climate of the state, which may make later harvesting and keeping the grain in sacks on the field for some time possible (Far West); (d) the importance of the wheat crop in relation to the general economic activity of the state.

The first group of only two states is by weight probably the most significant. Both Kansas and Nebraska are important winter wheat areas and together account for about 40 per cent of winter wheat harvested. The peak of marketing is in July; the range of fluctuations is relatively narrow.

The next group of three southern states, in which wheat is not of importance, shows wider ranges. Two states, Maryland and Virginia, market their wheat quite rapidly. North Carolina, which is more of an industrial state than either of the other two, has a rather mild swing, comparable in some ways to the swing of the other three industrial states, New York, Pennsylvania and Michigan, but differing in timing because of the difference in climate.

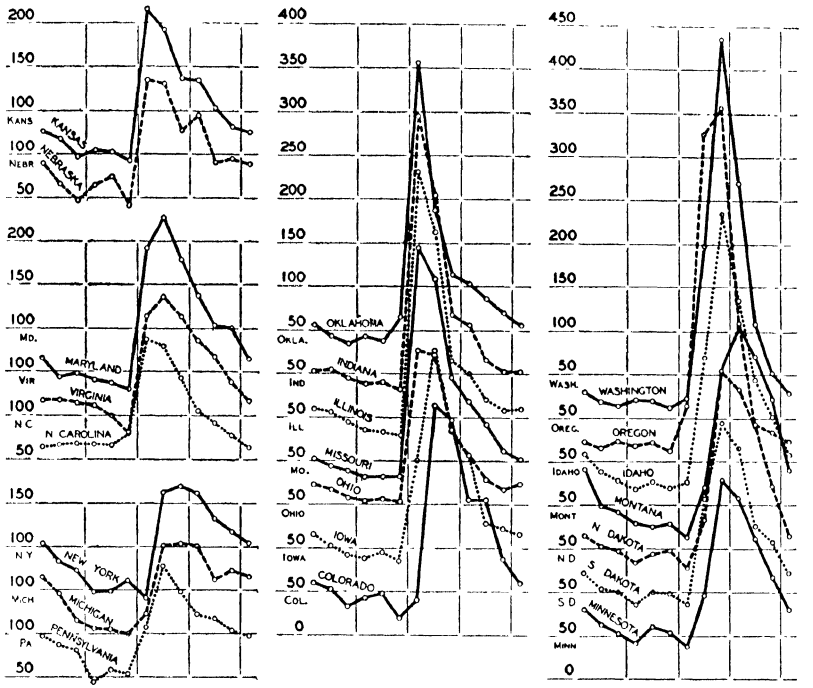
The third group consists of states in which winter wheat is relatively important but comes into competition with other crops. To their location in the Middle West or North is due their similarity in timing. Competition of other crops for labor and machinery and the necessity of removing the wheat from the fields quickly may account for the rather extreme violence of their swing. This seems to be especially true of the first four states of the group, Illinois, Indiana, Oklahoma and Missouri. The swing is milder in the other three, especially in Ohio, which is the most industrialized state of the seven.

The next group exhibits patterns typical of marketing in the great industrial states. The farmers market the wheat, which is a relatively unimportant part of the farm economy, in a leisurely fashion. Only in these three states are marketings above normal, that is, above the line of 100, for fully six months in the year. The range is also very narrow. The

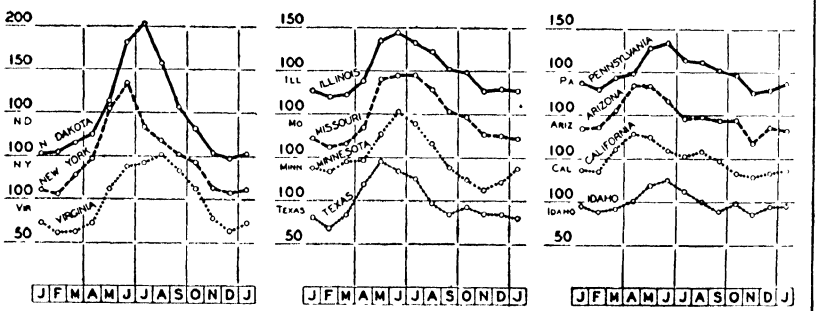
CHART 43

SEASONAL MOVEMENT OF WHEAT AND BUTTER, SELECTED STATES

WHEAT MARKETING BY FARMERS IN SELECTED STATES, 1909-1921



BUTTER, FACTORY PRODUCTION IN SELECTED STATES, 1921-1925



peak is in August or September. Were it not for climatic differences, North Carolina and Ohio would have been added to this group.

The fifth group covers states in which spring wheat is the chief crop. The peak of marketing in these is in September, in one even in October. Since wheat-growing is the main occupation of the farmers and the weather becomes severe early in the winter, marketing proceeds at a much more intensive rate immediately after the harvest. This group has the widest ranges. However, the states in it with the largest acreage, Minnesota and the Dakotas, have the mildest seasonal swings. Other factors disregarded, the greater the area covered by the crop the more stable will the total marketing movement appear, since it will be a sum total of possibly divergent regional movements.

The three states of the last group, California, Texas and Kentucky, are characterized by rather large seasonal swings. The immediate disposal of wheat may be accounted for in Kentucky by the pressure exerted by tobacco and in Texas by cotton. In California the dry weather would make it possible to leave wheat on the fields for some time after harvest, and quick marketing may here be attributable to the pressure of the fruit crops for the release of labor and machinery.

The above grouping may be incorrect for one or two states, but on the whole the division seems logical. Where timing is concerned, the climatic factor and consequently the type of wheat grown are of primary importance. Where amplitude is concerned timing may be of some moment, for the later wheat is harvested the greater may be the pressure for removing it from the fields. But other factors intervene: the extent and the climatic heterogeneity of territory; the degree to which the farmers depend upon the cash returns from wheat crops; and the competitive pressure for labor and machinery on the part of other crops.

To illustrate the extent of seasonal disturbance, upon the assumption of non-mobility of productive factors, the seasonal swing may be computed without algebraic cancellation of peaks and troughs in the index for the country as a whole. Statistical Bulletin No. 12, which contains the marketing percentages for the twenty-five states, also presents their average, taken algebraically. If we convert this average into a

seasonal index, and take the deviations from 100, the quantitative measure of the seasonal swing assumes the following form:

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Av.
+62	+109	+96	+52	+7	−16	−35	−46	−54	−60	−58	−56	54.3

If however the negative and positive deviations from 100 in each state for a given month are added without regard to sign, the total average seasonal swing becomes:

113	116	96	54	32	29	37	46	54	60	58	59	62.8

This second set of figures yields an estimate of the effect of the seasonal disturbance on the flow of wheat, upon the assumption that the factors involved have no mobility at all as among the twenty-five states that are assigned equal weights (and be it added, perfect mobility within the states). The first set of figures, derived from the total index for the twenty-five states, assumes perfect mobility of factors as among the states (and within states). The average disturbance is clearly greater when no cancellation of standings below and above 100 is allowed.

As far as any such method may be used to estimate the burden imposed by seasonal disturbances, the true approximation would probably lie between the two measures. In some respects there is mobility among the states, for example, in labor supply. There is less mobility in storage equipment. On the other hand, even the state figures may conceal rather significant differences in seasonal pattern as among the various regions within one and the same state.

2. Butter Production

In butter production we have another example of an industry in which seasonal variations are most obviously due to climatic influences. It will be remembered from Chapter III that the principal factor in the determination of the seasonal swing in butter production is the increased supply of raw milk during the summer. It might be supposed then that the various parts of the country would show divergent seasonal patterns, since in some regions the climate makes possible year-round out-door pasturage while in others the season is confined to the summer. We find, however, that although

there are differences in seasonal amplitude from state to state, there is a marked persistence of seasonal pattern.

Table XV brings out the principal results of the seasonal analysis.

TABLE XV

BUTTER, FACTORY PRODUCTION, IMPORTANT BUTTER-PRODUCING STATES

TIMING AND AMPLITUDE OF SEASONAL VARIATIONS IN EACH STATE

State [a]	Timing		Amplitude	
	Peak	Trough	Average Deviation	Range
North Dakota	July	December	44.2	155
South Dakota	June	November	34.7	111
Mississippi	August	February	32.2	100
New York	June	February	32.0	128
Massachusetts	June	November	31.8	143
Virginia	August	February	31.8	91
Kentucky	July	February	30.0	92
Montana	July	December, February	29.8	98
Tennessee	August	February	29.8	84
Wyoming	July	February	29.3	96
Nebraska	June	November	29 1	99
Oklahoma	June	November	28 1	91
Ohio	June	February	27.0	90
Missouri	June-July	February	26.9	83
Kansas	June	November	25.2	83
Iowa	June	November	25.2	85
Illinois	June	February	23.2	76
Wisconsin	June	November	22.8	80
Minnesota	June	November	22 8	89
Indiana	June	February	22.7	76
Colorado	June	November	22.0	79
Michigan	June	November-December	21.9	81
Texas	May	February	20.7	78
Oregon	May-June	February	20.0	67
Washington	June	February	16.8	65
Pennsylvania	June	November	15.1	58
Arizona	April	November	15.1	66
California	April	November	14.2	49
Utah	June	November	14 0	63
Nevada	July	February	12.5	48
Idaho	June	November	9.4	39

[a] In order of declining seasonal amplitude.

While the amplitude varies within a rather wide range, the pattern, as delineated by the low and high months, exhibits a considerable degree of persistence. In all the states the peak occurs in the spring or summer, the earliest being in April and the latest in August. But June preponderates heavily, being the peak month in eighteen states, and one of two peak months in two additional states. In all the states the trough occurs during the autumn or winter; fourteen states show the lowest standing in November and fourteen in February.

This similarity of pattern is confirmed by a graphical comparison of the seasonal indexes for selected states, given in Chart 43. The selection was carried through in such a way as to represent adequately each of the three groups of states: those showing rather wide seasonal swings, those showing mild seasonal swings, and the middle group. Within each group a variety of seasonal patterns was chosen. And in spite of this attempt to represent all departures from the prevailing pattern, the similarity in the timing of the seasonal swings presented is striking. It would seem that in spite of differences of climate, and consequent differences in pasture and feeding, a surplus of milk and hence the peak in butter production occur in all regions in the summer.

Because of this close synchronism of the seasonal swings in the various states, the *average* seasonal index for the country as a whole comes out approximately the same when the separate state indexes assigned an equal weight are added together algebraically and when they are added without regard to sign. The results of such computations, in a form similar to that for wheat marketings, are as follows:

With algebraic cancellation:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
−23	−30	−19	−3	+32	+49	+38	+20	−1	−9	−28	−27

Without algebraic cancellation:

23	30	20	13	32	49	38	22	10	11	28	27

Significant differences appear only in two months, April and September. The average disturbance in one index is 23.2, in the other 25.2. The introduction of lack of mobility does not materially change the picture of the *average* swing for the country as a whole.

To explain the variations in the size of the seasonal swing from state to state is rather difficult. There seems to be little geographic or other consistency. Thus, in the group of large amplitudes are states with quite different characteristics—New York and Massachusetts, North and South Dakota, Virginia and Montana. Similarly among the states of mild amplitude we find Pennsylvania next to Arizona, Michigan next to Colorado and Texas. The only apparently significant feature is that the states in the Far West—Colorado, Oregon, Washington, California, Nevada, Idaho, Utah—all show rather mild seasonal variations.

The most plausible explanation of a mild seasonal swing would lie either in a combination of summer and winter dairying, which ought to produce a continuous milk supply to the butter factories, or in the absence of any raw milk market whatever and the consequent lack of an appreciable milk surplus in summer.

3. Portland Cement Shipments

Regional differences in the construction industry, as revealed by the data on building permits and building contracts, have already been studied by Joseph B. Hubbard.[3] To carry further the analysis of seasonal variations which are of such importance to the industry as a whole, we have studied data on shipments of Portland cement by states, reported since 1924 by the United States Bureau of Mineral Resources.

Two considerations guided the choice of the states for analysis: (1) an attempt was made to include widely different climatic conditions so as to secure a representation for each of the most important regions of the country; (2) preference was given to states presenting a substantial demand for cement over smaller states which absorbed only a minor share of the country's total production. The fourteen states thus included were: Pennsylvania, New Jersey, New York, and Maryland (for the East); Illinois, Kansas, Missouri, Ohio (for the four corners of the Middle West); California (for the Pacific Coast); Arizona, Texas, Alabama, Louisiana, Florida (the last three states representing the South). In 1928 these fourteen states received 106 million barrels out of 176 million shipped.

[3] See his An Analysis of Building Statistics for the United States, *Review of Economic Statistics*, January 1924, pp. 32-62.

The indexes are presented graphically in Chart 44; Table XVI indicates the variations in timing and amplitude.

The differences in amplitude revealed by these series for various states are large and significant. The regional differences are much more marked than for the groups in the Harvard analysis cited above, owing undoubtedly to the fact that we have taken single states, that is, smaller divisions than the regions demarcated by Hubbard.

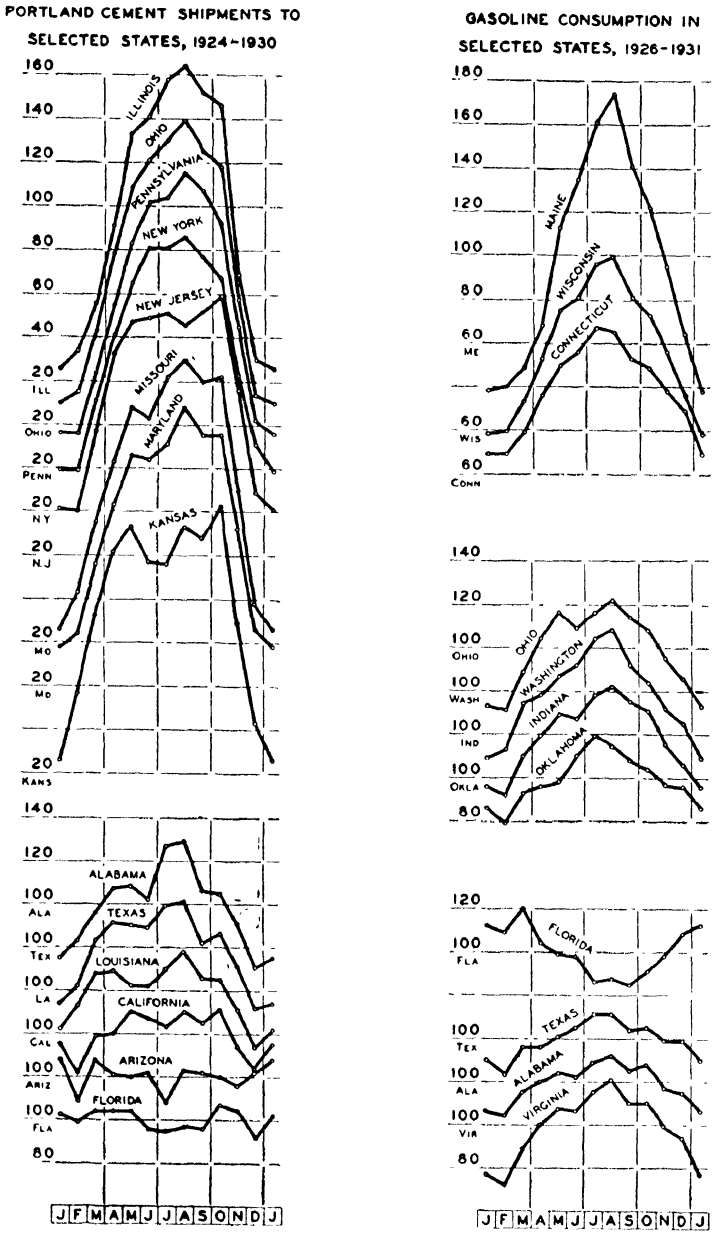
It may be seen also that the violence of the seasonal swing is largely explained by severity of climatic conditions. Illinois and Ohio are the most northern states of the fourteen analyzed and their large seasonal swings are without doubt attributable to their severe winters. The same is true of the next six states. There is a marked drop in the size of seasonal variations between Kansas and Alabama, the average deviation and the range being cut in half. Finally, the very mild seasonal patterns in Louisiana, California, and especially Arizona and Florida, are obviously due to their warm climate.

The first eight states have remarkably similar seasonal patterns, all showing small shipments in November and even smaller shipments from December through March. High levels prevail during the summer. The peak occurs in August in six of the eight states. New Jersey and Kansas show a somewhat different behavior during the summer. In New Jersey there is a minor trough in August and a secondary peak in July. In Kansas a similar summer pattern is repeated in accentuated form, possibly because of the influence of crops: June and July are low months and October shows a sharp peak. During the July harvest labor may be drawn away from construction, returning to it in August, September and especially October. But the same explanation could hardly apply to an industrial state like New Jersey.

The patterns of the seasonal swings in California, Alabama, Louisiana and Texas are somewhat similar to those observed in the colder states, although of course the amplitudes are much narrower. In California low levels prevail in November through February, and fairly high levels in the summer. In Alabama, as in the other states, while the peak in shipments occurs in August, the movement to and from the peak is much sharper. The same is true to a somewhat less extent of Louisiana and Texas. This rapid decline after August, in contrast

CHART 44

SEASONAL MOVEMENT OF PORTLAND CEMENT AND GASOLINE, SELECTED STATES



to the more gradual decline through the later autumn an early winter characteristic of northern states, may be a tributable to the influence of the cotton harvest, which du ing October, November and December draws away the avai able labor force.

Florida and Arizona have entirely different pattern Slightly lower levels prevail in summer, the peak is in eithe

TABLE XVI

PORTLAND CEMENT SHIPMENTS, SELECTED STATES

TIMING AND AMPLITUDE OF SEASONAL VARIATIONS IN EACH STATE

State [a]	Timing		Amplitude	
	Peak	Trough	Average Deviation	Rang
Illinois	August	January	49 0	138
Ohio	August	January	43 7	129
Pennsylvania	August	January-February	40.4	119
Missouri	August	January	38.0	124
New York	August	January-February	36.2	107
Maryland	August	January	33.8	110
New Jersey	October	February	32.8	99
Kansas	October	January	31 9	116
Alabama	August	December	14.0	58
Texas	August	December	13.5	49
Louisiana	August	December	10.0	44
California	October	February	7.7	29
Arizona	January, March	July	4.4	20
Florida	October	December	4.2	15

[a] In order of declining seasonal amplitude.

October or January and high levels prevail during the winte undoubtedly because of climatic conditions, the mild winte temperature being more favorable for outdoor work than th hot summers.

4. Gasoline Consumption

A sales tax on gasoline in most states furnishes data for study of the seasonal swings in gasoline consumption in th various parts of the country. The main features of the in dexes for eleven states, representative of different region are given in Table XVII.

It is remarkable that in spite of considerable climatic differences between the states the seasonal pattern in gasoline consumption persists (Chart 44). In Alabama and Texas, where the cold weather is not as severe as in such states as Maine and Wisconsin, and where therefore the roads are more usable in winter, the peak of gasoline consumption is nevertheless in July or August and the trough in February. Whether

TABLE XVII

GASOLINE CONSUMPTION, SELECTED STATES

TIMING AND AMPLITUDE OF SEASONAL VARIATIONS IN EACH STATE

State	Timing		Amplitude	
	Peak	Trough	Average Deviation	Range
Maine	August	January	41.0	136
Wisconsin	August	January	24.2	81
Connecticut	July	January-February	16.7	58
Washington	August	January	14.7	59
Ohio	August	February	14 6	51
Indiana	August	February	13.7	50
Oklahoma	July	February	9.2	40
Virginia	August	February	11 5	49
Alabama	August	February	6 9	28
Texas	July-August	February	6.2	28
Florida	March	September	9.0	35

this pattern is attributable to a country-wide summer vacation custom or in these southern states to the concentration, in the winter, of the cotton season which prevents much use of cars for pleasure, cannot be determined with any degree of assurance. The fact remains that gasoline consumption, like butter production, shows a generally similar seasonal pattern in regions differing greatly in climate. The only notable exception is Florida, possibly because of its rôle as a winter resort. The peak of gasoline sales is in March, generally low levels prevail in summer, and the trough is in September. The influx of vacationists, evidently of considerable magnitude as compared with the resident population, serves to increase gasoline consumption in winter.

Variations in seasonal amplitude, on the other hand, accord with expectations. In states of considerable weather contrast between summer and winter the seasonal swing in gasoline consumption is wide. This is especially true of Maine and Wisconsin. The influx of summer tourists to Maine probably serves to heighten the summer peak which would have appeared in any case. In Washington, Ohio, Indiana and Oklahoma the seasonal swing is about average. In such states as Alabama and Texas, owing to few extremes of temperature, it is mild.

5. Stocks and Consumption of Cotton

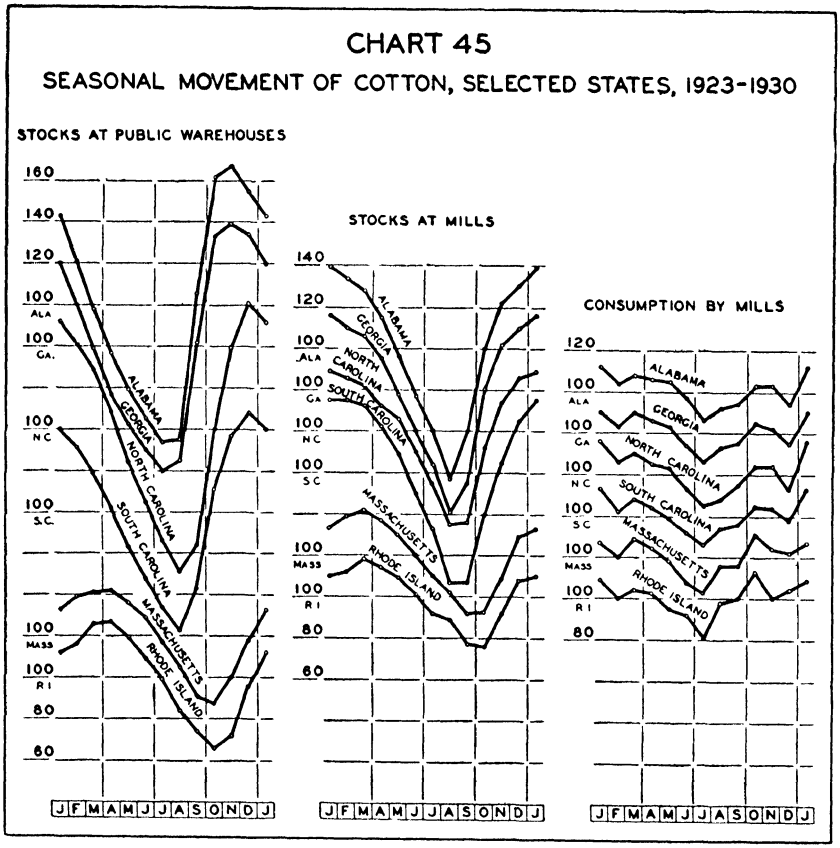
The industries discussed so far are susceptible to the influence of climatic factors. The material variation of these factors from region to region should, of course, make for considerable regional variations in the seasonal behavior of the activity affected. It is interesting to see whether there are significant regional differences in activity when the general seasonal pattern is determined not directly by climatic factors but by conventions and social habits.

The data on stocks and consumption of cotton that are available by states admit of such an analysis. While stocks of cotton at public warehouses and even at consuming establishments are subject to the influence of organic and climatic factors which determine the inflow and concentration of the raw material, consumption of cotton is a purely manufacturing activity, performed under conditions which are relatively independent of climatic or organic forces. These diverse aspects of activity show striking differences in the regional variability of seasonal behavior.

Table XVIII gives the essential features of the seasonal indexes for these three groups of series for each of six states, chosen so as to represent the two important regions of the industry, the South and New England.

It may be seen from Table XVIII and Chart 45 that the nearer the activity is to the influence of the organic seasons the greater is the regional diversity in seasonal behavior. Thus in cotton stocks at public warehouses the amplitude of the seasonal index varies from an average deviation of 42.2 and a range of 133 for the southern state of Alabama to 16.8

and 54 for the northern state of Massachusetts. This difference in amplitude is accompanied by an essential difference in seasonal pattern. In the southern state stocks are lowest at the end of July or August, rising to a peak in November or



December. In the northern state stocks do not begin to rise until after October and are highest at the end of April.

A somewhat smaller but still a substantial regional diversity is to be observed in the seasonal behavior of stocks kept by consuming establishments. Here also the seasonal amplitude is much higher in the southern states, declining almost by half in the New England states. And again there is a difference in the seasonal pattern. In the southern mills stocks

are lowest at the end of August, rising to a peak in January or February. In the northern mills stocks do not begin to rise until after September or October, reaching a peak by the end of March.

TABLE XVIII

STOCKS OF COTTON AT PUBLIC WAREHOUSES, STOCKS AT MILLS AND CONSUMPTION BY TEXTILE MILLS, SELECTED STATES

TIMING AND AMPLITUDE OF SEASONAL VARIATIONS IN EACH STATE

State	Timing		Amplitude	
	Peak	Trough	Average Deviation	Range
STOCKS AT PUBLIC WAREHOUSES				
Alabama	November	July	42.2	133
Georgia	November	July	37.9	119
North Carolina	December	August	38.3	130
South Carolina	December	August	31.4	105
Massachusetts	April	October	16 8	54
Rhode Island	April	October	18.2	61
STOCKS AT MILLS				
Alabama	January	August	28.2	102
Georgia	January	August	26.8	95
North Carolina	January	August	22.2	74
South Carolina	January-February	August-September	27.2	88
Massachusetts	March	September	15.3	50
Rhode Island	March	October	12.2	42
CONSUMPTION BY TEXTILE MILLS				
Alabama	January	July	6.5	26
Georgia	January, March	July	6.3	24
North Carolina	January	July	7 8	31
South Carolina	January	July	5.9	27
Massachusetts	October	July	6.3	28
Rhode Island	October	July	5 5	32

One of the reasons for this difference in seasonal behavior in stocks of consuming establishments may lie in the volume of stocks held. In southern mills the average ratio of stocks held to monthly consumption has been about 1.0 during recent years (varying from 1.3 for South Carolina to 1.0 for North Carolina). In northern mills the ratio has been about 2.7

or 2.8. These ratios confirm the comment made in Chapter IV concerning the different cotton purchasing policies of southern and northern mills.

Regional diversity of seasonal behavior disappears almost entirely when we consider the manufacturing series, consumption of cotton by textile mills. Seasonal amplitude is about the same in southern mills as in northern. There is also a marked similarity of pattern. In all six states consumption is lowest in July, and while in the southern states the peak is in January (or March) and in the northern in October, inspection of the indexes shows that in all states January, March and October are months of high levels of activity. Apparently the relatively stable manufacturing activity is not affected by regional diversity in the supply of raw materials or by possible differences in the seasonal behavior of consumers' demand.

6. Department Stores—Sales and Stocks

Distributive trades, when studied by regions, appear to show as little diversity of seasonal behavior as manufacturing activity. An effective illustration is afforded by the seasonal indexes for department store sales and stocks computed by the Federal Reserve Board for eleven Reserve districts (one district is omitted for lack of data) for the period 1919-27. Although the Reserve districts are much larger territorial units than states, still they segregate regions in which the seasonal behavior of natural factors is quite divergent. Thus the Atlanta, Richmond and Dallas districts represent the southern states while such districts as Boston and Chicago cover the North-northeast. If climatic or conventional differences have any influence on the seasonal behavior of retail trade this should appear in the comparison of the seasonal indexes for these regional units.

Table XIX presents the most conspicuous features of the seasonal indexes.

The similarity of the seasonal pattern appears clearly (Chart 46). The primary peak in sales in all districts is in December, accounted for by Christmas buying. The much lower secondary peak shifts from April to May. Similarly, the primary troughs in sales fall in July or August in all districts

CHART 46

SEASONAL MOVEMENT OF DEPARTMENT STORE SALES AND STOCKS BY FEDERAL RESERVE DISTRICTS, 1919-1927

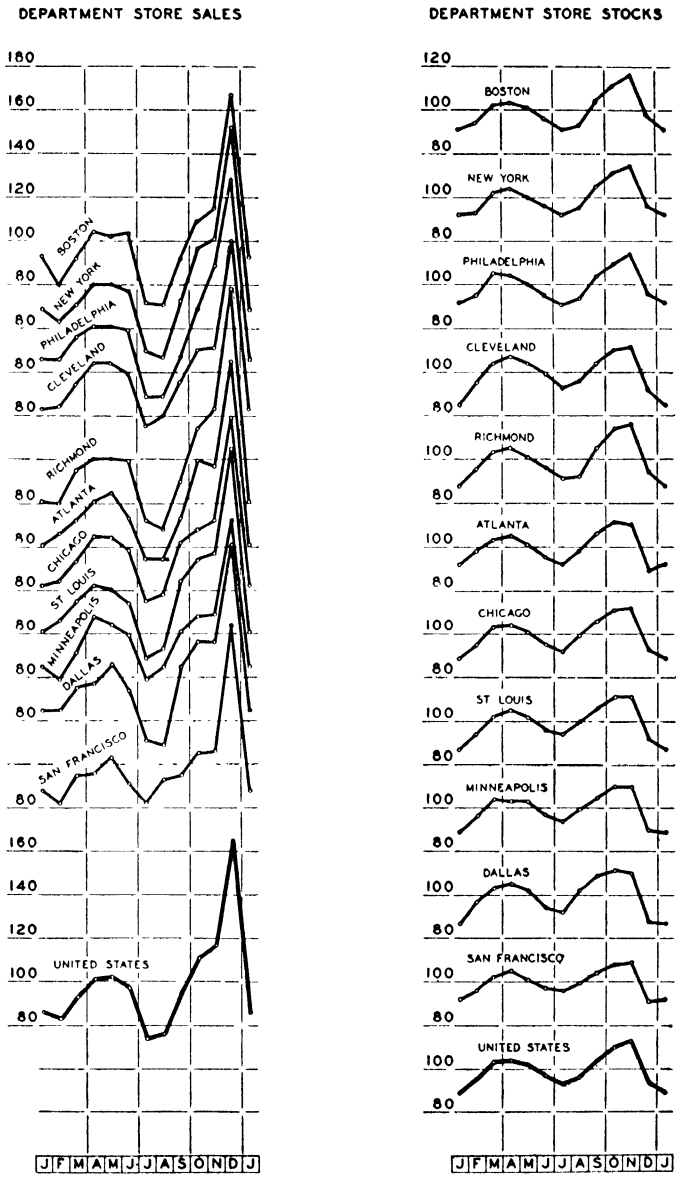


TABLE XIX

DEPARTMENT STORES, SALES AND STOCKS, ELEVEN FEDERAL RESERVE DISTRICTS

TIMING AND AMPLITUDE OF SEASONAL VARIATIONS IN EACH DISTRICT

Federal Reserve District	Timing				Amplitude	
	Primary Peak	Secondary Peak	Primary Trough	Secondary Trough	Average Deviation	Range
			SALES			
Boston	December	April	August	February	16.7	96
New York	December	April-May	August	February	18.3	105
Philadelphia ..	December	April-May	July-Aug.	Jan.-Feb.	18.0	99
Cleveland	December	April-May	July	January	15.0	86
Richmond	December	April-May	August	February	19.2	110
Atlanta	December	May	July-Aug.	January	17.8	91
Chicago	December	April	July	January	15.0	84
St. Louis	December	April	July	January	17 0	96
Minneapolis ..	December	April	July	February	13.7	73
Dallas	December	May	August	Jan.-Feb.	17.3	92
San Francisco..	December	May	July	February	13.0	82
United States..	December	May	July	February	16 0	91
			STOCKS			
Boston	November	April	January	July	6.2	25
New York	November	April	January	July	6.0	22
Philadelphia ..	November	March	July	January	6.2	23
Cleveland	November	April	January	July	6.7	26
Richmond	November	April	January	July	7.3	28
Atlanta	October	April	December	July	6.0	22
Chicago	November	April	January	July	6.2	23
St. Louis	Oct.-Nov.	April	January	July	6.2	24
Minneapolis ..	Oct.-Nov.	March	January	July	5.8	21
Dallas	October	April	January	July	7.0	24
San Francisco..	November	April	December	July	4.8	18
United States..	November	April	January	July	6.0	24

while the secondary troughs are concentrated in January or February.

Stocks exhibit a similar persistence of seasonal pattern from district to district. The primary peak is in November in most of the districts, in October in some, an obvious preparation for the peak sales during December. For like reasons, the secondary peak in stocks occurs in most districts in April, in some in March. Stocks are lowest in January or December; there is almost as deep a secondary trough in July. Obviously, the conventional factors which make for variations in stocks are the same the country over.

Seasonal amplitude varies considerably from district to district. There does not seem to be any definite association of this seasonal amplitude with climatic factors. While the widest swing in sales is in the southern district of Richmond, the next widest is in New York, a northern district. However, all the southern districts, Richmond, Atlanta and Dallas, do show seasonal swings in sales larger than the average. Wherever sales show wide seasonal swings, stocks do also. There are, however, interesting exceptions to such a correlation; for example, in New York. It seems most justifiable to assume that the seasonal amplitude in sales and stocks is determined not only by regional climatic differences. Size of department stores, merchandising and stock-keeping policies, closeness to the source of supply, the type of goods carried and the seasonality in the flow of consumers' incomes are probably also of considerable significance.

CHAPTER IX

SEASONAL SIMILARITIES AND DIFFERENCES AMONG INDUSTRIES

GENERAL CHARACTERISTICS

It has been pointed out that in respect of a single industry the burden of seasonality cannot be determined from a seasonal index for the industry as a whole. If regional differences exist, the total index will, in the absence of complete mobility of the productive factors, tend to under-estimate the seasonal burden. Similarly, differences in seasonality in individual plants are concealed in the seasonal variation characteristic of the industry, and the seasonal variability of a group of industries differs from that found in any of the industries making up the group. As in the case of a swing which is a combination of seasonal variations in different regions of the country a combined index is significant only if the productive factors may be assumed to move freely between branches of an industry or between industries.

It is clear that capital may flow not only from the East to the Southwest within a single branch of production but also from one industry, such as moving wheat crops, to another, such as moving the cotton crop. Labor may shift from one industry to another, and a number of essential raw materials are used by more than one branch of the productive system. Moreover, such auxiliary branches of the productive system as trade and transportation serve not one industry but many and thus exemplify a mobility of resources at the other end of the industrial chain. But since such mobility cannot be assumed to be perfect, it would seem to be essential to a measure of the complete burden imposed by seasonality upon industry that industrial units be studied.

To divide an industry into units, however, is impossible because data are lacking. The only seasonally affected

branches of production for which such detailed figures are available are the automobile companies and, to a smaller extent, retail trade. In the former (see Chapter V) the variations in the seasonal production patterns of different companies are determined largely by the type of car produced; in the latter quite often by the type of goods carried. This aspect of the seasonal problem had, therefore, to be omitted from consideration.

A study of seasonal variations in an area of production or trade that embraces more than a single group of commodities is relatively easy. Upon the assumption of perfect mobility among the constituent parts, the addition of seasonal indexes for specific industries or trades in various combinations would give the total seasonal swing. This, however, would be an experiment of limited interest. It is more important to ascertain similarities and differences in seasonal movements among various industries than to merge them into a total index.

Accordingly, we now compare the dates of seasonal peaks and troughs in the various industries. Such a seasonal calendar for the movement and stocks of raw materials, manufacturing production and stocks of manufactured goods reveals the extent to which peaks and troughs occur in the same month in the various branches of productive activity. If the calendar discloses substantial synchronism there is obviously little chance of a cancellation of seasonal swings when for some purpose the productive system is to be treated as a whole.

The calendar is supplemented by an analysis of data on transportation and trade which were already easily available in significant economic groupings. Freight car loadings are reported for seven groups and the comparison of seasonal behavior in them throws light upon the variation from one group to another. Exports and imports are classified in five groups. Data on sales are collected for nine lines of wholesale trade and several retail chain stores in eight fields. For a limited group of department stores in New England seasonal indexes of sales by a number of separate departments are available. The comparisons thus made possible provide a good illustration of the industrial aspects of the problem and enable us to observe the

presence or absence of synchronism in the seasonal movement in various groups of commodities.

The survey indicates much more synchronism than would at first be expected. If all branches of industry and trade are considered together, without any distinction between the various stages of fabrication, timing of seasonal swings is most diverse. The flow of agricultural commodities is at peak during the autumn and winter, the production of many finished and semi-finished commodities in March, of dairy products and some of the automobile and construction goods in mid- and late summer, of another group of finished goods in October and so on. If all the numerous raw materials, semi-finished goods and finished goods are viewed together and their flow at the various stages, from manufacturers, wholesalers, retailers, are added, there is not a month but marks a seasonal peak for one group of commodities and a seasonal trough for another.

But if the broad units are separated, if raw materials are set off from finished goods, the flow from manufacturers from the flow from retailers, then within each group, in spite of the diversity of commodities included, considerable synchronism characterizes the seasonal swings. General reflection would suggest that it is these broad groups that are significant rather than the chaotic total of all commodities, no matter what stage of fabrication they represent or at what link of the productive and distributive system they are taken. The possible mobility of productive and auxiliary factors is much more easily assumed to operate within these groups than among them. We can assume much more easily that labor, for example, shifts from one branch of retail trade to another than that it shifts from retail trade to the harvesting of crops. We may assume that banking credit is transferred with greater facility from one branch of wholesale trade to another than from wholesale trade into financing such longer term operations as are involved in many branches of manufacture and agriculture. Since this is so, it seems more significant to stress the synchronism of seasonal swings within these broad groups of raw materials, semi-finished and finished goods, and distinguish their flow in the primary markets from their movements through the hands of wholesalers and retailers. Such

synchronism means that for the economy as it is separated into these broad divisions the seasonal problem still persists to a considerable degree, even if there is complete mobility among the productive factors involved.

This conclusion is strengthened by the similarity in the timing of seasonal variations at both ends of the chain that leads from raw materials to final consumers, namely, at the point of inflow of raw materials to primary markets and at the outflow of finished goods into the hands of domestic consumers. It is these two stages that are characterized by the most conspicuous seasonal variations, and it is, therefore, in them that the lack of synchronism would, upon the assumption of the mobility of the factors involved, result in the greatest cancellation of burdens imposed by the seasonal problem. What happens is quite the contrary. At each of these two stages, whenever the violent seasonal swings arise from climatic, organic and conventional elements there is a most conspicuous synchronism of seasonal movement, obviously because the groups of basic factors are the same for the different commodities. The natural laws that cause wheat to mature only once a year in the temperate zone impose the same inexorable limitations upon corn, tobacco, most fruits and the more important vegetables, and impose them within the same calendar limits. The conventional factors that prompt final consumers to buy more during the Christmas and Easter seasons exercise their influence upon demand for many diverse commodities.

Because of the synchronism of seasonal swings at the stages where they are most conspicuous, the series that reflect the total movement of commodities in the economic system (such, for example, as car loadings) and add algebraically the varying swings on the implicit assumption of complete mobility, still reflect clear-cut seasonal movements. It is true, of course, that such variations as are present in these series are mild, since they are reduced by the lack of precise synchronism in the seasonal swings of the component parts. But the conclusion is undeniably suggested that even under the most optimistic assumption of complete fluidity of the productive factors that bear the seasonal burden in various branches of the industrial and distributive system, these burdens are still present to an appreciable degree.

DETAILED COMMENTS

1. Dating of Seasonal Peaks and Troughs in Industry

A complete account of the comparative timing of seasonal patterns in various industries and trades would be possible only upon an exhaustive analysis of all available monthly series on the flow of commodities in the United States. But from the seasonal indexes computed in this study, supplemented by those found in other sources, a few tentative generalizations may be formulated.

One way to compare the timing of seasonal swings is to survey briefly the indexes that characterize the various channels of commodity flow. Of the indexes available from the present and from other studies a considerable number have been selected to represent as fully as possible the various branches of industry in this country. The dating of the seasonal peak (or peaks, when there is more than one high month) and trough for these indexes have been assembled into comparative tables.

In order to facilitate comparison, the series were subdivided into five groups. First, raw materials, semi-finished manufactured goods and finished manufactured goods were segregated. Semi-finished commodities, the only group concerning which there may be a question as to definition, include those goods which serve directly as raw materials for some other industry but have at the same time undergone some fabrication or processing.

Within these groups production was separated from stocks. This cross-grouping yielded originally six divisions, but as the data on stocks of semi-finished goods are very scanty it was considered advisable to group them with the stocks of finished manufactured goods.

a. *Raw Materials*

Table XX, the first of these seasonal calendar tables, presents the dating of seasonal peaks and troughs in the movement of raw materials, covering receipts at primary markets, imports and carlot shipments. The commodities included fall naturally into two categories: agricultural products and other, primarily mineral, raw materials.

In agricultural raw materials there is a definite concentra-

tion of seasonal peaks in autumn and early winter. Wheat receipts are at peak in August, cotton, cattle and sheep, potatoes and apples in October, corn and hogs in January, and so on. Altogether, thirteen of the nineteen agricultural raw materials show their respective peaks between August and January, and among these are series with the widest seasonal swings.

The other prominent peak among agricultural raw materials is in March-April (eggs, citrus fruits, coffee, raw sugar). With the exception of eggs this group is made up of tropical and semi-tropical goods. Obviously the climatic factors affecting these commodities are essentially different from those affecting livestock, grains and cotton.

In agricultural commodities the trough dates show much less tendency to cluster about a single month. For three series the trough occurs in September, for another three in April, for two or three in July, for two in February. Of the many series with autumn or winter peaks some show troughs in April (wheat), others in December (potatoes), still others in July (cotton).

The reasons for such a showing are quite obvious. Peak dates are concentrated because most of the organic raw materials ripen after the summer and are harvested in the autumn. This is true of such important agricultural products as wheat, corn and cotton, of such animal products as livestock and of most fruits and vegetables except citrus fruits. The climatic difference that makes for the spring peak in citrus fruits accounts also for the occurrence of peaks in the supply of such products as coffee and raw sugar in spring instead of in autumn.

But while the basic climatic factors of the temperate zone produce a considerable synchronism of peaks, they do not exercise a similar influence on the troughs. In none of these commodities is there really one sharply defined trough. Instead, a low plateau prevails over several months. It is thus to a large degree a matter of chance in which particular month the lowest point occurs. Since low levels characterize several months, the limits within which troughs in various raw materials may differ in timing are fairly wide.

The non-agricultural raw materials form a rather miscellaneous subgroup. There is some tendency for the seasonal

TABLE XX

DATING OF SEASONAL PEAKS AND TROUGHS IN THE MOVEMENT OF RAW MATERIALS [a]

Agricultural Raw Materials	Peak		Trough	
	Primary	Secondary	Primary	Secondary
Wheat, Receipts at Primary Markets	August		April	
Corn, Receipts at Primary Markets	January		April	
Cotton, Receipts into Sight	October		July	
Cottonseed, Receipts by Mills	October		July	
Cattle and Calves, Receipts at Primary Markets	October		February	
Sheep and Lambs, Receipts at Primary Markets	October		February	
Hogs, Receipts at Primary Markets	January		August	
Poultry, Receipts at 5 Markets	December		April	
Eggs, Receipts at 5 Markets	April		November	
Raw Milk Production, Minneapolis area	May		September	
Potatoes, Carlot Shipments	October	June	December	August
Apples, Carlot Shipments	October		June	
Citrus Fruits, Carlot Shipments	March		September	
Tobacco Sales, Loose Leaf at Warehouses	November		June-July	
Raw Wool Receipts at Boston	July	March	October	May
Raw Silk Imports	August		March	
Raw Sugar Receipts at Refinery Ports	March		December	
Coffee Imports	March		September	
Rubber Imports	January	April	August	February

[a] Most of the indexes utilized in this and subsequent tables have been computed in this study. Additional indexes have been taken from the records of the Business Cycles study or from the releases of the Research Division of the Federal Reserve Board. The dates in this and following tables have been chosen from the seasonal indexes for all periods, if more than one have been covered. In case of disagreement between indexes for different periods, the index for the latest was taken.

TABLE XX (CONTINUED)

Mineral and Other Raw Materials	Peak		Trough	
	Primary	Secondary	Primary	Secondary
Bituminous Coal Production	October-November		April	
Anthracite Coal Production	October	January	March	July
Petroleum, Crude, Production	May-July		February	
Copper Mined	February-April		July	
Iron-ore Shipments	August		December-April	
Loadings of Stone, Gravel and Sand	August		February	
Woodpulp, Mechanical, Production	April-May		August	

peaks to cluster in late summer and early autumn, synchronizing with those in agricultural raw materials. Thus, in four of the seven commodities listed the peak occurs in August or October. This dating of the peaks may be attributed partly to the favorable conditions for mining and transportation (stone, sand and gravel, iron ore and coal) in summer, and partly to an attempt to prepare for winter demand (coal). There is considerable diversity of timing in the seasonal troughs, again a situation analogous to that in the case of agricultural raw materials.

For raw material stocks (Table XXI) the data available concern almost entirely agricultural products. In timing the swing in stocks follows those characteristic of production and receipts.

Among domestic raw materials such as wheat and cotton stocks reach a peak some time after the peak in receipts. Among imported raw materials, on the contrary, the peaks in stocks and in imports tend to be synchronous. As a result, stocks of both domestic and foreign raw materials tend to be at peak almost at the same time. Thus, between November and April stocks are at peak for corn, poultry, tobacco, coffee, cotton, silk, rubber, Portland cement and cottonseed—altogether nine of the thirteen commodities that show seasonal variations.

There is more concentration of troughs in stocks than in receipts because in the former the climatic factor causes a

TABLE XXI

DATING OF SEASONAL PEAKS AND TROUGHS IN STOCKS OF RAW MATERIALS

	Peak		Trough	
	Primary	Secondary	Primary	Secondary
Wheat, Visible Supply	October		June	
Corn, Visible Supply	March		August	
Cottonseed, at Mills	November		July	
Poultry, Cold Storage Holdings	December-January		July-August	
Eggs, Cold Storage Holdings	July		February	
Raw Sugar, Stocks at Refinery Ports	June		February	
Coffee, Visible Supply	February-March	August	May	October
Tobacco, Stocks with Manufacturers and Dealers, Quarterly				
Cigar Type	I		IV	
Non-Cigar	I		III	
Raw Cotton,				
In Warehouses	December		July	
At Mills	January-March		August	
Wool, Quarterly				
With Dealers	II		I	
With Manufacturers	I, III		IV	
Raw Silk				
In Warehouses	December		April	
At Manufacturing Plants	January		July	
Rubber Stocks				
Total	March		September-October	
Afloat	December		July	
With Dealers	February		August	
With Manufacturers	March		September	
Petroleum	None	None	None	None
Portland Cement, Clinker	April		October	

sharp trough; depletion of stocks of raw materials by consumption continues until the new crop becomes available. Thus the trough occurs between June and August in seven of the fourteen commodities—wheat, corn, poultry, tobacco (non-cigar), cotton, silk at manufacturing plants, cottonseed—the most important domestic raw materials.

b. *Semi-Finished Goods*

A much more diversified picture is presented by the production of semi-finished goods.

The first impression of Table XXII is the much greater number of secondary peaks and troughs, as compared with Tables XX and XXI. The inference that a two-peak seasonal pattern prevails appreciably more often among semi-finished goods than among raw materials is amply supported by the discussion in the preceding chapters.

The peaks cluster about two months: March and October. Thus March is the month of the seasonal peak for six commodities: sugar, steel ingots, steel sheets, malleable castings, silver, plate glass; together with January: cotton consumption and silk deliveries; and together with January or February for three more. October is the primary peak for seven commodities and a secondary peak for three or four others. Production is high in February for four series, probably because the indexes, taken from the study of the Federal Reserve Board, have all been adjusted for the number of working days in each month.

The seasonal troughs are concentrated about July, December and February. Production is most frequently low in July and among highly diverse commodities. December appears as the secondary trough in six commodities.

The industries listed in Table XXII are not equivalent units. Nevertheless, a tabular comparison of the distribution of peaks and troughs by months is not without interest. Allowing for the obvious differences in importance of the commodities and in the conspicuousness of their seasonal peaks and troughs, we can still infer the essential synchronism of the seasonal pattern from the frequency distribution presented in Table XXIII.

Clearly a spring peak in March, an autumn peak in October and November, and troughs in July are most common. There are two other less conspicuous trough months, December and

TABLE XXII

DATING OF SEASONAL PEAKS AND TROUGHS IN THE PRODUCTION OF SEMI-FINISHED GOODS

(including consumption of raw materials)

	Peak		Trough	
	Primary	Secondary	Primary	Secondary
Cattle Slaughtered	October		February	
Calves Slaughtered	May	October	February	August
Sheep and Lambs Slaughtered	October		April	
Hogs Slaughtered	January	June	September	April
Sugar Meltings	March		January	
Cotton Consumption, Textile Mills	January, March	October	July	December
Wool Consumption	October	March	July	December
Silk Deliveries	January, March	August	December	June-July
Upper Leather, Total	October	March	May	November
Leather, Calf and Kip	October		May	
Sole and Belting Leather	October		February	
Newsprint Production	April-June		July-August	
Book Paper	February		July	
Fine Paper	February		July	
Pig Iron	April	November	July	December
Steel Ingots	March	October	July	December
Steel Sheets	March	October	July	December
Malleable Castings	March		November	
Copper Smelted	February	October-November	July	December
Zinc	February		July-August	
Lead	November		September	
Silver	March	November	July	December, January
Coke, By-Product	February-March		July-August	
Lumber, Softwood	May		December	
Lumber, Hardwood	September	February-March	December	July
Portland Cement	August		February	
Petroleum Asphalt	August		December	
Common Brick	November		February	
Floor and Wall Tile	October		January	
Plate Glass	March	August	December	July

February. Identification of the series in this frequency distribution table reveals that were some specifically different groups such as paper and the non-ferrous metals eliminated, the concentration of peaks and troughs would be still more appreciable.

The factors that determine the concentration of seasonal peaks and troughs in the production of semi-finished goods

TABLE XXIII

FREQUENCY DISTRIBUTION OF SEASONAL PEAKS AND TROUGHS BY MONTHS*

PRODUCTION OF SEMI-FINISHED GOODS

	Number of Series Having			
	Primary Peak	Secondary Peak	Primary Trough	Secondary Trough
January	2	0	2	½
February	4½	½	5	0
March	7½	2½	0	0
April	1½	0	1	1
May	2	0	2	0
June	½	1	0	½
July	0	0	10½	2½
August	2	2	1½	1
September	1	0	2	0
October	7	4½	0	0
November	2	2½	1	1
December	0	0	5	6½
Total	30	13	30	13

* Whenever a peak or a trough occurs in two months, half of the frequency is given to each.

(or consumption of raw materials) are different from those accounting for the synchronization of flow and stocks of raw materials. The latter are influenced primarily by climatic and organic forces; the former primarily by conventional and only indirectly by natural factors. One reason why February appears often as a trough is that it is short, with fewer working days than any other month. Low levels tend to prevail in July and August not only because high temperatures make difficult some types of productive activity but also because of summer vacations. Only in the case of lumber, hardwoods and sugar does the December trough seem to be definitely associated with climatic conditions.

c. *Finished Goods*

Among the finished manufactured goods is found an even greater variety of series than among the semi-finished. Table XXIV begins with food products, in some of which the direct effects of climatic factors are still conspicuous (dairy goods); then come textiles, in which the seasonal variations are largely

TABLE XXIV

DATING OF SEASONAL PEAKS AND TROUGHS IN THE PRODUCTION OF FINISHED GOODS

	Peak		Trough	
	Primary	Secondary	Primary	Secondary
Wheat Flour	October		June	
Beef	October		February	
Lamb	October	January	June-July	November
Pork	January	June	September	April
Cottonseed Oil, Refined	November		August	
Evaporated Milk				
Bulk	June		December	
Case	June		November	
Condensed Milk				
Bulk	June		November	
Case	May		September	
Butter, Factory	June		November	
Oleomargarine	October		July	
Cheese				
Total	June		December	
American	June		December	
All Other	June		January, February	
Ice Cream	July		December	
Tobacco, Consumption				
In Mfd. Tobacco and Snuff	August, October		December	
In Small Cigarettes	June		December	
In Cigars	October		January	
Finished Cotton Goods	March	October	July	November
Fine Cotton Goods, New Bedford	March	December	July	February
Cotton Textiles	March	December	July	February
Knit Underwear	March	October	July	December
Working Clothes	October	March	December	July
Hosiery	October	March	July	December
Fresh Water Pearl Buttons	March	October-November	July	January
Shoes, Total	October	March	December	June-July
Rubber Heels	May		November	
Gloves, Total	October	March	December	July

TABLE XXIV (CONTINUED)

	Peak		Trough	
	Primary	Secondary	Primary	Secondary
Automobiles				
Passenger Cars	May		December	
Trucks	March, May		December	
Taxicabs	December		July, September	
Tires				
Inner Tubes	August	March	December	July
Pneumatic Casings	May	August	November	July
Solid and Cushion	June	August	November	July
Radiators	March	October	December	July
Cast Iron Boilers				
Square	October	March	December	July
Round	October	April	December	July
Baths (derived)	March	August	December	May
Lavatories (derived)	March	October	January	September
Sinks (derived)	March	October	November	September
Locomotives	August	March	January	April
Shipbuilding	August		January	
Paper Boxes	February	September	December	July

in preparation for conventional seasons, durable consumers' goods, construction materials and finally even such machinery series as the output of locomotives and ships. But in spite of this diversity peaks and troughs apparently cluster about certain months.

As in the output of semi-finished goods activity appears to be at peak in March and October, slightly more often in the latter. Of the forty-three series recorded in Table XXIV these two months mark primary peaks in twenty-one. Other months of considerable concentration of peaks are June and May. But these peaks are found primarily in the series covering output of dairy products (eight out of the total nine). March and October also appear as prominent secondary peak months, being recorded for 12½ of the twenty-two series for which secondary peaks could be distinguished.

Seasonal troughs are again concentrated in July and December, but February appears only once as a trough month and December dates the seasonal low in many more instances than July. This preponderance of December troughs among finished products is largely accounted for by the coincidence

of troughs in dairy products, construction materials and automobiles. All are lowest at the end of the year, and, because of the stimulating influence of the warm weather on the demand for their products or supply of their raw materials, none tends to have a mid-summer low. The weight of these three groups in the table for semi-finished commodities is much smaller than in Table XXIV and for this reason the December trough does not appear as important.

The degree of concentration of the seasonal peaks and troughs in the various months appears in the frequency distribution in Table XXV. Again, warning must be given that the forty-three series in the group are far from being equivalent units.

TABLE XXV

FREQUENCY DISTRIBUTION OF SEASONAL PEAKS AND TROUGHS BY MONTHS

PRODUCTION OF FINISHED GOODS

	Number of Series Having			
	Primary Peak	Secondary Peak	Primary Trough	Secondary Trough
January	1	1	4½	1
February	1	0	1½	2
March	9½	7	0	0
April	0	1	0	2
May	4½	0	0	1
June	9	1	1½	½
July	1	0	8	9½
August	3½	3	1	0
September	0	1	2½	2
October	11½	5½	0	0
November	1	½	7	2
December	1	2	17	2
Total	43	22	43	22

If we combine Tables XXIII and XXV, the preponderance of March and October as seasonal peaks and of July and December as seasonal troughs becomes quite conspicuous. This synchronism means, of course, that when the seasonal movements in the diverse branches of industrial activity are combined in a total of productive activity, seasonal movements with spring and autumn peaks and mid-summer and mid-winter troughs are still clearly outlined.

This conclusion is largely confirmed by Babson's Calendar of Manufacturing Activity which is based upon questionnaires and contacts with the industries (Table XXVI).

TABLE XXVI

FREQUENCY DISTRIBUTION OF SEASONALLY ACTIVE AND INACTIVE PERIODS BY MONTHS

TWO HUNDRED AND FOURTEEN MANUFACTURING INDUSTRIES

	Number of Industries Showing Manufacturing Activity		
	Greater than Average (*1*)	Less than Average (*2*)	Col. (*1*) minus Col. (*2*)
January	99	115	— 16
February	129½	84½	45
March	157	57	100
April	134½	79½	55
May	94½	119½	— 25
June	59½	154½	— 95
July	43	171	— 128
August	59½	154½	— 95
September	109½	104½	5
October	136½	77½	59
November	114½	99½	15
December	85½	118½	— 33

Clearly, the month in which most industries are characterized by levels of activity above the average are March and October, the number being slightly larger in the former. July is again in general unmistakably the month of subaverage activity. In contrast to former tables, however, Table XXVI reveals that June and August are more generally low months than December. But Babson's Calendar does not distinguish an actual trough from activity below the average. Similarly, the failure to distinguish between actual peak and activity above the average may account for the showing of March rather than October as the predominant peak.

d. *Stocks of Manufactured Goods*

The timing of seasonal variations in the stocks of manufactured goods is given in Table XXVII. Here timing varies much more. Many commodity stocks are at peak at the end of the year (meats and some cotton goods in December); others during the spring (construction materials) and still another

TABLE XXVII

DATING OF SEASONAL PEAKS AND TROUGHS IN STOCKS OF FINISHED GOODS

(including a few semi-finished commodities)

	Peak		Trough	
	Primary	Secondary	Primary	Secondary
Wheat Flour				
All Positions	September-October		May	
At Mills, Quarterly	III		II	
Beef, Cold Storage	December		August	
Lamb, Cold Storage	December		August	
Pork Products, Cold Storage	June		November	
Evaporated Milk				
Case Goods, Total	July		February-March	
Case Goods, Unsold	August		February	
Condensed Milk				
Case Goods, Total	July		March	
Bulk Goods, Total	June-July		February	
Butter, Cold Storage	August		April	
Cheese, Cold Storage				
Total	August		April	
American	August		April	
All Other	August		March-April	
Cottonseed Oil, Crude	January		July	
Cottonseed Oil, Refined	March-April		September	
Finished Cotton Goods	December	June-July	February	September
Cotton Textiles	December	June	September	March
Knit Underwear	July		November	
Overalls	April		August-September	
Hosiery	July		December	
Fresh Water Pearl Buttons	June		August	
Rubber Heels	May		November	
Rubber Tires				
Inner Tubes	May		September	
Pneumatic Casings	May		September	
Solid and Cushion Tires	June		October-November	
Gasoline	April		October	
Portland Cement	March		October	
Petroleum Asphalt	May		October	
Common Brick, Burned	November		May	
Floor and Wall Tile	March		September	
Southern Yellow Pine	February-March		November	

TABLE XXVII (CONTINUED)

	Peak		Trough	
	Primary	Secondary	Primary	Secondary
Maple Flooring	March		September-October	
Radiators	June		December	
Boilers				
Round	June		December	
Square	June		December	
Baths	March		September	
Lavatories	March		October	
Sinks	March		October	

group, dairy products, in mid-summer. Nor are the seasonal troughs any more concentrated in a single month. Some occur in February, others in September, October and December.

This showing may arise partly from the small number of series in the table, but a more significant explanation suggests itself. Most series measure the holdings of stocks of finished and semi-finished goods by producers. Preceding discussion has indicated that while producers carry large stocks of raw materials, they do not, as a rule, carry large stocks of finished commodities. In only a few industries, notably some of the construction goods, do producers carry stocks in order themselves to meet the discrepancy that arises from the difference between the rate of their production and the seasonality in consumers' demand for their products. Of other commodities producers hold only small stocks and in these seasonal variations are rather mild and patterns none too clearly outlined.

Moreover, stocks of finished commodities, if measured at different stages of the sequence from producer to consumer, are likely to reflect diverse types of seasonal factors. Thus the stocks that are reported as cold storage holdings are affected by the seasonality of both supply and domestic and foreign demand. Such stocks as those of wheat flour at mills are primarily the reflection of the seasonal in production only, a feature that is characteristic of several other stocks of finished goods held by producers. In view of the diversity of types of influence on the various measures of stock holdings, little synchronism in their seasonal swings may be expected.

The general results of this brief survey of seasonal timing in industry may be summarized as follows:

1. In respect of both flow and stocks of raw materials there is considerable synchronism of seasonal peaks and troughs owing to the similarity in the climatic and organic factors determining them. Crops and livestock mature in early autumn, and all through the autumn and early winter the supply of the chief domestic raw materials is large. The seasonal minerals, coal, iron ore and stone, are also at peak at the end of the summer and in the autumn. Their stocks reach a peak a few months after the peak in raw materials. And while the troughs in the flow of these products are not well synchronized, the troughs in stocks are.

Two notable exceptions in timing appear in this group: (a) imported colonial raw materials, in so far as they are subject to an appreciable seasonal swing, are likely to show peaks and troughs in months other than those characteristic of domestic raw materials; (b) dairy products, in contrast with all other, are at peak in early summer, not after the summer is over.

2. In production of both semi-finished and finished goods seasonal peaks concentrate in March or October or in both. This seems to be due primarily to conventional factors, although, as will be seen in the inspection of retail and wholesale trade, these two peaks may be interpreted as peaks of preparedness for the high months in consumers' purchases, April and December. There are notable exceptions. The group of dairy products again and some of the construction materials tend to have peaks in mid-summer. Troughs tend to occur in February, July and December, again primarily because of conventional seasonal factors.

3. In stocks of both semi-finished and finished goods seasonal variations are rather mild. The tables indicate considerable diversity in the timing of seasonal peaks and troughs, owing partly to the paucity of series, partly to the lack of measures of stocks at the various stages of the industrial process.

2. Car Loadings

The data available on car loadings by groups of commodities enable us to see whether or not the seasonal patterns observed in the flow of raw materials, semi-finished and

finished goods are impressed upon the volume of railroad transportation. The figures are classified in only seven groups, of which one is miscellaneous. But even among such broad divisions interesting similarities and differences appear.

Table XXVIII and Chart 47 present at a glance the main results of the seasonal analysis. The largest seasonal swing is in ore, with a peak in July and generally high levels during the summer. Since iron ore is the most important commodity in this group, the index reflects the season in navigation on the Great Lakes which opens in April or May and closes in November or December.

TABLE XXVIII

CAR LOADINGS, BY GROUPS OF COMMODITIES

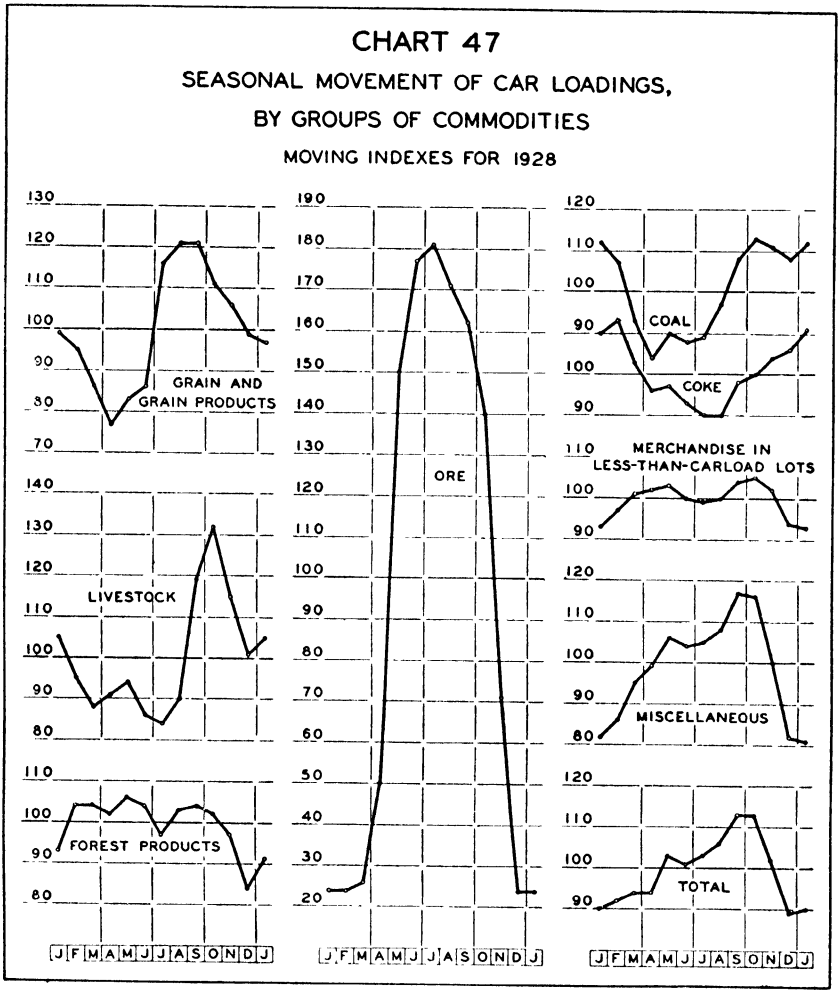
AMPLITUDE OF SEASONAL VARIATIONS IN EACH GROUP [a]

Groups of Freight	Average Deviation	Range
Ore	63.5	157
Coal	9.8	29
Coke	6.0	23
Livestock	12.0	48
Forest Products	4.8	22
Grains and Grain Products	12.5	44
Merchandise L. C. L.	2.8	12
Miscellaneous	9.3	35
Total	6.8	24

[a] Moving seasonal index computed by the Research Division of the Federal Reserve Board, *Federal Reserve Bulletin*, February 1931, p. 110. Index for 1928 taken for the table above. Total index is an arithmetic mean of indexes of separate groups weighted by average volume for 1928.

The seasonal swings in grain and livestock are also fairly substantial. Their pattern is clearly traceable to the harvest cycle in grains and the feeding cycle in livestock and has been discussed above in connection with the series covering the production and shipments of these two groups of commodities. In contrast to the much wider swing encountered in the series on marketing and shipments of the individual grains or groups of livestock, the seasonal swing in car loadings is mild. The reason is obvious: car loadings combine the seasonal swings for various commodities, somewhat diverse in pattern.

The index for forest products confirms both by its amplitude and pattern the results of the seasonal analysis of lumber (Chapter VI). The two peaks may be attributed to the combination of softwood and hardwood; the former tends to



show a primary peak in spring and the latter in autumn, although some groups of softwood also tend to be at peak in the autumn.

The miscellaneous group appears to be a combination of agricultural products and manufactured goods, including cot-

ton, all the fruits and vegetables and all the manufactured products sent in carlots. The pattern, with a September peak, suggests the predominance of manufactured goods.

Coal and coke, the most homogeneous divisions, show plausible seasonal patterns, with large shipments during the winter and small shipments in summer. In this respect these are almost the exact opposite of the pattern in ore loadings. However, the seasonal swings in coal and coke are much milder than those in ore loadings.

Merchandise in less than carlots is composed primarily of manufactured finished goods. The seasonal pattern, therefore, is one most typical of industrial goods at large: a peak in the spring (May), a peak in the autumn (October) and a trough in July and in January. Owing both to the diversity of commodities included and to the generally mild seasonal swing in the flow of the dominating group of manufactured commodities, the seasonal index for the total group shows the mildest amplitude.

Although the timing of the seasonal peaks and troughs of these eight divisions of car loadings is characterized by considerable diversity, still there is some synchronism. Thus at least six of the eight groups tend to show high levels in autumn (grains, livestock and miscellaneous, forest products, coal and merchandise l. c. l.). As the miscellaneous group outweighs all others, total car loadings retain a very definite seasonal pattern, with a marked peak in September-October and a marked trough in December.

However, the seasonal swing in total car loadings is rather mild. Three of the eight groups show a milder amplitude and only one other group shows a similar amplitude. The other four groups are subject to a seasonal swing much wider than that of the total. This is but another illustration of the general statement that with seasonal variations, as with cyclical fluctuations, the total often tends to understate the size of the swings which characterize the component parts.

3. Foreign Trade

The available monthly data on exports and imports are classified as: (1) crude materials, (2) crude foodstuffs, (3) manufactured foodstuffs, (4) semi-manufactured goods, (5) fin-

ished manufactured goods. This division by the mixed principles of stage of fabrication and of foods—non-foods enables us to distinguish the seasonal behavior of various commodity groups. The main characteristics of their seasonal variations appear in Table XXIX and Chart 48.

TABLE XXIX

FOREIGN TRADE OF THE UNITED STATES, BY COMMODITY GROUPS

AMPLITUDE OF SEASONAL VARIATIONS IN EACH GROUP

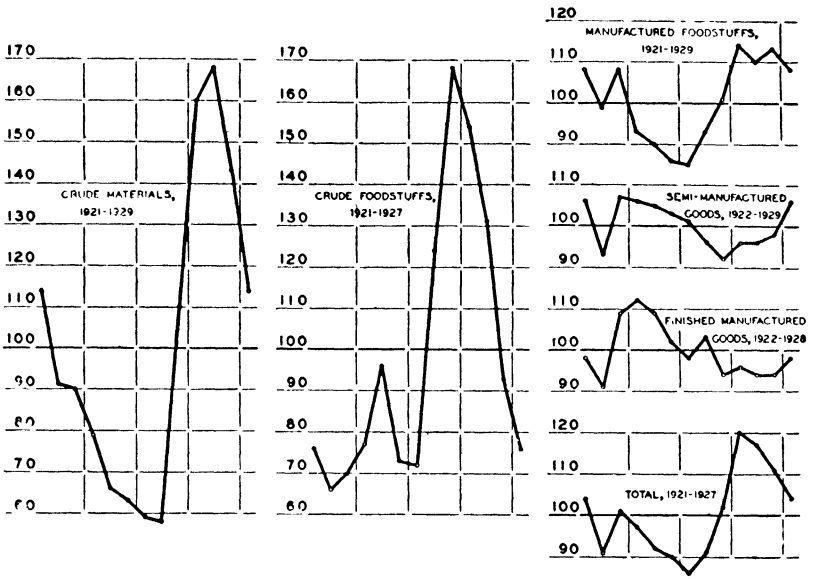
	Average Deviation	Range
Imports		
Total	4.2	20
Crude Materials	7.8	26
Crude Foodstuffs	7.8	33
Manufactured Foodstuffs	13.1	53
Semi-manufactured Goods	4.5	16
Finished Manufactured Goods	4.8	21
Exports		
Total	9.0	34
Crude Materials	32.4	110
Crude Foodstuffs	29.5	102
Manufactured Foodstuffs	9.0	29
Semi-manufactured Goods	4.8	15
Finished Manufactured Goods	5.8	21

In imports the seasonal movement is quite mild because the most important goods imported during recent years come from a rather wide area and are not subject to violent changes of seasons. Thus in crude materials the two most important commodities are silk and rubber, followed at a considerable interval by hides and skins. For none of these is there any violent seasonal swing in supply. The same is true of the group of crude foodstuffs which is dominated by coffee. Only in manufactured foodstuffs is there an appreciable seasonal swing, and it arises from the importance in this group of cane sugar which comes primarily from one source, Cuba. And, as might be expected, the seasonal swings in the semi-manufactured goods (primarily metals such as tin, copper and brass, and such other products as paper-base stock and leather), and in manufactured goods (newsprint paper, manufactured jute, art work) are very mild.

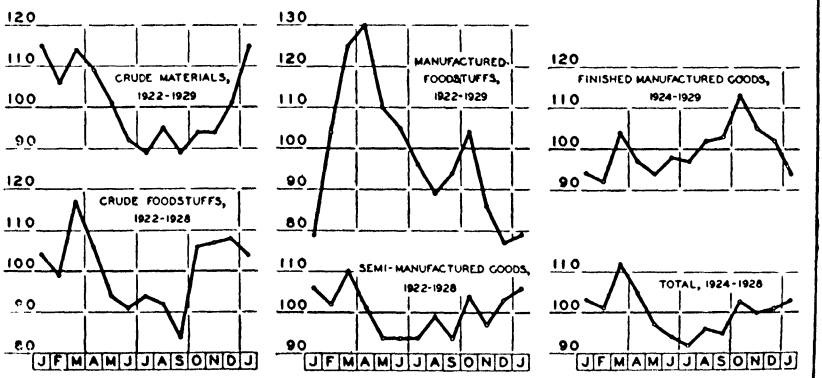
CHART 48

SEASONAL MOVEMENT OF FOREIGN TRADE, BY GROUPS OF COMMODITIES

EXPORTS



IMPORTS



As they are, the various groups of imports show little synchronism in seasonal swing. Crude materials and crude foodstuffs show some similarity, the prevalence of high levels in winter and low levels during the summer being common to both. But in manufactured foodstuffs the pattern is quite different. The peak occurs in spring and low levels prevail during the winter months up to February. In the last two groups there is the usual two-peak seasonal swing characteristic of most manufacturing activity: peak in spring and autumn or winter, trough in mid-summer. The movement in the total index is accounted for by the combination of the first and last two groups, the pattern being most similar to that in crude materials.

The seasonal swings in exports are much wider, primarily because the country exports to such an appreciable extent raw materials whose supply is greatly influenced by climatic and organic factors. Thus in the group of raw materials cotton has a preponderant weight, constituting about 70 per cent of the group, with tobacco next. It is not surprising, then, that there is a large seasonal swing with the peak in November. Grains are the most important crude foodstuffs exported, fruits the next; hence another appreciable seasonal swing with a peak in September. Even in manufactured foodstuffs the seasonal pattern is considerable because of the constitution of the group: grain preparations (for the most part, flour), lard, fruits and meats, all branches of productive activity that still retain some of the seasonal swing which characterizes the supply of their raw materials. Only in the group of semi-manufactures (metal, leather and lumber) and the group of finished manufactures (machinery, vehicles and gasoline) does the seasonal swing diminish appreciably.

In direction groups of exports show as little synchronism in seasonal movement as imports. The patterns in the crude materials and crude foodstuffs are somewhat similar, both showing low levels during the summer and high levels in the autumn and early winter. The same is true to a limited extent of manufactured foodstuffs. But in semi-finished and finished manufactured goods the pattern is quite different, spring being characterized by peak levels, autumn and early winter by low levels. For this reason the total index, while reflecting the autumn peaks of the crude materials and foodstuffs group, has a rather mild swing.

Foreign trade manifests a considerable cancellation of seasonal swings because of the lack of synchronization in the movements of raw materials and of manufactured commodities. But it is doubtful whether the picture presented by foreign trade truly reflects the flow of commodities in the movement of domestic trade. Certainly in the distributive trades within the country there is a much greater synchronization in the seasonal flow of goods, as is clearly revealed by the analysis of data on wholesale and retail trade.

4. Wholesale and Retail Trade

The main characteristics of the indexes for nine lines of wholesale trade computed by the Research Division of the Federal Reserve Board are given in Table XXX and Chart 49.

In spite of the diversity of lines included there is substantial similarity of seasonal pattern. In all lines except clothing the primary peak is either in October or in the preceding month. In most lines there is a definite secondary peak in March. Similarly, two troughs occur in most lines: one in mid-summer (July or June) and the other in December, January or February.

This similarity of seasonal pattern is the more remarkable since the differences in amplitude are striking. The narrowest swing is in meats, a perishable commodity, subject to regular consumption. But the variations are small also in the two other lines dealing with perishable consumers' goods, groceries and drugs. At the other extreme are the lines that handle clothing, for which demand by final consumers is subject to such definite conventional and climatic seasonal variations. Between the two extremes are furniture and hardware, both durable consumers' goods. The steady business demand for the latter probably accounts for the narrow seasonal swing in its sales, while the variations in the demand for the former are connected primarily with the conventional moving dates.

The reason that, in contrast to foreign trade, domestic wholesale trade in such diverse types of goods follows similar seasonal patterns lies undoubtedly in the fact that these series reflect variations at one stage nearer the demand of final consumers. Data on foreign trade picture sales at all stages from

the supply of the raw material to the passing of the finished products to ultimate consumers. Domestic wholesale trade, being much more definitely in the nature of a direct preparation for consumers' demand, reflects the seasonal habits of final buyers, whose purchases are, on the whole, synchronous for diverse groups of goods.

TABLE XXX

SALES BY WHOLESALERS, NINE LINES OF WHOLESALE TRADE

AMPLITUDE OF SEASONAL VARIATIONS IN EACH LINE

	Average Deviation	Range
Groceries	5.5	26
Meats	4.2	18
Drugs	5.8	23
Furniture	8.8	37
Hardware	5.7	24
Men's Clothing [a]	30.3	106
Women's Clothing [a]	43 3	151
Dry Goods	11.5	45
Boots and Shoes	14 0	46
Total for Nine Lines [b]	9.8	33

[a] Moving Seasonal Index. Index for 1923 taken.

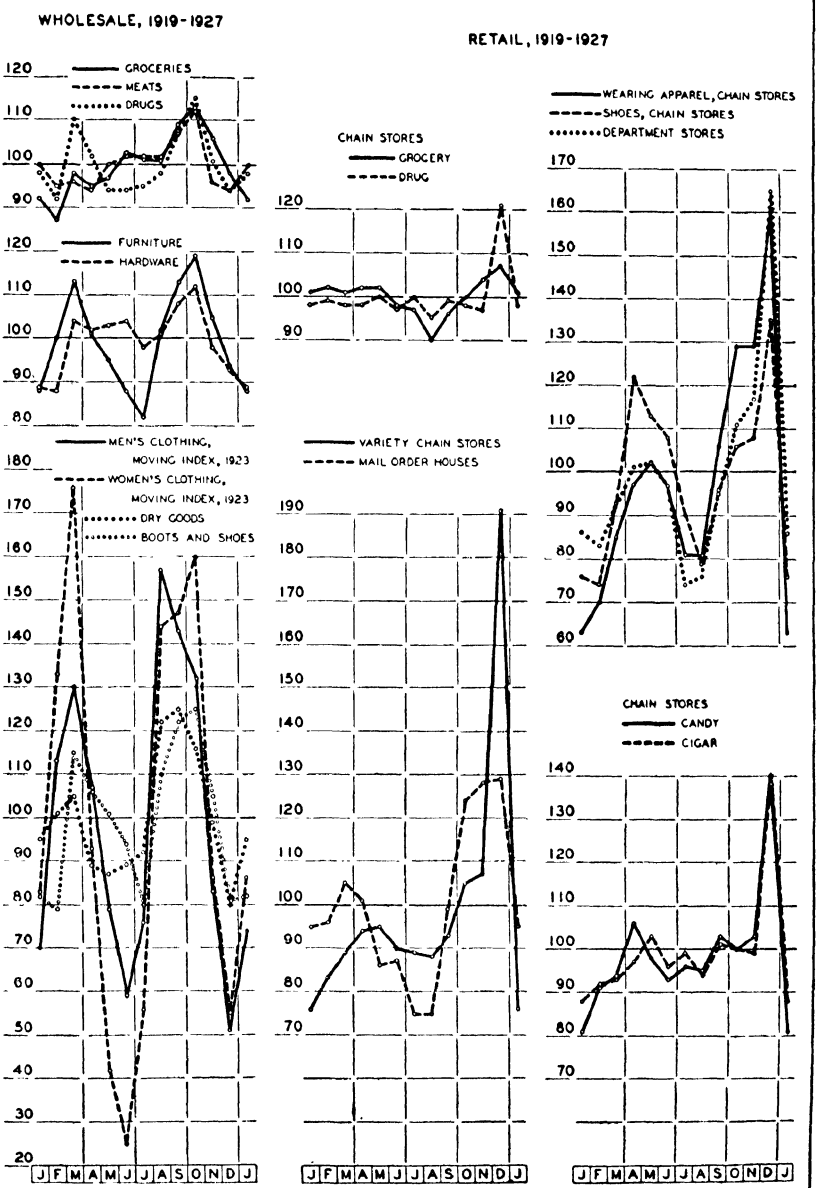
[b] Computed as a weighted arithmetic mean of the seasonal indexes for the nine lines. Weights used are those employed by the Federal Reserve Board to obtain an index of total sales at wholesale. See *Federal Reserve Bulletin,* December 1927, pp. 827-8.

This last statement is substantiated by an inspection of the seasonal swings characterizing sales in various groups of chain stores (Table XXXI and Chart 49). There is little reason to suppose that the seasonal variations in chain store sales are materially different from those in independent stores carrying the same commodities.

The close synchronism of the seasonal movements in retail trade is clear on Chart 49. All lines of trade have their primary peaks in December, their secondary peaks in spring, March, April or May. The early occurrence of the spring peak in mail order houses indicates a significant difference in timing between the purchases of the rural population, which are largest before the beginning of spring activity in the fields, and the

CHART 49

SEASONAL MOVEMENT OF SALES, SELECTED LINES OF WHOLESALE AND RETAIL TRADE



demand of the urban population, which tends to be large in several branches before the beginning of summer. Similarly, all lines have a trough in January-February and in July-August.

The differences in seasonal amplitude are clearly connected with the character of the goods involved. The seasonal swing

TABLE XXXI

SALES IN NINE LINES OF RETAIL TRADE*

AMPLITUDE OF SEASONAL VARIATIONS IN EACH LINE

	Average Deviation	Range
Grocery Chains	3.2	17
Drug Chains	3.5	26
Candy Chains	8.7	59
Cigar Chains	7.0	50
Wearing Apparel	21.0	97
Shoe Chains	15.3	61
Department Stores	16 0	91
5 and 10 Cent Stores	17.2	115
Mail Order Houses	14.5	54
M. Copeland's Index of Retail Trade, 1919-27	10.5	53

* As in the wholesale series, we are using the indexes computed for the period 1919-27 by the Research Division of the Federal Reserve Board. *Federal Reserve Bulletin,* April 1928, p. 235.

of perishable necessaries, which are sold chiefly by grocery and drug chains, is of course rather mild. In semi-luxuries, such as candies and tobacco, for which demand increases during holidays but for which there is a steady volume of demand throughout the year, the seasonal swing is appreciably wider. It is very wide in clothing and shoes, for holidays accentuate fashion and climatic seasons. In department stores and variety chains the range is amplified by the concentration of demand on the two holiday periods. But the variety of goods handled, as compared with such more limited groups of commodities as are sold in wearing apparel stores, helps to mitigate the seasonal swing. Finally, in mail order houses the variations are appreciable because they are determined

by very marked seasons in the degree of absorption in productive activity and in the income flow of the farmers who are their main customers.

Thus the various lines of trade in the stages nearest to the passing of the goods into the hands of private consumers (as distinct from industrial consumers) are subject to conspicuous and synchronous seasonal swings. Hence there is little chance of cancellation of the variations if for some reason the field of trade is to be considered as a whole. Of course, it must be remembered that not all the areas of retail sales have been covered in the comparison. Thus, sales of gasoline, which are quite high during the summer, show a pattern inverted to the spring- and winter-peak pattern of the retail lines we have considered so far. But even the most comprehensive monthly index of retail trade considered in Chapter VII (which includes gasoline sales) still shows marked seasonal swings (Chart 35).

5. Department Store Sales by Departments

Seasonal variations in the retail sales of a larger number of groups of commodities may be observed in data available on sales in New England stores by departments. While these stores do not cover all branches of retail trade, they do present sales for more groups than have been considered heretofore. It is possible, of course, that department store sales of a certain commodity, such as luggage, tend to have a seasonal pattern unlike that shown by sales in special luggage stores. But the difference between the two should not be appreciable.

Covering a sample of department and specialty stores in the Boston Federal Reserve district during the years 1926-30, the data used in the analysis are the same as were discussed in Chapter IV. Owing to the large number of departments it is difficult to present the resulting indexes graphically. Table XXXII shows, however, their most important characteristics.

The departments are grouped according to the type of their seasonal pattern. In the first group are all the departments that show a preponderant spring or early summer peak and where the secondary peak, if present, is much lower. This group is composed of departments that sell primarily summer clothes, dresses, their materials and accessories. Naturally, the six departments included tend to show synchronism of sea-

sonal swing. In four the peak is in June and in another four the trough is in August. The seasonal amplitude of sales in these six departments is of fairly wide range but it is on the whole milder than in most of the other departments.

The second and largest group includes departments whose sales are subject to a spring and an autumn or winter peak, both prominent. With the exception of two (house furnishings

TABLE XXXII

DEPARTMENT STORE SALES, NEW ENGLAND, BY SEPARATE DEPARTMENTS

TIMING AND AMPLITUDE OF SEASONAL VARIATIONS IN EACH DEPARTMENT

Departments	Timing				Amplitude	
	Primary Peak	Secondary Peak	Primary Trough	Secondary Trough	Avg. Dev.	Range
GROUP I						
Silks and Velvets, Dress Goods	March		August		17.2	73
Cotton Dress Goods	June		September		24 8	92
Women's Dresses	June		August		21.7	91
Misses' Dresses	June	October	August	February	17.4	73
Millinery	April	October	February	July	32.4	104
Corsets and Brassieres	June		August		10.3	43
GROUP II						
Woolen Dress Goods	October	March	July	February	32.7	145
Laces, Trimming Embroidery	December	April	July	February	21.5	96
Ribbons	December	June	August	February	26 7	153
Notions	December	June	August	February	10 8	56
Men's Clothing	November	April	August	February	17 3	69
Boys' Wear	December	April	July, August	February	30 0	133
Infants' Wear	December	April	July	February	27 4	136
Neckwear and Veiling	December	April	August	February	30.9	213
Women's Coats	October	April	July	February	33.0	128
Misses' Coats	October	April	July	February	32.1	147
Juniors' and Girls' Ready-to-Wear	December	April	July	February	27.7	98
Waists, Blouses and Sweaters	December	May	February	August	18.4	85
Women's and Children's Hosiery	December	June	February	August	22 2	133

TABLE XXXII (CONTINUED)

Departments	Timing				Amplitude	
	Primary Peak	Secondary Peak	Primary Trough	Secondary Trough	Avg. Dev.	Range
Silk and Muslin Underwear	December	June	September	February	30.0	185
Aprons and Housedresses	December	June	August	February	27.9	111
Women's and Children's Shoes	December	April	February	August	18.6	79
Men's and Boys' Shoes	December	June	August	February	22.2	157
House Furnishings	December	May	July	February	17.5	106
Luggage	December	June	February	October	34.7	208
GROUP III						
Linens	December		April		26.6	111
Domestics	January		April		24.2	108
Art Goods and Needlework	December		July		28.2	140
Furs	January		June		64.8	192
Knit Underwear	December		August		32 2	185
Furniture,Beds,Mattresses, Springs	August	January	July	December	21.8	106
Draperies, Lamps	October	May	July	February	20.7	92
Floor Coverings	October	January	July	December	19.5	80
Musical Instruments and Radios	January		June		54.2	269
GROUP IV						
Toilet Articles and Drugs	December		August		21.6	151
Handkerchiefs	December		July		70.5	454
Silverwear and Jewels	December	June	July	March	36.8	244
Leather Goods	December		February		38.6	268
Umbrellas, Parasols, Canes	December		February		51.2	336
Men's Furnishings	December	June	February	August	35.5	234
Women's and Children's Gloves	December	April	July	February	46.1	258
Toys and Sport Goods	December		January, February		80 8	530
Books and Stationery	December		July		58 2	365

and luggage) all departments in this group sell shoes or clothing. But the articles of clothing sold are such as to be subject to both summer and winter demand. In some departments, for example, women's and misses' coats, spring demand is more conspicuous than winter, while in others the reverse is true.

There is considerable synchronism of seasonal swing in this group also. In fifteen departments out of nineteen the primary peak is in December and the secondary peak in either April (nine departments) or June (seven departments). In fourteen departments the primary trough is in either July or August while the secondary trough is preponderantly in February. There are considerable differences in seasonal amplitude but most of the average deviations are below 30.

In the third group are all departments that show one peak in the winter but no concentration in December. This group is the winter-peak group as against the summer-peak group, in a way a counterpart of Group I. It includes furniture and the heavier types of house furnishings, some special winter clothing (furs, winter underwear) and the textiles that are a part of house equipment (linen, domestics, draperies).

There is not as much synchronism in Group III as in the other groups. While most of the peaks occur during the winter, they are distributed over December, January, October and in one instance a peak occurs even in August. The troughs occur in April, in June or in July. The seasonal amplitude is measured by an average deviation of between 20 and 30.

Group IV is the most distinctive and interesting. It may be designated as the group of Christmas goods, including commodities that are bought mainly in connection with the holidays: toilet articles and drugs, handkerchiefs, ornaments, leather goods, canes, some men's furnishings, gloves, toys, books and stationery. In all these departments the peak is, of course, in December, and there are few conspicuous secondary peaks. The trough occurs in February or July. With one exception, the department of toilet articles and drugs, all show very wide seasonal swings. The average deviations of the indexes are above 30 and the ranges especially are very much larger than those observed for the departments in the other groups.

Thus total sales of department stores are a composite of at least four distinct groups of commodities: one with a summer peak, one with high levels during the winter, one with both spring and autumn or winter peaks, and one with the Christmas peak. This grouping implies considerable divergence in the seasonal pattern characteristic of each department.

Upon the assumption of mobility among the various departments, the index for total sales in which the divergent seasonal movements are allowed to cancel themselves was computed as a straight arithmetic mean of the indexes for the forty-three departments listed in Table XXXII:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
+1.7	−28.3	−11.7	−3.1	−2.5	−2.5	−34.8	−27.9	−11.3	+11.5	+13 9	+95.2

Average 20.4

The same deviations from 100 upon the assumption of lack of mobility are:

26.5	29.6	17.6	23.3	18 6	22.1	35.5	36 3	18.7	22.0	19.9	99.1

Average 30.8

It may be seen that the average disturbance in the level of sales due to seasonal variations is much greater when we assume lack of mobility among the departments. In the index based upon such lack of mobility the average deviation is one and a half times as large as in the other index.

CHAPTER X

TEMPORAL CHANGES IN SEASONAL PATTERN

GENERAL CHARACTERISTICS

Seasonal variations are defined for statistical purposes as fluctuations recurrent annually within a twelve-month period. Upon the assumption of persistent recurrence in time, seasonal swings have been measured in Chapters III through IX by means of average seasonal indexes. The value of this recognizably rough assumption, which brings the task of measuring the seasonal swing within practical limits, can now be tested.

Although repeated measurements do often indicate a marked persistence from one period to the next, it is difficult to assume, in view of the continual progress in the material and social technology of economic processes, that seasonal variations are a species of change that persistently recurs in exactly the same way. It is true that the basic factors making for seasonal variations, such as climate, organic seasons, conventions, are highly stable, at least when considered in the time spans that delimit significant economic changes. Summers and winters are much as they were a hundred years ago. But their reflection in economic series may be anything but constant. Many factors may intervene between these stable causal elements and the economic activity that they affect to modify their influence. In series reflecting an economic process for the country as a whole a shift in the geographic center of production involving a transfer from one climatic area to another may result in modifications in either the pattern or the magnitude of the seasonal swing. Technical progress may render the processes relatively less dependent upon climatic or other natural forces (for example, the development of refrigeration). Consumers' habits may change so that a

commodity is consumed for a longer or shorter season than formerly.[1]

This chapter and the next will attempt to measure temporal changes in seasonal variations, first, those in pattern, second, those in amplitude, in order: (a) to ascertain whether there is an increased independence of climatic, organic and conventional factors in recent years as a consequence of the elaboration of technique, the expansion of areas of economic intercourse and the greater skill on the part of the distributive trades in spreading sales through the year; (b) to draw conclusions of some significance from the standpoint of statistical technique.

The results of the analysis are somewhat limited because the choice of the series is confined largely to those analyzed and

[1] The significance of the problem of changing seasonals was recognized and emphasized as early as 1841. J. W. Gilbart, probably the first English student of seasonal problems, wrote "On the Laws of the Currency in Ireland, as exemplified in the changes that have taken place in the Amount of Bank Notes in Circulation in Ireland, since the passing of the Acts of 1845" (*Journal of the Statistical Society of London,* XV (1852), pp. 307-25):

"The following important evidence, given by Mr. Murray before the Committee on Banks of Issue, in the year 1841, shows in what way the monthly variations in the circulation of notes may indicate the degree of agricultural distress:—'The condition of the people is vastly improved within the last fifteen years; and with the permission of the committee I will state a substantial instance of that improvement. In 1825, the crop of Ireland, especially that of the south and west, came to market with extreme rapidity after it was cut, and in very bad condition, being altogether thrashed out in the open fields. Stockyards were not to be seen, or rarely so. The markets were filled to overflowing during the months of October, November and December. In January and February these markets were comparatively thinly attended by the farmers, as the crop was nearly out of their hands. After February, a cargo of wheat or oats could not usually have been collected out of the ordinary markets. The case is now very different. The markets are much less crowded with produce in October, November and December and continue equally well supplied in January and February. In March and April, field-labour occupies the farmers, but in May, June and July, the markets now continue to be well filled where none appeared before, and the corn brought to them in good order; thereby showing that the people are now in a condition to hold over the property which they were formerly, from necessity, compelled prematurely to dispose of.'

In the evidence given by myself (*i.e.,* Gilbart) before the Committee on Banks of Issue in 1841, it was stated that the highest point of circulation was about January, but since the year 1845, the highest point has usually been in November; thus confirming the statement of Mr. Murray, that in seasons of distress the crops are brought earlier to market." (pp. 317-18)

With this recognition of the problem there was, however, no attempt to measure precisely either the stable seasonals or shifts in them.

discussed in the preceding chapters; and because the periods covered include primarily only the last decade and a half. From this limited sample some conclusions, however, stand out clearly, and, in respect to temporal changes in seasonal pattern, may be summarized as follows:

1. Seasonal variations, especially those which are wide, persist in time.

2. Disturbances in seasonal pattern appear to be unrelated to the magnitude of the seasonal swing, when measured absolutely. Hence relative measures of persistence of pattern tend to be high for indexes with wide seasonal amplitudes and low for indexes with narrow seasonal amplitudes.

3. As tested from period to period or from year to year, disturbances in seasonal pattern were concentrated in a few industries, primarily those dealing with the flow of wheat as grain, production of automobiles and production and shipments of some construction materials.

4. Furthermore, the disturbance in seasonal pattern was concentrated in the early post-War years. Since this was a period of rapid adjustment to peace conditions, it was not a favorable time to test stability of seasonal pattern.

5. Series covering stocks of commodities manifest greater stability of seasonal pattern than those dealing with their production, shipments and consumption.

6. The causes of shifts in seasonal pattern seemed to be:

   a. In respect of the supply of raw materials, a shift in the geographic area where the commodities were either produced or consumed. For materials used in more than one industry, a shift in the relative importance of the various industrial users, each subject to a seasonal swing of a different pattern.

   b. In respect of the demand for finished products, the enlargement of the social body of consumers whose demand the activity in question satisfied, technical changes facilitating storage and preservation, and a growing emphasis on the variable fashion and style elements.

DETAILED COMMENTS

1. Methods of Measuring Temporal Changes in Seasonal Pattern [2]

a. *Moving and Average Seasonal Indexes*

Current methods of studying temporal changes in seasonal movements measure the so-called moving seasonal swing by introducing a moving central tendency, either graphically or algebraically on small charts which show the succession of yearly ordinates for each month. This moving central tendency may be determined free-hand,[3] or as a median of a moving period,[4] or as a straight line fitted to the seasonal items,[5] although Dr. Snow, who uses this method, fits his line to the original data, thus correcting at once both for trend and moving seasonal, or as a smoothed moving average, as does the Research Division of the Federal Reserve Board.[6] In each method the attempt is made to fit some line of secular movement to that part of the series which is supposed to represent the seasonal element.[7]

All these methods introduce into the problem of measuring seasonal changes the difficulties of the procedure of establishing secular movements. These difficulties are especially formidable in series that cover a rather short period, for in such series the fitting of a line supposed to reflect secular movements is subject to considerable danger of distortion by the cyclical or random elements. Even if a moving average is fitted to the series to isolate the seasonal elements, the relative deviations from a moving average contain some part of the cyclical swing of the series. It is dangerous, therefore, to introduce mathematical curves describing the secular movement even for periods as long as fifteen years, unless it is

[2] Since the technical problem of measuring temporal changes in seasonal swings is not simple, a brief preliminary explanation follows. Readers who are primarily interested in the results may turn at once to page 284.

[3] See W. I. King, An Improved Method for Measuring the Seasonal Factor, *Journal of the American Statistical Association*, September 1924, pp. 301-13.

[4] See O. Gressens, On the Measurement of Seasonal Variations, *ibid.*, June 1925, pp. 203-10, and W. L. Crum, Progressive Variation in Seasonality, *ibid.*, March 1925, pp. 48-64.

[5] E. C. Snow, Trade Forecasting and Prices, *Journal of the Royal Statistical Society*, May 1923, p. 334.

[6] See *Journal of the American Statistical Association*, September 1928, pp. 241-52.

[7] For a survey of these and other seasonal methods see O. Donner, Die Saisonschwankungen als Problem der Konjunkturforschung; *Vierteljahrshefte für Konjunkturforschung*, Sonderheft 6 (Berlin 1928).

certain that the cyclical and other elements present in the series balance. The same difficulty limits the use of the more elastic moving average fitted to deviations that measure the seasonal element. Even if the period over which the moving average is computed is varied with changes in the duration of cycles, the moving average cannot take account of short-time changes in amplitude of the cyclical element. And a moving average always leaves the ends of the smooth line to be finished free-hand. Any secular line obtained for a short series is subject to grave doubt. Only when a substantial period of time is covered can secular movements in seasonality be measured properly.

Despite the difficulties indicated above, when it is desired to eliminate the seasonal element most thoroughly (in order to reveal more clearly the other fluctuations in the series), moving seasonal indexes may be used to obtain an elastic seasonal correction. Even if the moving seasonal indexes are suspected of including non-seasonal elements, it may be preferable to use them in order to make sure that the seasonal changes are entirely eliminated. But in the present investigation, where interest centers in the analysis of the seasonal variations themselves rather than in their elimination, the doubts concerning the line of the moving seasonal index are too serious to be overlooked. The measures must represent the seasonal element and nothing else. For this reason, a moving seasonal index was used in the present study only in the few series in which the change in seasonal variations was very rapid. If the need arose and the length of the series made it possible, average indexes were computed for more than one short period.

The advantages of such a procedure over the fitting of a continuously changing line of seasonals were manifold. First, it enabled us to deal with only a few seasonal indexes instead of having as many seasonal indexes as there were years in the series. This is an important consideration when the task was that attempted in the earlier chapters, namely, studying the comparable features of typical seasonal swings in related industries. Second, it confined the arbitrariness of the procedure to the choice of the period, while the type of line chosen to describe the secular movements in the seasonal was not affected. Third, by yielding several seasonal indexes, computed independently for one and the same series, it pro-

vided a good check upon the reliability of these constant indexes.

The choice thus made predetermined to a large degree the statistical procedure followed in this chapter. To gauge temporal changes in seasonal variations we have chosen or designed measures based upon average seasonal indexes for successive, rather short periods.

b. *The Index of Similarity and the Pearsonian r*

To estimate the degree of similarity or difference in two seasonal patterns we can no longer rely upon visual comparisons as was done in preceding chapters. We must derive some measure that will reflect more precisely the degree of persistence from one period to the next. For this purpose we choose a coefficient that involves only first moments rather than the frequently used Pearsonian coefficient of second moment correlation, for the squaring of the items in finding the Pearsonian r exaggerates the importance of the larger deviations from the arithmetic mean. Even in the first moment exceptionally large or small items influence the eventual measure, but at least the distortion is not so large and the significance of a measure based upon first moments is much clearer than that of a coefficient of correlation.[8]

The measure used in the present analysis is quite similar to that advocated by Gressens and Mouzon. The steps involved in the computation were as follows:

(1) The seasonal indexes to be compared were taken as deviations from 100, that is, from their arithmetic mean.

(2) These deviations were reduced to a common base. Since in the comparisons below indexes were used for only two periods, the later usually covering the more recent years, the sum of the deviations of the index for this later period was taken as the base. Accordingly, the deviations for the earlier period were raised or lowered to add up to the total for the later period.

(3) The differences between the seasonal indexes, month by month, were summated without regard to sign, and the sum divided by the base.

[8] For a discussion of this entire problem of the application of correlation to time series see O. Gressens and E. D. Mouzon, Jr., The Validity of Correlation in Time Sequences and a New Coefficient of Similarity, *Journal of American Statistical Association,* December 1927, pp. 483-92, and G. R. Davies, First Moment Correlation, *ibid.,* December 1930, pp. 413-27.

(4) The coefficient was obtained by subtracting the result under (3) from 1.

If there is perfect agreement between the two indexes, the result under (3) will be 0 and the coefficient +1. If the movement of the two is perfectly inverse, the result under (3) will be 2 and the final index of similarity will be —1. If definite relationship is lacking, the index will tend to be 0. The following example illustrates the computation of the index of similarity.

BUTTER, FACTORY PRODUCTION

Period	Deviations of Seasonal Index by Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total
1. 1917-22	−27	−33	−20	−9	+35	+58	+46	+23	0	−12	−32	−32	327
2. 1923-31	−19	−23	−12	−1	+31	+46	+35	+15	−6	−13	−28	−25	254
3. 1917-22 reduced to base of 1923-31 ...	−21	−26	−16	−7	+27	+45	+36	+18	0	− 9	−25	−25	255
4. Differences (2)−(3)	+2	+3	+4	+6	+4	+1	−1	−3	−6	−4	−3	0	37

$$\text{Index of Similarity} = 1 - \frac{37}{254} = 1 - 0.15 = +0.85$$

It may be seen that the index of similarity measures the percentage of deviations from 100 that is common to the two seasonal swings compared. In the example, of total seasonal deviations 85 per cent were common to the seasonal indexes for 1917-22 and 1923-31, indicating a considerable degree of similarity between the two indexes.

The measure just presented is used below to describe the similarity in pattern of average seasonal indexes, computed for successive periods, and of a moving seasonal index for any pair of years. To test the persistence of a seasonal pattern year by year within the period for which an average index is computed the deviations of the original data from the moving average might be taken for each calendar year (or any twelve-month period), centered about 100 and compared with the average deviation of the average seasonal index for the period within which the chosen year (or twelve-month period) falls.

In such a comparison, however, the index of similarity cannot be used, because the deviations of the original data from the moving average contain not only the seasonal element but also the random changes and whatever parts of the cyclical

movements have not been eliminated by the moving average. Thus, when we compare these deviations with the average seasonal index for the corresponding period, we are not comparing the pure seasonal swing for the given year with the seasonal swing for the period. The presence of the non-seasonal elements in the deviations of the original data from the moving average will serve to swell the discrepancy in the comparison and as a consequence make for unduly low indexes of similarity.

This difficulty may be overcome by the use of the Pearsonian coefficient of correlation, provided we accept one assumption: that the non-seasonal elements in the deviations of the original data from the moving average are not correlated with the seasonal pattern. If this assumption is granted, and it seems obvious as a matter of definition, then it will be seen that the presence of non-seasonal factors does not influence the product-moment, in which the deviations of the original data from the moving average constitute one of the variables and the deviations of the average seasonal index from 100 another variable. Although the resulting r is affected by any defects in the second moment procedure in time series data, it gives a much better approximation to the measure of similarity of patterns than would a first moment index of similarity under the same conditions.

This coefficient of correlation is then computed by the usual formula

$$r = \frac{\Sigma ds}{\sqrt{\Sigma s^2 \ (\Sigma d^2 - 12c^2)}}$$

where

d = percentage deviations of original data from moving average
s = deviations of corresponding average seasonal index from 100
c = correction to center the d's about 100

This second moment correlation procedure is also used in Chapter XI to study the changes in seasonal amplitude from year to year, again for the reason that, when the first moment measures are applied, regression for single years, like similarity, is too greatly affected by the presence of the non-seasonal variations in the variable d.

2. Persistence of Pattern

a. *From Period to Period*

Table XXXIII presents the indexes of similarity between seasonal patterns in two successive periods for all the series discussed in preceding chapters for which seasonal measures were computed for more than one period. Its significance is limited by the method of selection of the series. (This was determined by the rather fortuitous circumstance of previous discussion and availability of data for a considerable period.) Nevertheless it yields some interesting observations concerning the tendency of seasonal patterns to persist from period to period.

In the majority of the series the two periods compared cover either the post-War years or the War and the post-War years. The later period runs usually from 1923, 1924 or 1925 to 1931, the earlier period from 1917, 1918 or 1919 to 1924, 1925 or 1926. The comparisons therefore cover more or less the same historical period.

TABLE XXXIII

INDEXES OF SIMILARITY BETWEEN AVERAGE SEASONAL INDEXES FOR SUCCESSIVE PERIODS

SERIES RELATING TO THE FLOW OF COMMODITIES

Series	Periods Compared		Total Deviations of Seasonal Index Period		Total Discrepancy between Seasonal Indexes	Index of Similarity
	1	2	1	2		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
FOOD PRODUCTS						
Wheat, Marketing by Farmers	1909-19	1919-30	618	719	243	0.66
Wheat, Receipts at Primary Markets	1920-24	1925-31	442	620	323	0.48
Wheat, Shipments from Primary Markets	1920-24	1925-31	366	435	183	0.58
Wheat Exports (wheat only)	1918-23	1924-31	420	549	256	0.53
Wheat, Visible Supply, U. S.	1918-22	1923-31	432	268	52	0.81
Wheat Flour Production	1918-23	1924-31	151	93	27	0.71

TABLE XXXIII (CONTINUED)

Series	Periods Compared		Total Deviations of Seasonal Index Period		Total Discrepancy between Seasonal Indexes	Index of Similarity
	1	2	1	2		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cattle and Calves, Receipts at Primary Markets	1917-22	1923-31	190	158	29	0.82
Cattle Slaughtered	1907-19	1919-27	141	101	19	0 81
Calves Slaughtered	1919-24	1924-28	98	81	51	0.37
Beef and Veal, Cold Storage Holdings	1917-22	1923-29	246	335	40	0.84
Beef and Veal, Apparent Consumption	1917-22	1923-31	79	58	31	0.47
Sheep and Lambs, Receipts at Primary Markets	1917-22	1923-31	329	259	93	0.64
Sheep and Lambs Slaughtered[a]	1922	1926-30	91	66	30	0.55
Mutton and Lamb, Cold Storage Holdings	1917-22	1923-29	337	272	84	0.69
Mutton and Lamb, Apparent Consumption	1916-22	1923-31	93	50	36	0.28
Hogs, Receipts at Primary Markets	1917-22	1923-31	191	160	36	0.78
Hogs, Commercial Slaughter	1913-21	1922-29	232	169	30	0.72
Pork Products, Cold Storage Holdings	1917-22	1923-29	244	223	26	0.88
Pork Products, Apparent Consumption	1916-21	1922-31	121	71	31	0.56
Butter, Factory Production	1917-22	1923-31	327	254	37	0 85
Butter, Receipts at 5 Primary Markets	1920-24	1925-31	313	232	51	0 78
Butter, Cold Storage Holdings	1915-22	1923-31	711	781	111	0 86
Butter, Apparent Consumption	1917-23	1924-31	164	113	17	0.85
Evaporated Milk, Case Goods, Production	1918-23	1924-31	245	305	70	0.77

[a] Moving seasonal index prior to 1926. The index for 1922 taken as representative of the period 1919-25.

TABLE XXXIII (CONTINUED)

Series	Periods Compared		Total Deviations of Seasonal Index Period		Total Discrepancy between Seasonal Indexes	Index of Similarity
	1	2	1	2		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
American Cheese, Production	1920-24	1925-29	368	348	42	0.88
Cheese, Receipts at 5 Primary Markets	1920-24	1925-31	215	189	62	0.67
Cheese, Cold Storage Holdings	1917-23	1924-31	414	259	14	0.95
Eggs, Receipts at 5 Primary Markets	1919-24	1925-31	572	503	64	0.87
Eggs, Cold Storage Holdings	1915-21	1922-31	809	775	59	0.92
Dressed Poultry, Receipts at 5 Primary Markets	1920-24	1925-31	617	521	118	0.77
Dressed Poultry, Cold Storage Holdings	1916-22	1923-31	465	460	92	0.80
Cottonseed, Receipts at Mills	1919-24	1925-31	1055	1057	115	0.89
Cottonseed Oil, Refined, Production	1919-24	1925-31	634	644	92	0.86
Cottonseed Oil, Refined, Stocks	1920-24	1925-31	412	364	83	0.77
Raw Sugar Meltings	1909-19	1919-28	284	172	87	0.50
Raw Sugar Stocks	1912-24	1922-28	556	487	222	0.54
TEXTILES AND SHOES						
Cotton, Receipts into Sight	1919-24	1925-31	724	911	221	0.76
Cotton, Visible Supply	1919-27	1927-30	344	424	41	0.90
Cotton, Stocks at Public Warehouses	1914-22	1923-31	329	444	99	0.89
Cotton, Stocks at Mills	1912-19	1919-27	231	216	34	0.84
Raw Wool Consumption	1918-23	1924-31	54	61	79	−0.30
Shoe Production	1922-26	1926-31	78	123	103	0.16
AUTOMOBILES AND THEIR MATERIALS						
Crude Rubber Imports	1919-24	1925-31	130	80	73	0.09
Inner Tube Production	1920-26	1925-31	50	121	110	0.09
Fabric Consumed in Automobile Tires	1921-25	1924-31	96	142	73	0.49
Petroleum Output	1913-22	1923-30	28	29	18	0.38

TABLE XXXIII (CONTINUED)

Series	Periods Compared		Total Deviations of Seasonal Index Period		Total Discrepancy between Seasonal Indexes	Index of Similarity
	1	2	1	2		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gasoline Production	1917-23	1924-30	39	26	17	0.35
Gasoline, Domestic Consumption	1918-25	1926-30	189	136	27	0.80
Gasoline, Refineries' Stocks	1919-24	1924-28	203	135	17	0.87
Steel Ingot Production	1920-25	1926-31	77	90	92	−0.02
Steel Sheet Production	1919-24	1924-28	108	76	39	0.49
Passenger Car Production	1919-25	1925-31	158	263	151	0.43
CONSTRUCTION AND CONSTRUCTION MATERIALS						
Building Permits Issued [b]	1915-21	1922-28	136	128	87	0.36
Contracts Awarded, Total [b]	1919-23	1923-31	216	145	72	0.67
Contracts Awarded, Residential [b]	1919-23	1923-31	150	138	42	0.72
Contracts Awarded, Commercial	1919-23	1923-31	212	122	75	0.39
Contracts Awarded, Educational	1919-23	1923-31	362	222	112	0.50
Contracts Awarded, Public and Semi-public	1919-23	1923-31	302	186	96	0.49
Contracts Awarded, Public Works and Utilities	1919-23	1923-31	358	240	86	0.64
Portland Cement Production	1912-24	1924-30	222	254	48	0.81
Portland Cement Shipments	1912-24	1922-28	364	404	66	0.84
Portland Cement Stocks	1911-24	1924-30	254	230	30	0.87
Southern Yellow Pine Production	1917-23	1923-31	54	42	22	0.48
Western Pine Production	1917-24	1924-31	354	259	45	0.82
Fabricated Structural Steel, New Orders	1915-21	1922-28	108	64	58	0.09
Bath Shipments	1917-24	1924-30	113	162	92	0.43
Bath Stocks	1919-24	1924-30	269	114	36	0.68
Lavatory Shipments	1919-24	1924-30	70	127	91	0.28
Lavatory Stocks	1919-24	1924-30	111	63	32	0.49
Sink Shipments	1919-24	1924-30	79	126	100	0.21
Sink Stocks	1919-24	1924-30	129	90	36	0.60

[b] First period used as base.

finished products. In the former one of the most common causes of any modification in seasonal pattern is a change in the geographic area covered by the series. Wheat marketing by farmers in the United States is treated as the same series through the years when the bulk of the grain is winter wheat coming from Kansas and Nebraska and the years when a larger than usual proportion of spring wheat is coming from Minnesota and the Dakotas. Such shifts in the area of influence of seasonal factors also affect series relating to building construction. Thus data on contracts awarded are available for only a certain number of states in one period; and for a larger number in another. Also the seasonal pattern in shipments of some construction materials may reflect a shift in the geographic area where construction is being carried on, a shift that subjects the industry consuming these materials to different seasonal conditions.

In the demand for finished products modifications in seasonal pattern may arise from two somewhat related factors: a change in the product, which makes its use more or less dependent upon seasonal factors creating discontinuity in demand, and the wider diffusion of its consumption, which implies geographic or income group shifts in the consuming body and in its seasonal behavior. Thus in passenger cars both factors were involved. In some food products technological improvements in preservation and changes in consumers' habits were, without doubt, largely influential in forming the seasonal pattern in demand.

In many series changes in the seasonal pattern are a consequence of shifts in seasonal swing in several related series. This is especially true of essential industrial materials such as steel. If more steel is used in railroad construction than in building construction and in the production of automobiles, the seasonal pattern of demand may be vastly altered. As more large residential buildings than one-family houses are built the seasonal pattern of demand for and hence in that of shipments of such commodities as baths, sinks and lavatories may change appreciably.

Indeed, a consideration of all the possible factors that might effect seasonal patterns would lead to the impression that stability should not be expected. The results of the comparison, as shown in Table XXXIII, however, tend to sub-

stantiate the usual assumption of time series analysis that seasonal swings are recurrent from period to period, especially when their amplitudes are relatively large.

In the case of our particular comparison there is reason to believe that the post-War period was not very favorable for the assumption and testing of the stability of seasonal patterns. The early years were affected by the events of the recent past, which may be considered as an important random disturbance. Consequently, seasonal patterns during the years 1924-31 tended to depart further from patterns prevailing in preceding years than would patterns in any similar successive periods characterized by more 'normal conditions'. This becomes clear in the next set of comparisons, between seasonal patterns in any pair of years of a moving seasonal index.

b. *Within Moving Seasonal Indexes of Production and Employment*

For industrial production and employment several constant and moving seasonal indexes were computed by the Research Division of the Federal Reserve Board for the years since 1919. Of the fifty-six series on industrial and mineral production eight were found not to possess consistent seasonal variations, nineteen could be analyzed with the aid of constant seasonal indexes and twenty-nine showed such a change in their seasonal swings that moving seasonal indexes had to be computed. For these last twenty-nine series indexes of similarity were calculated in order to measure the significance of the change in pattern described by the moving seasonal indexes. Most of the indexes were available since 1919 and comparisons were made between the patterns for 1919, 1926 and 1931. For a few series, analyzed only since 1921, comparisons were made between the patterns for 1921, 1926 and 1931.

The following tentative conclusions are suggested by Table XXXIV.

(1) The indexes of similarity generally run below those obtained in Table XXXIII for comparisons of patterns between periods. Thus, in column *11,* in which the indexes run on the whole higher than in column *10,* seven out of twenty-nine indexes run above +0.80, eleven run below +0.50, and as many as seven, below +0.30.

This lower run of indexes is to be expected in view of the greater precision of the moving seasonal indexes in reflecting any changes in seasonal pattern. But even though the indexes of similarity based upon these year-to-year comparisons run lower than those derived from comparisons for periods, it may be seen that the persistence of pattern indicated is fairly high.

(2) As in the preceding comparison there is a definite positive association between the amplitude of the seasonal index and the measure of the persistence of its pattern. Thus, an index of rank correlation between the items in column *6* and in column *11* is +0.45, a value lower than that for Table XXXIII but still indicative of a significant association.

(3) The change in seasonal pattern is greater in the early post-War years than in the more recent period. The indexes in column *11* generally run higher than those in column *10*. Of the twenty-six series for which such comparison is possible eighteen show higher indexes of similarity for the comparison between 1926 and 1931 than for that between 1919 (or 1921) and 1926 (or 1925). In two series the two indexes are about equal, and in only six is the index for the early period higher than that for the later.

TABLE XXXIV

INDEXES OF SIMILARITY BETWEEN MOVING SEASONAL INDEXES FOR SELECTED YEARS

INDUSTRIAL PRODUCTION

Series	Years Compared			Total Deviations of Seasonal Index			Total Discrepancy between Seasonal Indexes		Index of Similarity between	
	1	2	3	1	2	3	1 and 2	2 and 3	1 and 2	2 and 3
(*1*)	(*2*)	(*3*)	(*4*)	(*5*)	(*6*)	(*7*)	(*8*)	(*9*)	(*10*)	(*11*)
Wheat Flour Production	1919	1926	1931	190	120	90	66	34	0.45	0.72
Cattle Slaughtered	1919	1926	1931	154	98	98	19	2	0.81	0.98
Calves Slaughtered	1919	1926	1931	126	64	68	30	14	0.53	0.78
Sheep and Lambs Slaughtered	1919	1926	1931	140	54	56	29	16	0.46	0.70
Hogs Slaughtered	1919	1926	1931	234	188	180	38	15	0.80	0.92
Cigar Production	1919	1926	1931	60	130	154	54	30	0.58	0.77
Cotton Consumption	1919	1926	1931	20	70	68	78	32	−0.11	0.54
Wool Consumption	1919	1926	1931	66	82	78	136	11	−0.66	0.87

TABLE XXXIV (CONTINUED)

Series	Years Compared			Total Deviations of Seasonal Index			Total Discrepancy between Seasonal Indexes		Index of Similarity between	
	1	2	3	1	2	3	1 and 2	2 and 3	1 and 2	2 and 3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Calf and Kip Leather Production	1921	1926	1931	82	84	146	24	115	0.81	−0.37
Goat and Kid Leather Production	1921	1926	1931	50	84	48	18	90	0.79	−0.07
Shoe Production	1919	1925	1930	64	88	106	20	56	0.77	0.36
Pneumatic Tire Production	1921	1926	1931	82	80	170	22	29	0.72	0.64
Inner Tube Production	1921	1926	1931	50	72	158	45	46	0.38	0.36
Polished Plate Glass Production		1926	1931		46	82		17		0.63
Passenger Cars*	1919	1925	1930	134	134	250	46	51	0.66	0.62
Trucks		1925	1930		122	148		42		0.66
Steel Ingot Production	1919	1926	1931	28	62	76	76	48	−0.23	0.23
Lumber Production	1919	1926	1931	88	52	60	21	14	0.60	0.73
Cement Production	1919	1926	1931	228	230	264	28	24	0.88	0.90
Shipbuilding	1919	1926	1931	94	234	290	221	246	0.06	−0.05
Mechanical Woodpulp Production	1919	1926	1931	162	134	128	40	25	0.70	0.81
Chemical Woodpulp Production	1919	1926	1931	62	32	24	49	19	−0.47	0.41
Box Board Production	1919	1926	1931	58	40	52	33	20	0.18	0.50
Wrapping Paper Production	1919	1926	1931	60	32	18	42	29	−0.31	0.09
Paper Box Production		1926	1931		66	68		45		0.32
Anthracite Coal Output	1919	1926	1931	46	40	102	37	34	0.08	0.15
Bituminous Coal Output	1919	1926	1931	52	100	102	87	4	0.13	0.96
Beehive Coke Production	1919	1926	1931	82	176	160	190	11	−0.08	0.94
Silver Production	1921	1926	1931	42	26	54	30	20	−0.15	0.23

* Passenger cars and trucks combined in 1919.

It is possible that this difference is attributable to differences in the length of the intervals between the indexes compared; only five years elapse between 1926 and 1931 while seven years separate 1919 from 1926. It seems more likely, however, that during the early post-War years the change from the abnormal conditions prevailing at the close of the War and during the first post-armistice years to the more settled

TABLE XXXV

INDEXES OF SIMILARITY BETWEEN SEASONAL INDEXES FOR SELECTED YEARS

EMPLOYMENT IN MANUFACTURING INDUSTRIES

Series	Years Compared			Total Deviations of Seasonal Index			Total Discrepancy between Seasonal Indexes		Index of Similarity between	
	1	2	3	1	2	3	1 and 2	2 and 3	1 and 2	2 and 3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Flour	1919	1925	1930	65	43	25	15	12	0.64	0.73
Baking	1919	1925	1930	22	17	17	9	5	0.45	0.70
Slaughtering and Meat Packing	1919	1925	1930	30	43	25	46	48	−0.07	−0.12
Sugar Refineries (Cane)	1919	1925	1930	99	68	38	26	60	0.62	0.12
Cigars and Cigarettes.		1925	1930		30	36		25		0.30
Chewing and Smoking Tobacco		1925	1930		22	39		32		0.18
Cotton Goods	1919	1925	1930	8	35	21	58	15	−0.64	0.57
Dyeing and Finishing	1919	1925	1930	20	26	22	46	7	−0.77	0.73
Shirts and Collars....	1919	1925	1930	29	26	27	25	22	0.05	0.16
Millinery	1919	1925	1930	82	90	120	45	40	0.46	0.56
Shoes	1919	1925	1930	15	32	33	43	17	−0.33	0.47
Rubber Goods and Shoes		1925	1930		53	48		51		−0.06
Automobiles	1919	1925	1930	52	36	59	41	15	−0.15	0.58
Glass	1919	1925	1930	45	29	31	32	32	−0.11	−0.12
Hardware	1919	1925	1930	16	11	13	20	10	−0.81	0.06
Cement	1919	1925	1930	70	54	60	17	6	0.68	0.89
Stoves		1925	1930		49	49		28		0.43
Furniture	1919	1925	1930	18	28	46	30	30	−0.06	−0.05
Fertilizer		1925	1930		244	232		54		0.77

conditions of the years after 1921 was rather rapid and substantial. In other words, the seasonal swings of 1919 still bore the heavy impress of the War while 1926 was a year of much more normal conditions. Confirming evidence is found in the movement of seasonal amplitude.

For employment the Research Division of the Federal Reserve Board computes moving seasonal indexes for nineteen branches of manufacturing industry, most of them from 1919 to 1930. Indexes of similarity between seasonal indexes in 1919, 1925 and 1930 are presented in Table XXXV.

The indexes of similarity run still lower than in industrial production, but it seems probable that this is largely because the seasonal movements in employment are much narrower. Only one index of similarity is above +0.80, eight of the nineteen are above +0.50, and as many as eight are below +0.30.

The association between the seasonal amplitude and the size of the index of similarity is appreciably lower than in the two preceding comparisons although a coefficient of rank correlation of +0.25 is still indicative of some measure of positive association.

Again the indexes of similarity between 1925 and 1930 are on the whole higher than those between 1919 and 1925. This is true of ten out of the fourteen possible comparisons, while in one other the difference between the two indexes is rather slight.

c. *Year by Year*

The changes of seasonal pattern in time have been measured so far only from period to period. But whenever average seasonal indexes are computed, as was done in our study, it becomes important to measure the persistence of the pattern not only from one period to the next but for every year within each period. It is important to find out how greatly short-time changes in seasonal pattern qualify the significance of the seasonal index, assumed to be average for the entire period.

Short-time shifts in seasonal pattern occur quite frequently and their presence can be ascertained rather easily. They affect not only all the numerous time series that deal with the flow of agricultural crops to markets, shipments of crops from central markets, exports and stocks of crops at primary

TABLE XXXVI

CORRELATION YEAR BY YEAR BETWEEN AVERAGE SEASONAL INDEXES AND THE PERCENTAGE DEVIATIONS OF THE ORIGINAL DATA FROM THE MOVING AVERAGE

PRODUCTION, RECEIPTS AND CONSUMPTION

Series	Sum of s^2	Coefficient of Correlation by Years													r for the Period
		1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1930-1	
Wheat, Marketing by Farmers	55,245	0.99	0.96	0.99	0.99	0.97	0.97	0.99	0.95	0.99	0.99	0.91			0.95
Wheat, Receipts at Primary Markets	22,668–44,412			0.83	0.94	0.97	0.96	0.81	0.99	0.87	0.88	0.95	0.98	0.94	0 91–0.91
Wheat Flour Production	2,515–1,021	0.83	0.83	0.84	0.94	0.96	0.96	0.90	0.95	0.90	0.89	0.91	0.96	0.97	0.86–0.90
Wheat Flour Consumption	1,610			0.86	0.94	0.89	0 96	0.89	0.89	0.77	0.79	0.70	0.80	0.80	0.84
Cattle and Calves, Receipts at Primary Markets	4,290–3,262	0.94	0.93	0.93	0.97	0.97	0.96	0.94	0.97	0.93	0.94	0.96	0.93	0.92	0.94–0.95
Beef and Veal Production	661			0.84	0.90	0.93	0 82	0.82	0.88	0.91	0.83	0.88	0.80	0.74	0.88
Beef and Veal Consumption	749–508	0.73	0.92	0.77	0.75	0.92	0.87	0.82	0.83	0.85	0.70	0.92	0.87	0.82	0.75–0.84
Sheep and Lambs, Receipts at Primary Markets	11,921–9,901	0 97	0.98	0.96	0.92	0.98	0.97	0.99	0.96	0.99	0 99	0.98	0.97	0.96	0.94–0.97
Lamb Production	360			0.88	0.48	0.66	0.82	0.44	0.59	0.81	0.81	0.61	0.73	0.82	0.69
Mutton and Lamb Consumption	883–302	0.83	0 81	0.70	0.76	0.78	0 75	0.71	0.63	0.76	0.71	0.58	0.83	0.84	0.73–0.71

TABLE XXXVI (CONTINUED)

Series	Sum of s^2	Coefficient of Correlation by Years													r for the Period
		1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1930-1	
Hogs, Receipts at Primary Markets	4,829–3,346	0.99	0.93	0.97	0.98	0.95	0.93	0.96	0.97	0.75	0.92	0.96	0.98	0.97	0.92–0.90
Pork Production	3,201			0.94	0.91	0.92	0 93	0.94	0.87	0.77	0.85	0.94	0.98	0.96	0.88
Pork Products, Apparent Consumption	615				0 83	0.87	0 78	0.96	0.84	0.79	0.65	0.86	0.86	0.87	0.83
Cotton Consumption	502[a]		0.03	0.14	0.45	0.92	0.82	0.84	0.81	0.63	0.81	0.75	0.93	0.72	0.77
Wool Consumption	340–449	0.02	0.54	0.74	0.12	0.60	0.81	0 82	0.84	0.73	0.71	0.83	0.63	–0.05	0.37–0.74
Hosiery Production	456						0.76	0.75	0.86	0.92	0.91	0.84	0.81	0.71	0.81
Shoe Production	735–1,803					0.84	0.96	0 94	0.84	0.99	0.94	0.96	0.94	0.83	0.89–0.93
Passenger Car Production	2,664–8,327		0.67	0.87	0 90	0.86	0.36	0.57	0.81	0.99	0.95	0.95	0.90	0.92	0.70–0.86
Inner Tubes Production	326–1,875				0.69	0 37	0.60	0.44	0.53	0.85	0.86	0.94	0.96	0.91	0.47–0.78
Steel Ingot Production	691–972			0.58	0.34	0.27	0.92	0.89	0.73	0.96	0.76	0.66	0.96	0.98	0.63–0.80
Contracts Awarded, Total	4,836–2,415		0.87	0.89	0.98		0.82	0.88	0 75	0.96	0.94	0.80	0.75	0.92	0.91–0.80
Contracts Awarded, Residential	3,514–2,416		0.87	0 91	0.89		0.64	0.84	0.89	0.95	0.84	0.81	0.90	0.88	0.87–0.82

[a] Index for 1921-31 only.

stages of distribution, etc., but also the series that portray seasonal variations in consumers' demand due mainly to climatic conditions. In agricultural crops the exact month of harvest may not be the same every year. In retail trade the best example is afforded by the shift of the Easter holiday from March to April. Shifts in the exact date on which a new climatic season is really ushered in affect the sales of apparel, consumption of seasonal foods, sometimes even the beginning of construction operations or of water transportation.

The effect of these changes on the persistence of seasonal pattern from year to year can be measured, if only approximately, by the coefficient of second moment correlation between the percentage deviations of original data from the moving average and the deviations of the constant seasonal index from 100. If the coefficient is high year in and year out the inference may be drawn that the seasonal pattern is stable and that the non-seasonal changes, if present, are uncorrelated with the seasonal pattern. If the correlation is low, it is a definite indication of the importance of changes that are either non-seasonal in character, or if seasonal, different from the established constant seasonal pattern.

Table XXXVI presents these coefficients of correlation for twenty-two series relating to industrial activity. These coefficients are a by-product of the measurement of annual changes in seasonal amplitude, and the series were chosen so as to represent various groups and aspects of industrial activity. In addition to the measures that record the association for every calendar year, the table gives also the coefficient of correlation for the period as a whole (or for two periods, if two constant seasonal indexes were computed) and the sum of the squares of the deviations of the seasonal index from 100, a measure of seasonal amplitude.

Table XXXVI suggests the following observations:

(1) The coefficients of correlation run rather high. Those for the period as a whole range from 0.69 (considering the second period only) to 0.97. For single series the range is, of course, more appreciable; for some the coefficient in a single year falls close to 0 or even below it (cotton consumption in 1920 and 1921, wool consumption in 1930-31). But for several series the coefficients are uniformly high. Thus, for wheat marketing by farmers, receipts of cattle and calves, receipts

of sheep and lambs, the r's do not fall below 0.90; for wheat receipts at primary markets, wheat flour and shoe production, they do not fall below 0.80. These high values tend to indicate the importance of the average seasonal patterns as compared with other changes of a seasonal or non-seasonal character in the deviations of the original data from the moving average.

(2) As should have been expected, the magnitude of the correlation coefficients is closely associated with seasonal amplitude. For the more recent period the rank correlation between the column of Sum of s^2 and the r's (the latter taken for the period) is +0.77. For two selected years a similar index of rank correlation is +0.63 (for 1924) and +0.70 (for 1929). The indication is thus strong that, as in the case of the modifications in pattern from period to period, the absolute size of such modifications in pattern from year to year is unrelated to the magnitude of the seasonal swing. In series with conspicuous seasonal variations these disturbances in seasonal pattern are not sufficiently greater than in series with relatively mild seasonal swings to offset the difference in the amplitude of the constant seasonal variation.

(3) In view of the close association between seasonal amplitude and the measure of the persistence of the pattern, a more precisely specific measure of the latter could be established if we allowed for the differences in seasonal amplitude and proceeded to ascertain which series show a stability of pattern higher or lower as compared with the measure associated with amplitude. A simple if somewhat crude way of doing this is to rank the series by both amplitude and the r's and observe the difference in ranks. This is done in Table XXXVII using the r's for the entire period and for two selected years, 1924 and 1929.

This comparison reveals interesting differences among the series. Wheat flour production, receipts of cattle and calves, beef production, beef consumption, receipts of sheep and lambs, consumption of mutton and lamb, and production of hosiery and of shoes, all show a higher stability of pattern than that to be expected from the seasonal amplitude characterizing these series. Wheat receipts (and to a less extent, marketing by farmers), passenger car production, automobile tires and tubes, steel ingots and the two building con-

tract series, on the contrary, show a persistence of seasonal pattern considerably below that which might be expected from the large seasonal amplitudes characterizing these series. It seems evident that this division of series into those which are relatively stable seasonally from year to year and those which

TABLE XXXVII

COMPARISON OF RANKS BY SEASONAL AMPLITUDE AND BY STABILITY OF PATTERN

PRODUCTION, RECEIPTS AND CONSUMPTION

(*ranks in increasing order for both variables*)

	Difference between Ranks		
	r's for the Period	*r*'s for 1924	*r*'s for 1929
Wheat, Marketing by Farmers	+1	0	+9
Wheat, Receipts at Primary Markets	+3	+1	+3
Wheat Flour Production	−6	−7	−2
Wheat Flour Consumption	0	−5	+7
Cattle and Calves, Receipts at Primary Markets	−3	+1	−4
Beef and Veal Production	−6	−2	−3
Beef and Veal Consumption	−6	−5	−8
Sheep and Lambs, Receipts at Primary Markets	−2	−1	−2
Lamb Production	+1	−7	0
Mutton and Lamb Consumption	−1	−3	0
Hogs, Receipts at Primary Markets	+1	+4	−2
Pork Production	+1	+3	0
Pork Products, Apparent Consumption	−3	+2	−3
Cotton Consumption	+1	−3	0
Wool Consumption	0	−3	−5
Hosiery Production	−4	0	−5
Shoe Production	−7	−5	−7
Passenger Car Production	+6	+15	+2
Inner Tubes Production	+8	0	−2
Steel Ingot Production	+3	−3	+6
Contracts Awarded, Total	+7	+6	+8
Contracts Awarded, Residential	+6	+12	+8

are not agrees very well with the showing of the indexes of similarity between periods. The forces that are conducive to changes in seasonal pattern from period to period affect relative stability from year to year.

Similar results are obtained when the coefficients of correlation are observed for payrolls in eleven selected branches of manufacturing activity.

TABLE XXXVIII

CORRELATION YEAR BY YEAR BETWEEN AVERAGE SEASONAL INDEXES AND THE PERCENTAGE DEVIATIONS OF THE ORIGINAL DATA FROM THE MOVING AVERAGE

PAYROLLS IN SELECTED MANUFACTURING INDUSTRIES

Series	Sum of s^2	Coefficient of Correlation by Years								r for the Period
		1924	1925	1926	1927	1928	1929	1930	1930-1	
Flour Milling	175	0.93	0.85	0 98	0 85	0.92	0.93	0 84	0.97	0.88
Sugar Refining, Cane	262	0 87	0.82	0 72	0 88	0.39	0.77	0 78	0.79	0.73
Cotton Goods	232	0.93	0.89	0.97	0.75	0.76	0.86	0.96	0.74	0.83
Men's Clothing	533	0.94	0.95	0 94	0.98	0 95	0.92	0.85	0.70	0.91
Women's Clothing	2,950	0.98	0 96	0 90	0.94	0.98	0.98	0.96	0.94	0.95
Boots and Shoes	596	0.58	0.86	0 84	0.98	0 96	0.93	0.84	0.66	0.85
Passenger Cars	1,323	0.70	0.63	0 71	0.98	0.88	0.87	0.87	0.91	0.84
Auto Tires and Tubes	498	0.04	0.80	0 38	0.94	0.71	0.86	0.96	0.91	0.68
Furniture	357	0.82	0.88	0 97	1.00	0 98	0.83	0.74	0.73	0.87
Iron and Steel	262	0.85	0.69	0.66	0.92	0.90	0.34	0.86	0.90	0.70
Cement	763	0.93	0.92	0.95	0.98	0.96	0.99	0.94	0.93	0.91

Thus in Table XXXVIII also the coefficients run rather high, those for the period ranging from 0.68 to 0.95. Two of the series, cement and women's clothing, show coefficients that do not fall below 0.90 in any single year, and in one other, flour milling, the measures do not decline below 0.80. There is also a marked association between seasonal amplitudes and the coefficients of correlation, expressed by a coefficient of rank correlation for the period of +0.45.

The most significant correlation appears when the differences in rank are studied, with the series arrayed in the order of their seasonal amplitude and the magnitude of the r's. In such a comparison, flour milling, cotton goods, men's clothing, furniture and cement appear as a group whose stability of pattern is greater than expected; shoes, passenger cars, automobile tires and tubes, and iron and steel, as a group whose stability of pattern is less than expected. This division confirms, on the whole, the showing made in the larger number of series on production, receipts and consumption.

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		Average Deviation in Period	
	1	2	1	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 *	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

* 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

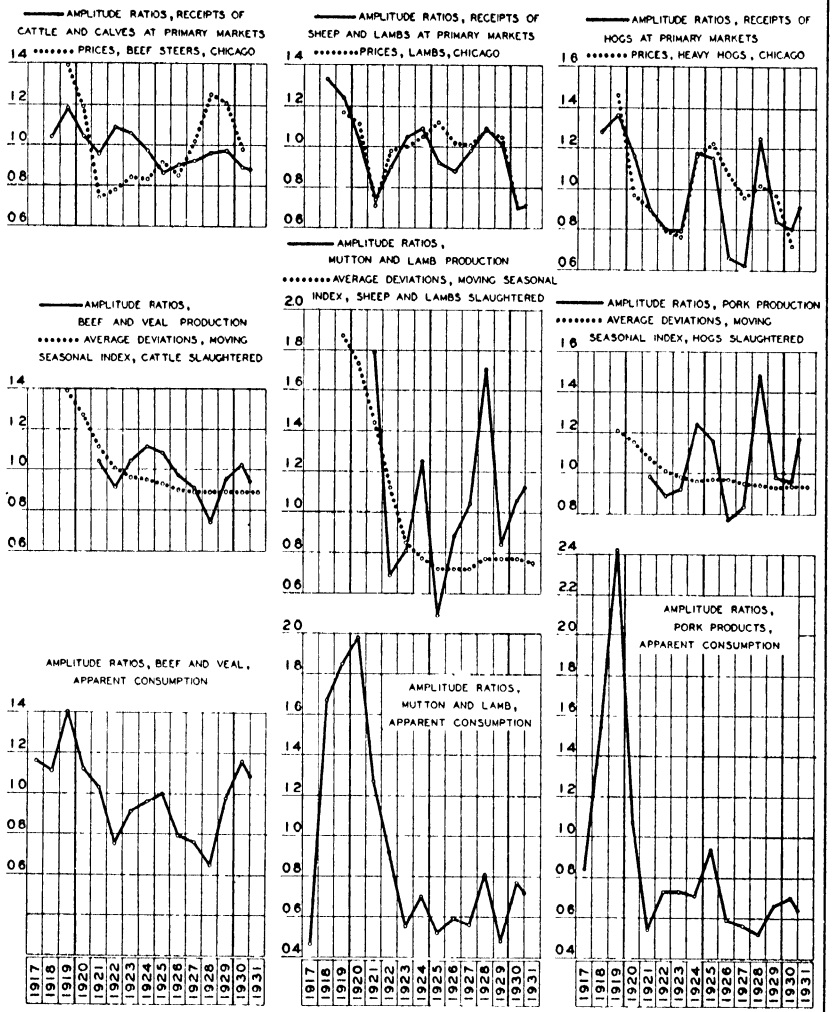
Seasonal Amplitude Ratios by Years

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 seasona

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: Number of Times the Two In Sign			Changes in Volume and Changes in Amplitude Ratios: Number of Times the Two In Sign		
	Agree	Disagree	Indeterminate	Agree	Disagree	Indeterminate
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	
Hogs, Receipts	6	7	0	7	6	
Pork Production	3	7	0	6		
Pork Consumption	7	7	0	6		
Total of 9 Series	49	58	4	54		

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

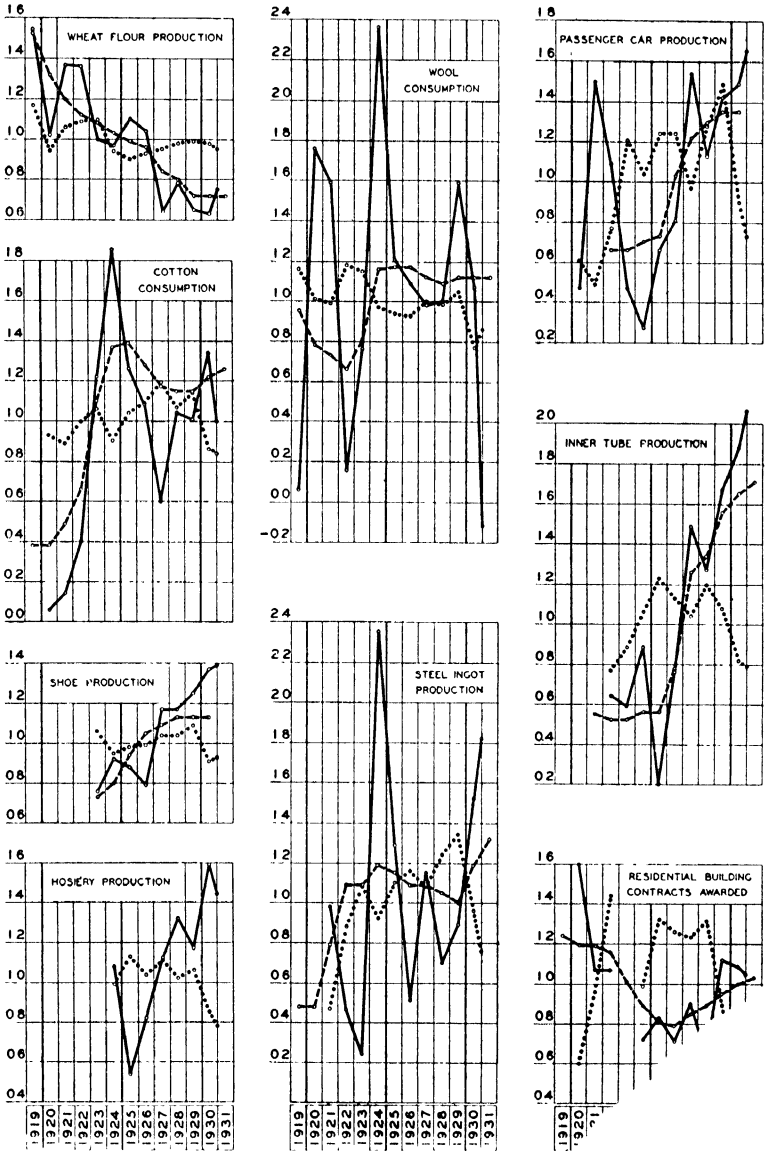
SELECTED SERIES OF INDUSTRIAL PRODUCTION

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
..	1.08	1.09	0.82	0.82	0 81	0.76	0.51	0.49
	0.60	0.98	1.17	1.12	1.54	1.49	1.15	0.85
	' 04	1.00	1.17	1.32	1.13	1.27	0.70	0.78
		1.59	1.25	1.17	1.42	1.67	0.89	0.98
		1.07	1.37	1.59	1.49	1.88	1.52	1.26
		`.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
ediate future. Decline in the volume of activity of the
ies producing passenger cars, cotton or steel ingots
dicates the presence of a cyclical contraction. Dur-
ning phase of the business cycle hand-to-mouth
distributive trades (and consumers) becomes
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			Changes in Volume and Changes in Amplitude Ratios: Number of Times the Two In Sign		
	Agree	Disagree	Indeterminate	Agree	Disagree	Indeterminate
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 ar[illegible] fluctuations has been pointed out by two Scandinavian students of [illegible] In his recently translated *Economic Progress and Economic* 1932) Dr. Johan Åkerman writes

> " it may be asked whether *each year* has approximate[ly] variation, or whether the deviations from the m

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 activity. Thus a month in a year of low business activity will thus show a greater deviation than a similar month in a year of high business activity. (Cycle Element in the Seasonal Fluctuation of the Degree of Unemployment. *Statsøkonomisk Tidsskrift* no. 2-3, 1931, abstracted in *Social Hygiene*, vol. 18, 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 unemployment develops that causes a secular rise sonal swing of productive activity, the rise co with imposing additional burdens on eq On the other hand, if it could be said tha

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
lyzed move in rather close agreement. Thus, out of
ven comparisons, in flour and automobile tires
hange is the same in five instances, in cotton
ars and steel ingots, in six. In the case of
cipated 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	Automobiles	Auto Tires and Tubes	Iron and Steel	Cement	Furniture
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
[illegible].....	1.09	0.91	0.59	0.87	1.09	1.14	1.18	2.12	0.31	1.01	1.30
...	0.55	0.90	1.24	1.27	1.10	1.27	1.34	1.72	1.33	1.51	0.77
.	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.

CONCLUDING NOTES

1. The Burden of Seasonal Variations

The detailed discussion in the preceding chapters has served to show that seasonal variations affect the rate of activity in almost every branch of industry and trade; that the solution of the seasonal problem involves keeping stocks of one kind or another; and that the exact nature of the solution depends upon and varies with economic conditions in the industries and trades affected. Seasonal irregularities in the flow of related commodities may be either non-synchronous or of unequal amplitude or subject to both types of disparity, and the surpluses may be in the form of an excessive accumulation of finished commodities or of raw materials, of idle machinery, of an excessive supply of labor or of any other of the numerous factors essential to carrying through an economic process.

A definition is given below of what constitutes ' excessive ' and what may be called ' surplus ' stocks, as distinguished from the stock of commodities accumulated for the purpose of a prosecution of an economic process at a constant and continuous rate. For the moment we are concerned only with the manner in which commodities, equipment or labor become ' excessive '. A surplus may arise not only from the disparate influence of seasonal factors on related economic processes but also from the varying influence upon these processes of other types of change: secular, cyclical and random. It is rather difficult to segregate the portions of the surplus available in excess of the amount needed for the most efficient prosecution of economic activity at a constant rate due specifically to the disturbing influence of seasonal, cyclical, secular and random factors. It would be impossible to attempt to estimate the burden imposed specifically by seasonality unless exhaustive data on the seasonal rate of utilization [illegible] trial equipment and labor, and measures of so[illegible] tions for stocks of all commodities at each of [illegible] the production of raw materials to the fini[illegible] at hand.

Such data are not available and the frequent gaps which have occurred in our detailed discussion have emphasized repeatedly the lack of quantitative records for the important links. However, a few partial indications of the burden of seasonal variations may be attempted. They are presented below in full recognition of their limited and highly tentative character.

a. *Surplus Stocks*

To measure the seasonal surplus of commodity stocks we may use the seasonal indexes that have been computed in the study. For each commodity, stocks are taken at the beginning of a month in which both the flow to the utilizing agents and the flow from them, that is, production and consumption, or shipments, are close to the average for the year. In every instance the seasonal flow from the utilizing agents during the chosen month is equal to or higher than the rate of supply to them during that month. The seasonal index of stocks at the beginning of the month then represents the minimum amount of stocks necessary for carrying through the activity in question at a rate free from seasonal disturbances. If for any other month the seasonal index of stocks is above the index for this month, this excess stock holding is due purely and exclusively to the seasonal disturbance in the flow and utilization of the commodity in question.

The seasonal surplus of stocks may then be measured in either of two ways. First, we may obtain the total sum of differences between the seasonal index for the month taken as the ' minimum ' and the seasonal indexes for the other eleven months. This sum of differences measures the seasonal surplus of stocks through the entire year. Second, we may obtain the difference between the ' minimum ' and the seasonal peak of stock-holding. This measures the maximum seasonal surplus of stocks for a single month.

The seasonal excess of stocks, measured in either way, may be expressed in units of the average monthly volume of ac-

[illegible]at the stock serves. In the first, total differences, a

[illegible]would mean that the seasonal surplus of stocks

[illegible]ear is equivalent to the holding for one month

[illegible]nodities equal to one month's output, con-

[illegible]s. In the second, the difference between

the ' normal minimum ' and the seasonal peak, a figure of 1.0 would mean that at its peak in any single month the seasonal surplus of stocks is equivalent to the holding for one month of a volume of commodities equal to one month's activity.

Example:

In evaporated milk, case goods, the seasonal index for March is 100 for production and 100 for shipments. Hence, stocks in producers' hands at the end of February are sufficient to enable the producers to ship at an average rate for one year while production is also at the same rate. The seasonal index for stocks at the end of February is 67, which is the ' minimum '. Hence

(1) The total seasonal surplus of stocks for the year is $33 \times 12 = 396$. The ratio of stocks to shipments (or production) being 1.34, the seasonal surplus in terms of production or of shipments is $396 \times 1.34 = 531$. Average monthly production is expressed by an index of 100. Hence, in terms of monthly volume of production, the seasonal burden of stocks through the year is 5.31.

(2) The stocks at seasonal peak are measured by an index of 139. Hence, the maximum seasonal surplus for a single month is $72 = 139 - 67$. In terms of monthly output, it is 72×1.34, divided by 100, or 0.96.

Table XLIX presents these estimates of the seasonal surplus of stocks for the commodities that were analyzed in the study.

The comparison could not be made for stocks of such agricultural raw materials as wheat and cotton because a month could not be found in which marketing by farmers (or receipts at primary markets), deliveries to mills and exports were all at a seasonally normal level, a clear indication that for a more analytical study of seasonal changes time units shorter than a month are essential. On the other hand, almost no records are available on stocks in the hands of the distributive trades. As a result the table covers only in the hands of manufacturing producers, which point of view of quantities involved and sonality, represent the less important s accumulation.

Nevertheless, for many of the commodities listed the purely seasonal burden of stocks appears considerable. In at least one-third the total surplus has a measure of 4.0 or more. This means either that stocks equivalent to four times or more of monthly production are held for one month or that the output of a month is held for four months or longer. If the seasonal surplus of raw material stocks of each of the commodities involved and the seasonal excess of the same commodities held by the distributive trades and the consumers

TABLE XLIX

SEASONAL SURPLUS OF COMMODITY STOCKS IN UNITS OF MONTHLY VOLUME OF PRODUCTION, SHIPMENTS OR APPARENT CONSUMPTION

Commodity [a]	Seasonal Surplus	
	For the Year	For the Peak Month
Wheat Flour, All Positions	0.2	0.10
Beef and Veal, Cold Storage	0.9	0.02
Mutton and Lamb, Cold Storage	0.1	0.05
Pork and Pork Products, Cold Storage	5.0	0.67
Butter, Cold Storage	6.1	1.17
Cheese, Cold Storage	6.5	1.17
Evaporated Milk, Case Goods	5.3	0.96
Condensed Milk, Case Goods	6.6	1.34
Condensed Milk, Bulk Goods	2 9	0.72
Cottonseed Oil, Refined	11 2	2.06
Raw Cotton at Textile Mills (unreliable)	11 0	1.51
Finished Cotton Goods	0.1	0.05
Knit Underwear	2.1	0.42
Hosiery	1.5	0.26
Working Clothes	1.4	0.24
Dry Goods, Wholesalers' Stocks [b]		
Philadelphia F. R. D.	2.6	0.40
Richmond F. R. D.	3 4	0.50
Dallas F. R. D.	4.8	0.78
Department Stores [c]	2 2	0.57
Crude Rubber, All Positions	2.7	0.57
Inner Tubes	3.0	0.65
[illegible]tic Casings	1.5	0.41
[illegible]ion Tires	1.8	0.34
[illegible]	1.5	0.62
[illegible]	0.6	0.09
[illegible]	5.5	0.85
[illegible]	1.2	0.18

TABLE XLIX (CONTINUED)

Commodity [a]	Seasonal Surplus	
	For the Year	For the Peak Month
Common Brick	4.3	0.98
Face Brick	3.2	0.71
Floor and Wall Tile	1.2	0.28
Southern Yellow Pine	0.3	0 08
Western Pine	4.1	0.68
Maple Flooring	2.8	0.50
Radiators	9.6	1.70
Square Boilers, Cast Iron	11.4	1.90
Round Boilers, Cast Iron	9 2	1.53
Baths	3.1	0 51
Lavatories	1.4	0.30
Sinks	2 0	0.49
Vitreous China	0 8	0 22
Dry Roofing Felt	0.2	0 04

[a] Unless otherwise noted, stocks are given as held by producers.
[b] Ratio of stocks to sales assumed as 2.0.
[c] Ratio of stocks to sales assumed as 3.0.

(industrial or private) could be added, the total would be much more impressive. Our partial estimate may be concluded by emphasizing once again the paucity of data on the monthly changes in stocks of commodities at the various stages of production and distribution.

b. *'Excessive' Equipment*

In measuring surplus equipment the difficulties created by lack of data are increased by the even more serious difficulties that arise in defining the concept. What is the capacity of an industry and when may it be said with assurance that over-capacity exists in a given branch of economic activity? Even if we resolve numerous difficulties by assuming that the volume of output affords a reliable measure of capacity, troublesome questions still remain. If, for example, the volume of output of a certain commodity is characterized by a seasonal swing that declines in one month to 60 [illegible] in another month to 150, may we say that for ou[illegible] capacity is measured by an index of 150 [illegible] any month in which production is below which a part of capacity is idle? Or is

scribed by an index of 100 and does any output above 100 indicate an extraordinary utilization of capacity? It is obvious that our measurement of the degree of over-capacity attributable to seasonal disturbances will vary with our answer to these questions.

The difficulty may be resolved by the assumption that the seasonal peak month measures the normal plus the latent capacity of the industry; that an output below the seasonal peak indicates an inadequate utilization of the maximum possible capacity of an industry; and that an output below a seasonal index of 100 indicates an inadequate utilization of the normal capacity of the industry. We can then set up two measures of the degree of over-capacity in industry attributable to seasonal disturbances: one gives the total difference in activity between each of the months and the month of peak output; the other the amount by which the months below 100 depart from 100. Dividing each of these by 12 we obtain two measures of the average monthly over-capacity attributable to seasonal disturbances.

These two measures may be computed for industrial production by utilizing the seasonal indexes for the component branches of manufacturing production and mineral output made available by the Federal Reserve Board. Since equipment may not be considered mobile as between industries, the measure was computed for each branch of production separately; then a weighted average was computed for manufacturing industry and for mineral output. The resulting figures are as follows:

For manufacturing industry—monthly average per cent by which output is	
below the seasonal peak	11.9
below the line of 100	3.3
For minerals—monthly average per cent by which output is	
below the seasonal peak	15.2
below the line of 100	4.9

[illegible]asure of seasonal over-capacity in manufac-[illegible]s probably lies between the two figures. It [illegible]verage deviation from the seasonal peak, [illegible]nth a higher output could probably be

achieved than would be possible under continuous utilization of capacity. On the other hand, the lack of utilization of capacity must be much higher than that indicated by deviations below 100. It seems likely that the true figure must be about 8 or 9 per cent in manufacturing industry and 10 to 12 per cent in minerals.

For manufacturing industry another interesting indication of the influence of seasonal disturbances on over-capacity may be obtained from the *Census of Manufactures* for 1921 and 1923. For these years " each manufacturing establishment was asked to estimate the percentage which its actual output during the census year constituted of its maximum possible output."[1] These percentages were computed by the Bureau of the Census for each industry, and an average, weighted by the value of products, was taken for all manufacturing establishments. The averages for all industries were 57.1 for 1921 and 72.2 for 1923.

Of the total number of industrial branches (335 in 1921 and 328 in 1923) 68 were chosen as subject to seasonal disturbances. For these we then compared the percentage of maximum capacity utilized with the average percentage for all industries during the same year. This comparison, when made for both 1921 and 1923, reveals whether the seasonal industries suffer from an over-capacity larger than that which prevails in the manufacturing industry of the country as a whole. Table L summarizes the results of this comparison.

It may be seen that in the overwhelming majority of instances the utilization of capacity by seasonal industries is below the average. In 1921 this is true of 45 out of 65 industries in the list; in 1923 of 57 out of 68. This difference in showing is due to the fact that in a year of business depression, such as 1921, the seasonal industries, which include many concerned with producing consumers' goods, did not suffer as deep a cyclical decline as the non-seasonal industries which include chiefly those turning out producers' goods. In 1923, on the contrary, a cyclical peak year, the seasonal industries tended to show a less steep cyclical
non-seasonal industries.

When the deviations from the averag
1923 are added, only 16 of the 68 ind

[1] *Census of Manufactures, 1923*, p. 1200.

TABLE L

PER CENT ACTUAL OUTPUT OF MAXIMUM POSSIBLE OUTPUT

MANUFACTURING INDUSTRIES CHARACTERIZED BY SEASONAL VARIATIONS

DEVIATIONS FROM AVERAGE FOR ALL INDUSTRIES

Industry	1921	1923
Agricultural Implements	−21 7	−11.1
Artificial and Preserved Flowers and Plants	+ 6 5	− 2.6
Artificial Stone Products, Excluding Paving and Roofing	− 8.3	−11.9
Asbestos Products Other Than Textiles, Steam Packing or Pipe and Boiler Covering [a]	−17.7	− 4.5
Awnings, Tents and Sails	− 3.2	−14 4
Beverages	−12 4	−38 3
Boots and Shoes Other Than Rubber	+ 5.6	− 0.4
Butter, Cheese, Condensed and Evaporated Milk	+13 9	− 2.4
Canning and Preserving, Fish, Crabs, Shrimps, Oysters and Clams	− 8.6	−27.9
Canning and Preserving, Fruits and Vegetables; Manufacture of Pickles, Jellies, Preserves and Sauces	− 5.0	− 7.0
Cement	+21.5	+14 0
Clay Products (Other Than Pottery) and Non-clay Refractories	− 3 3	+ 5 4
Clothing, Men's	+ 9.1	+ 0.7
Clothing, Women's	+ 7.7	− 3.1
Confectionery [b]	+ 2 9	− 9.8
Dairymen's Supplies, Creamery, Cheese-factory and Butter-factory Equipment; Poultrymen's and Apiarists' Supplies	− 2 8	−17.9
Fertilizers	− 6.7	−16.6
Flavoring Extracts	−22 1	−17.1
Flavoring Sirups and Bitters	−15.1	−24 8
Flax and Hemp, Dressed	−10.9	−34.3
Flour-mill and Grain-mill Products	− 2 8	−16 0
Food Preparations, Not Classified Elsewhere	− 6.2	−14 9
Fuel, Manufactured	−17.4	−23.4
Fur Goods	+ 7.1	− 4.3
Furnishing Goods, Men's	+ 7.4	− 8 8
Furs, Dressed	− 0 1	− 5 5
Glass	− 2.3	+ 2 4
Gloves and Mittens, Leather	−12.7	− 4 7
Gl[illegible]d Mittens, Cloth, Not Made in Textile Mills	− 9.1	+ 5.8
[illegible]rials	+ 0 4	−10.4
[illegible]han Fur-felt, Wool-felt and Straw	− 5.0	− 2 6
[illegible]	[c]	− 5.1
[illegible]	+ 5 6	+ 0 4
[illegible]	[c]	−18.0
[illegible]	[c]	−16.3

TABLE L (CONTINUED)

Industry	1921	1923
Ice, Manufactured	+ 1.1	— 18.8
Jewelry	— 1.4	— 3.8
Knit Goods	+ 9.6	+ 2.1
Lime	— 1 8	— 3.7
Linen Goods	— 11.4	— 12.1
Marble, Slate and Stone Work	+ 1.7	— 2 9
Millinery and Lace Goods	+ 8.2	— 4 3
Minerals and Earths, Ground or Otherwise Treated	— 13 5	— 4 6
Motor-vehicle Bodies and Parts	— 14 3	— 1 2
Motor Vehicles, Excluding Motorcycles	— 14.0	+ 2.7
Motorcycles, Bicycles and Parts	— 22.7	— 6 5
Oil, Cake and Meal, Cottonseed	— 5 0	— 24.4
Oleomargarine and Other Butter Substitutes Not Made in Slaughtering and Meat Packing Establishments	— 15 0	— 3.3
Paints and Varnishes	+ 3 9	— 1.3
Paving Materials Other Than Brick	+ 1 3	— 2.9
Peanuts, Grading, Roasting, Cleaning and Shelling	— 12 4	— 25.6
Poultry Killing and Dressing	— 2 8	— 1.9
Rice Cleaning and Polishing	— 11.1	— 16 0
Roofing Materials, Excluding Wood, Slate, Burnt Tile, Asbestos, and Metal Other Than Metal Shingles and Ceilings	— 0 7	— 7.8
Rubber Tires and Inner Tubes	— 5 0	— 5.7
Saddlery and Harness	— 13.2	— 17.1
Sand-lime Brick	— 6.9	— 1.8
Ship and Boat Building, Steel and Wooden, Including Repair Work	— 11 4	— 36.4
Soda-water Apparatus	— 6.4	— 6 1
Steam and Other Packing, Pipe and Boiler Covering, and Gaskets, Not Made in Textile Mills	— 2.9	+ 0 3
Steam Fittings and Steam and Hot-water Heating Apparatus	— 3 6	+ 8.7
Stoves and Appliances, Gas and Oil	— 2 3	— 3.2
Stoves, Other Than Gas, Oil, or Electric, Hot-air Furnaces and Fireless Cookers	— 9.8	— 3.0
Structural and Ornamental Iron-work, Not Made in Rolling Mills	— 15 6	+ 3.5
Sugar, Beet	+ 24 9	— 8 4
Sugar, Cane, Excluding Refinery Products	+ 8.4	— 21.9
Sugar Refining, Cane	+ 8.0	— 0 8
Toys, Games and Playground Equipment	— [illegible]	[illegible]

[a] Includes asbestos textiles in 1921.
[b] Includes ice cream in 1921.
[c] No data

utilization of capacity above the average and in several of these 16 the excess utilization is very slight. Thus, if we count only the 38 industries for which the total deviations for 1921 and 1923 are either +10.0 or —10.0 and over, we find 34 industries below the average and only 4 above. This is a clear indication that seasonality in an industry contributed to the accumulation of excess capacity.

But manufacturing production and mining, while highly important branches of activity, especially from the viewpoint of the amount of equipment utilized, are not as subject to such large seasonal disturbances as are agriculture, construction, most branches of wholesale and retail trade, and even transportation. For agriculture there is no single measure that would indicate the seasonal rate of utilization of equipment, but of course the seasonal surplus of capacity must be enormous.

For the other branches of activity we have single indexes that may be taken as representative of total activity. These single indexes are likely to over-estimate the rate of utilization of capacity, for they measure the course of activity in several branches at once and reduce the total seasonal variation by the process of algebraic addition of peaks in one branch with a lower level in others. For most equipment such an algebraic cancellation is indefensible, since at the time of peak activity in the transportation of coal the demand for coal cars is not relieved by the fact that during the same month the seasonal demand for ordinary box cars is low. On the other hand these estimates are slightly exaggerated since the indexes are not adjusted for the number of working days in the month. In spite of a probable under-estimate, the measures of seasonal over-capacity yielded by these indexes are rather high. Thus, for construction (index of volume) the measures of over-capacity are: average below the seasonal peak, 26.8, below 100, 10.0. Similar measures for railroad freight transportation (freight cars loaded) are 15.2 and 3.0; for wholesale trade (9 lines), 18.4 and 4.9; for retail trade (Cope-

37.2 and 5.2.

seasonal disturbances in industry and
and the importance of such disturb-

ances in creating a surplus labor supply may be estimated, using concepts and data similar to those used in the estimates of surplus equipment. If the seasonal peak in employment indicates the number of workers attached to a given industry, then the average monthly departure from that peak measures the average seasonal unemployment and hence the surplus labor that is in the industry because of seasonal swings. If, however, we consider only the annual average as the proper estimate of labor attached to the industry, then only departures below 100 should be considered as measuring seasonal unemployment and excess labor supply.

The problem of seasonal employment is complicated by another factor. It may safely be assumed that plant and equipment cannot move from industry to industry, especially since the periods involved in seasonal variations are so short. But labor may be assumed to move with some degree of freedom from enterprise to enterprise, from industry to industry, and from one branch of activity such as manufacturing, mining, trade and agriculture to another. For manufacturing, therefore, we present two estimates, one based upon the assumption of mobility among various branches, the other upon the assumption of lack of mobility.

For the industrial groups covered in Table LI the exact measure of excess labor supply attributable to seasonal factors lies within the limits indicated. If we assume that this rate is roughly 3 per cent for manufacturing industry, 15 per cent for construction, and 5 per cent for total trade, the absolute amounts involved can be computed by using Dr. W. I. King's estimates of the number of wage-earners attached to each of these groups in 1927 [2]—9.1 million in manufacturing, 1.4 in construction and 3.9 in mercantile pursuits. Persistent seasonal unemployment thus affects 273,000 workers in manufacturing, 210,000 in construction and 195,000 in trade. Although there is some mobility among these groups, the estimates are, on the whole, low, for they assume perfect mobility among the individual enterprises, and in construction and trade, perfect mobility among the various bra
these estimates we obtain a rough figur
as that of the seasonally unemployed in

[2] See *National Income and Its Purchasing Pow*
Research 1930) Table IV, p. 56.

The estimates do not cover agriculture, with about 2,300,000 wage-earners, mining, with about 1,200,000, and transportation, with about 2,500,000, a total of about 6,000,000 as compared with the 14,400,000 covered in the three groups above. In view of the extreme seasonality of employment in agriculture and the marked seasonality in mining, it appears more than safe to

TABLE LI

MEASURES OF SEASONAL EXCESS LABOR SUPPLY

Employment in	Average Monthly Departure Below	
	Seasonal Peak	100
Manufacturing Industry [a]		
(Mobility among branches)	3 5	0 6
Manufacturing Industry [a]		
(No mobility among branches)	3 7	2.2
Construction [b]		
Ohio (1914-24)	22.2	9.1
Pennsylvania (1921-27)	20.0	6.9
Retail Trade [b]		
Pennsylvania (1921-27)	17.0	2.1
United States (1929)	20 6	2 9
Wholesale Trade [b]		
United States (1929)	4.9	0.9

[a] Based upon the seasonal indexes for manufacturing employment for 1930, computed by the Research Division of the Federal Reserve Board.

[b] From various sources, assembled in P. H. Douglas and A. Director, *The Problem of Unemployment* (New York 1931) Chapter VI, pp. 73-85.

add a similar proportion of these 6,000,000 to make possible a complete, though exceedingly rough estimate of the seasonal surplus of labor. This would vary from month to month, but about one million would be the average volume of seasonal unemployment persisting from year to year. One million unemployed out of a total of 27.3 million wage-earners appears very substantial, but it is, if anything, an under-estimate of the labor surplus attributable to seasonal variations

rden imposed upon the economic system by
fluences is thus apparent. Surplus com-
s equipment ranging from 5 to 30 per
excess labor supply of one million un-
that the problem is far from slight.

2. Seasonal Variations and Cyclical Fluctuations

This study has been devoted mainly to tracing the responses of various branches of productive activity to the influence of seasonal factors. The nature of the factors that make for cyclical fluctuations is far less definitely determined. In analyzing cyclical fluctuations, indeed, attention is centered upon the establishment of differences in cyclical behavior of various aspects of economic activity as representing differences in response to one and the same set of events. It might even be seriously argued that differences in response are in themselves sufficient to account for the presence of cyclical oscillations, for if there is any material variation in the responses of related economic processes to the same stimulus it seems very probable that this variation in response will tend to cumulate into a cyclical swing.

Of the numerous factors determining the different responses of various economic processes to the same stimulus two are particularly relevant to our attempt to describe the influence of seasonal variability upon cyclical fluctuations: (1) the continuity of activity in each economic process; (2) stock accumulation. The short-term variations that we have studied as seasonal imply discontinuity in the economic process affected. The wider the seasonal swing the more marked the discontinuity. But this presence of seasonal variability means a qualification in the possibility of response to the stimulus of factors other than seasonal. Thus, if an impetus to greater activity is given during a certain month, an industry not subject to seasonal swings may be able to feel such an impetus fully and react to it accordingly. But if such a stimulus acts upon a highly seasonal industry, such as road construction, during the time of the year when operations are almost impossible, for example, in December, it cannot exercise any effect until weather conditions make an expansion of activity feasible.

It may be said that in highly seasonal industries such a stimulus is not even felt by the economic agents who guide the industry's activity, although under cond
continuous operation such a stimulus wo
its full influence. Thus, retailers in ma
are unable to judge properly the sta
sumers until the peak month or mont

have passed. In certain types of construction, builders and producers of building materials are not able to judge whether or not conditions are favorable until the season begins. Consider how different such a situation is from that in an industry in which the monthly rate of operations is relatively constant and changes in business conditions can be apprehended and responded to in whatever season they occur.

The influence of such discontinuity in activity upon cyclical fluctuations in the affected branch of industry cannot be determined easily. It is not inevitable that such intermittent economic processes should show cycles of smaller amplitude than continuous economic processes. It seems probable, however, that such discontinuity will affect the timing of the cyclical swings.

J. Åkerman [3] suggests an interesting connection between seasonal swings and the timing of turning points in cyclical fluctuations, to which, however, one could subscribe only upon further evidence.

It is scarcely surprising that it should in general be difficult to keep the different periods of economic life apart. One asks oneself whether times are improving or growing worse, but seldom takes into consideration in what degree this depends upon the season, upon the cycle, or upon the average rate of progress.

An examination of the history of economic cycles will show us to what a surprising extent the seasonal variations have influenced the cyclic movement. Further evidence of this state of affairs was supplied during the depression of 1930-31, in that no one expected an upward cyclic movement at any other time of the year than the autumn or possibly the spring. It is the seasonal advance which is needed to release the expansive forces, not less in the sphere of consumption than in those of production and credit.

The increased credit requirements of agriculture, industry, and trade in the autumn thus supply the impulse for the inception of the upward cyclic movement, and also for the breakdown of the boom. The increased amount of purchasing power which is placed during the autumn at the disposal of industry for purely seasonal needs acts during a depression as a push in the upward direction, assuming the existence of other conditions for better times. On the other hand, the seasonal credit requirements of industry act during the boom as an extra burden on the money market [illegible] by enterprise, and force on the crisis.

[illegible] has this effect, largely psychological, upon cyclic [illegible]ral that the cyclic waves should, as a rule, have a [illegible]h an even (?) number of years. The year, the [illegible]ivisible unit like a piece in a game of dominoes.

omic Crises (London 1932) pp. 99-101.

The short cyclic waves are, therefore, as a rule exactly three (or exceptionally exactly two or four) years in length. So the season affects not the cycle only, in that it regularly releases the forces which encourage enterprise; it is also a standard in the system of economic periods.

Seasonal variability and cyclical fluctuations are, however, intimately interconnected through stocks of commodities, idle equipment and a seasonal labor surplus. Indeed the influence of these surpluses on cyclical oscillations cannot be over-estimated. It may be observed in two ways: (1) the large ratio of equipment to current output helps to account for the change in cyclical amplitude as we pass from one stage of production to the next; (2) excessive stocks of commodities and a surplus of labor help to explain how the economic system can respond to these disturbances without any material change in its processes until the cumulation in one direction serves to initiate a movement in either that direction or the opposite.

Students familiar with various theories of the business cycle will recollect how equipment of a value larger than current output serves to pass any changes in output in an exaggerated fashion back to the production of equipment. Thus, cyclical fluctuations in industries making producers' goods are so much more violent than the oscillations in industries producing consumers' goods because the existing equipment is in large ratio to current output, and any changes initiated in current output find an exaggerated reflection in the changes necessitated in equipment.[4] Similarly, if we conceive of stocks in the hands of retailers and wholesalers as the necessary equipment for ' production ' of sales, these stocks serve to pass, in an exaggerated form, any change in final sales back to the preceding links in the chain from the finished product to the final consumer.

In so far as seasonal variations make for a larger volume of idle equipment they serve to magnify disparities in cyclical amplitude between the processes themselves and the subsidiary processes connected with these producers' goods. If, for example, in the automobile industry equipment is in the ratio of 5 to 1 to average monthly output, while it might be 3 to 1 were there no seasonal variations in monthly prod[illegible] effect of this ratio on the cyclical fluctuations in

[4] See J. M. Clark, Business Acceleration and the *of Political Economy,* March 1917, pp. 217-35; also t' Clark and Ragnar Frisch, *Journal of Political Ec* 1931 and April and October 1932.

essential to the production of automobiles has been materially increased by seasonal variations. If branches of retail trade could sell rather evenly through the year, and could therefore keep smaller stocks, the magnification of any changes in retail sales, when passed on to sales by wholesalers, would be smaller.

Passing now to the second way in which surpluses affect cyclical fluctuations we find that the accumulation of commodities and of a labor surplus is a means by which related economic processes are enabled to proceed at diverse rates. The surpluses serve as a buffer to absorb small disturbances, preventing an immediate effect upon the complex interrelated economic system. And in this buffer-rôle surpluses make possible a cumulation of small disturbances which may eventually provide an impetus towards a cyclical swing.

Indeed, let us imagine an economic system so adjusted as not to need any stocks of commodities and to provide full employment for the labor group. Any disturbance originating at any link would tend to be passed on directly and immediately all through the system. Any sequence of small changes would then result in a similar sequence reflected all through the various branches of production, distribution and consumption.

The real situation is different. Since stocks exist, any minor change in supply and demand, either for commodities or for labor, need not be reflected immediately in production, distribution or consumption. Stocks make possible a slightly larger supply or a slightly smaller demand, the stocks themselves absorbing the change. This lessens the closeness with which economic elements are interrelated, but it also makes possible a cumulation of small disturbances, which by chance may be in the same direction. This cumulation of changes is a very important factor in accounting for cyclical oscillations, for it helps to explain the initial push necessary to set in motion that entire set of disparities, stresses and strains which are the essence of the cyclical phenomenon.[5]

[5] ...author's article, Random Events and Cyclical Oscillations, *Journal of ...l Association*, September 1929, pp. 258-75. On the connection ...ons and the amplitude of the business cycle we may again ...tion by Åkerman:

> ...h the variations of temperature are great, for ...tes, there are naturally also strongly marked ...strial life. All wage-earning labor in such

In some industries the surplus of labor, which, if not created by the seasonal swing in production, is at least maintained and perpetuated by it, has far-reaching consequences on the type of organization in the industry and hence also on the cycles characteristic of the industry. For example, in the cloak, suit and skirt industry of New York City, which is subject to marked seasonal variations in activity

. . . . this excess of labor seems to have characterized the industry during most of its history. For many years during the period of great immigration from 1880 down to 1910 potential workers were always at hand among the immigrant population in excess of the actual present needs of the industry. On the other hand, the seasonal character of the industry has required just such a labor supply in excess of normal needs to meet the seasonally recurrent peaks of production. It has been necessary at some time during each spring and fall season to be able to call extra workers into the shops for a short period to lift production to the level of the seasonal demand. At such times the labor supply is frequently not in excess of the momentary need and there may even be difficulty in se-

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a country is subject to considerable vicissitudes even in so brief a period as a year. The formation of new means of production, which is the foundation of economic progress, tends in such a country to be stimulated by external circumstances. In another country, Italy for example, the contrast between summer and winter is less violent and the impulse to enterprise with a view to the future is less powerful.

Without anticipating the consideration of the cyclic periods, we may therefore draw the conclusion that in a country having great variations of temperature, and therefore great seasonal variations in industry, the cyclic fluctuations have a tendency to be particularly pronounced . . . .

But the association between seasonal and cyclic variations is not of so simple a nature that one can lay down any generally applicable law It is not only that different countries are industrialized in different degrees and therefore not directly comparable, but also that the accumulated capital required for the formation of new means of production may be drawn from any quarter. The international nature of the money market thus interferes with local conditions. . . . .

So long as we confine ourselves to the seasonal and cyclic variations of production and employment within a single country, the association is, however, plain enough Those branches of industry which have marked seasonal variations—such as the building and iron industries—prove to be also very susceptible to cyclic fluctuations, whereas other branches of industry—for instance, clothing and many of the provision industries—show neither seasonal nor marked cyclic variations." (*Economic Progress and Economic Crises*, pp. 39-41.)

Obviously, Åkerman under-estimates the complexity of the
tween seasonal variations and business cycles even within
is not true that large seasonal variations and marke
closely associated, as witness the evidence of retail
dustry which is cited by Åkerman to the contr
cycles in various industries is often determined
nitely with seasonal forces.

curing all the workers required. This excess of work at the peak of the season has no doubt tended to maintain in the industry the surplus workers who might otherwise have been driven into other employments. The prospect of a chance to obtain work at the height of the season is very likely to hold out to the worker an illusory hope of regular employment which co-operates with his natural inclination to stick to his old trade and thus interferes with the natural economic tendency to equalize the supply of labor as of everything else with the demand for it.

The existence of a surplus labor supply serves in turn to enhance the seasonal character of the industry. Given the possibility of calling at short notice a large number of additional workers into the shops, there is an inducement to the manufacturer to time production to the vagaries of demand and to do nothing toward producing in advance of demand or toward seeking to stabilize demand. A restricted labor supply is bound to be a stimulus to continuous production, and even if the conditions of demand are such as to make continuous production impossible, serves to some degree to stabilize employment. A surplus labor supply on the other hand works in the opposite direction and is an actual force making for discontinuous and seasonal operation.

The cumulative and reciprocal force of an excess of labor co-operating with a demand which is naturally seasonal has no doubt helped to bring about several of the specific developments in the New York cloak and suit industry in recent years. For one thing it has tended to stimulate the increase of submanufacturing shops. Many of the more ambitious and energetic workers have no doubt sought to free themselves from a life of irregular employment by setting up shops themselves in the hope that by their own energy they might succeed in finding more work than their previous employers could find. The increase in the number of separate shops, however, has not been accompanied by a corresponding increase in the total amount of work available, and, resulting as it has in increased competition for the available work, has tended to increase the irregularity of production and the resulting seasonal unemployment.

Seasonal unemployment under the particular conditions of the industry is thus a thing which breeds upon itself and tends continually to increase within the limits of the existing labor supply. As it becomes more pronounced, and production concentrates more narrowly to a peak, there may come to be an actual shortage of labor at the height of the season, and this tends in turn to bring even more workers into the industry who swell the number of unemployed during the period of slack work. Meanwhile the pressure of the demand for labor at the height of the season is an effectual check on the natural economic tendency of supply to conform to demand." [6]

...onal disparities in related processes, by calling
... equipment, commodities and labor, create
...n the relations of the economic elements

of the Cloak, Suit and Skirt Industry of New York
Morris Kolchin, to the Governor's Advisory Com-
5.

and sometimes magnify appreciably the ratio which productive means bear to the final product. The effect of both of these influences of seasonal disturbances is to facilitate the appearance of cyclical oscillations and to magnify the unequal movement of various groups of processes in the cyclical swing. As a result of surplus commodities and labor random events may cumulate sufficiently to initiate a cyclical rise or decline. Surplus equipment serves to magnify the difference between the amplitudes of cyclical swings in consumers' and producers' goods, and surplus labor sets up a condition of instability in the industry which leads to a type of industrial organization of possibly decisive bearing upon the character of cyclical fluctuations in the industry.

3. Some Practical Implications of the Survey

The problem created by seasonal surpluses of commodity stocks, equipment and labor may be considered from two angles: (1) the viewpoint of society as a whole—the waste involved in the inactivity of a part of the limited resources of our economy in the form of unproductive stocks; (2) the viewpoint of the different social groups—observation of which classes of the population bear this burden of idleness. Any remedial program directed towards ironing out seasonal disturbances and reducing their burdens should distinguish clearly between these two approaches to the problem.

In the former it may be noted that conspicuous seasonal disturbances arise only at the points where man is not in complete control of the economic process. The disturbances persist only because of this lack of control. Thus seasonality characterizes all those productive processes in which climatic and organic forces are as yet beyond complete control by producers—agriculture, construction, inland water transportation—and also consumers' purchases, over which the sellers do not exercise complete control.

One way of reducing seasonal disturbances would
fore, consist in extending the control of those
ested in stabilizing economic processes. I
would mean a technical development in a
industries affected by climate to a pc
productive process itself was made

least some perishable products were rendered sufficiently durable to be stocked. Considerable progress may be made in this direction, especially in rendering some perishable products durable (note the development of quick freezing of foods, refrigeration and cold storage of eggs, poultry, meats and the dairy products). Were sufficient stimulus provided, it is quite possible that technical research might yield substantial results. In spite of the commonly prevalent notion of the alacrity with which the economic system supposedly grasps every technical advance, economic activity is, in fact, considerably affected by traditional procedures which may have once corresponded to the prevalent level of the industrial arts but which do not fully utilize present technical possibilities. It may also be noted that the investment in existing equipment sometimes acts as a deterrent to the adoption of more modern technical methods (note, for example, the problems of winter construction); an added incentive towards more continuous activity may help to overcome such obstacles.

The course of technical progress cannot be foretold with any assurance. Still it is clear that short of a technical revolution which would enable man to produce the basic food products by inorganic rather than organic processes, or at low cost to counteract completely the effects of climate on outdoor activity, seasonal factors in agriculture and construction are likely to continue, exercising fully their disturbing influence on the rate of productive activity. On the other hand, greater technical advance may be made (and has been made) in the stages intermediate between the raw materials and the final products (manufacturing, transportation and trade). It is in manufacturing and transportation that the degree of control made possible by the development of technical arts has grown most strikingly, and with it has come emancipation from those forces which still disturb agriculture and construction. The development of steam has freed transportation from interruptions in activity occasioned by the f ing of inland waterways. The decline in the price of t has freed manufacturing from limitations im- upon natural light, just as artificial hot and manageable some of the manufacturing d been well nigh impossible during ex- But all these developments have re-

duced and sometimes completely eliminated only the disturbing influences exercised directly upon these types of activity by climatic factors. They have contributed nothing towards the reduction of the original disparity between the seasonal influences on the supply of the raw materials and on the demand for the finished products by final consumers.

Just as at present there appears scant hope for complete technical control over the climatic and organic forces which affect agriculture, construction or inland water transportation, so not much hope appears for an extension of control over consumers' purchases, short, of course, of a complete recasting of our social order. So long as consumers' freedom to buy is limited only by the amount of purchasing power at their disposal, and purchasing power is distributed under the system of free exchange, there is little hope that the sellers, so long as they wish to remain in business, will gain control over the rate of purchase by consumers. Consumers' reluctance to buy may be partly overcome by a definite price policy, but the effective limits of any such policy are necessarily narrow since price differentials are felt more acutely by the sellers than by final consumers, and losses to sellers from off-season discounts should not exceed the cost of keeping stocks of either the commodity or productive equipment.[7] Moreover, in recent years any tendency towards making consumers' purchasing steadier through a price policy appears to have been more than counterbalanced by the attempt of industries which sell durable goods to render them more perishable by a greater insistence on the elements of style and fashion, thus accentuating the seasonally intermittent character of consumers' demand. Only in those exceptional fields where a virtual monopoly of supply exists can the sellers force the buyers to make their purchases at a more even rate.

But besides an extension of control over the climatic and conventional forces there is another method of ameliorating the seasonal problem: the dovetailing of activities characterized by varying seasonal swings so that productive resources which formerly served only one purpose and were th
partly unemployed may be made to serve additi
and in this way be rendered capable of mor
vice. Such dovetailing is theoretically poss

[7] See discussion, Chapter I, Section 4.

the employment of productive resources in carrying through an economic process. In manufacturing, mining, transportation, agriculture and trade it is possible technically to arrange the utilization of common resources in such a way as to avoid in part the under-employment attributable to seasonal disturbances.

The limits of such a policy are strictly set by two counteracting tendencies. The first limitation is purely technical. Increase in efficiency is easier to achieve when a tool or method of utilization of resources is designed for a specific purpose rather than to serve many purposes. The second limitation is social. The incentive for devising multi-purpose tools is not appreciable because each independent enterprise has its own specific function and its profit-motive prevents it from considering definitely the effects of technical progress from the point of view of society as a whole. Were a premium put upon technical progress that assured a greater continuity of operation and a greater percentage of exploitation of the total resources of the economy, it is quite possible that progress in the direction of multi-purpose equipment would be greater.

Moreover, the lack of conscious cooperation among the enterprises and agents in our economic system means that no definite facilities are set up for dovetailing productive resources, except within the limits of single enterprises or within the ken of individual agents. In some instances such cooperation results voluntarily or under pressure or encouragement by public authority. Thus the organization of some agricultural enterprises into cooperative institutions has sometimes resulted in pooling the resources and apportioning them in such a way as to bring about more continuous utilization. The activity of the trade unions and of public employment exchanges in encouraging migration of labor to the points of seasonal demand is another instance, and, of course, the most conspicuous example is the mobility and dovetailing of credit, achieved by an elastic banking system guided by a central bank.

[illegible] the possibilities of a solution of the technical aspect
[illegible] problem are limited not only by factors which
[illegible]as not learned to control; not only by the
[illegible]ess to produce uni-purpose rather than
[illegible]but also by the social conditions which

put a premium upon changes of one kind and not of another. It is these social conditions which confine economic planning within the narrow boundaries of individual enterprises, within the limited possibilities of voluntary cooperation. Moreover, tardy formation of public opinion or authority as an active force limits the possibilities of even the technical solution of the seasonal problem.

Thus examination of the seasonal problem from the standpoint of the interests of society as a whole suggests that considerable alleviation may be achieved if technical and organizational ingenuity is stimulated towards a stabilization of activity; that more hope lies in the direction of dovetailing uses of productive resources which are subject to divergent seasonal swings than in an attempt to master directly the climatic or conventional forces which make for disturbances; that in our present social organization considerable limitation upon any such solution of the problem is imposed by the independence of individual business enterprises; and that from the point of view of social policy directed towards elimination of seasonal disturbances it seems advisable to bring pressure to bear upon those economic agents who are in a position to exercise their power and ingenuity to achieve a more efficient and continuous utilization of resources which society has placed at their disposal.

Before we examine the seasonal problem from the viewpoint of different social groups, it is important to note that at the stages intermediate between the supply of raw materials and the flow of finished products to final consumers there is sometimes an appearance of a reduction of the seasonal burden. This reduction of the burden is real enough as far as the stage at which it occurs is concerned, but it is accompanied by an increase of the seasonal burden at some other stage. In other words, what is taking place from the point of view of ociety as a whole is not a reduction of the seasonal burden but a shifting of it from one economic group to another. The most notable instance was the hand-to-mouth buying policy that characterized many distributive trades aft[illegible] 19[illegible] whose effects appear so clearly in the analys[illegible] XI. The diminution of seasonal variation ir[illegible] trades was accompanied by a growth of s[illegible] in manufacturers' activity and in empl[illegible]

nomic system as a whole the waste involved has perhaps increased rather than diminished as a result of the partial escape which the distributive trades have made from sharing in the burdens involved.

Passing now to the consideration of how the burden of the seasonal problem is borne by the various social groups, we may observe that at present the main factor which determines what share any economic agent will assume seems to be his economic strength in relation to that of any other agent. In a buyers' market a buyer can force upon the seller the burden of seasonal variations, but in a sellers' market it is the buyer who has to accept the burden.

In a perfectly competitive and static economy it would not much matter which agent bore the seasonal burden, for he would be adequately compensated for any waste of resources involved. But our society is not static, nor is it subject to conditions of perfect competition. On the contrary, there are many non-competitive areas and in some of these a burden of seasonal irregularity imposed upon one of the productive factors cannot be passed on by a process of equalizing mobility. It was seen above how in the New York garment industry the seasonal burden on labor was not compensated for by a shift of workers to other industries. Such a condition is typical, rather than exceptional, of seasonal industries.

It becomes a problem of social policy, then, on whom the burden of seasonal variations should fall. From the viewpoint of society as a whole the desirable method of disposing of the seasonal problem seemed to be to put the burden upon those who are capable, if thus stimulated, of changing technological and organizational conditions in such a way as to lighten it. But to this purely technical viewpoint may be added the consideration of some definite criteria of social policy.

Such criteria must be formulated by the social body of opinion. Suggestions are being made that labor should bear
)ossible of any of the ill effects of seasonal varia-
'repreneurs be forced to forego the opportunity
'he workers the burdens of the seasonal swing
'his appears natural because of the obvious
'he capacity of capital and of employed

workers to bear burdens and carry through adjustments. The social advantages of such a change are emphasized by pointing out that some of the incomes derived from economic activity are free from any seasonal disturbances which may affect it. For example, enterprises pay the interest on their bonds quite regularly in spite of the fact that the buildings and machinery that are bought with the money thus advanced are not used to the same extent through every month of the year. The suggestion is made that labor also should be paid throughout the year rather than have its income subject to seasonal variations in activity and that the task of dovetailing diverse seasonal swings so as to avoid excessive waste should be put upon the shoulders of the entrepreneurs rather than upon those of the employees, whose circumstances make them less capable of meeting the situation. On the other hand, the advantages of such a policy are counterbalanced in qualified measure by any changes it might make in the desirable mobility of labor. And, of course, the entrepreneurs may pass on a large part, if not all, of the additional seasonal burden to the consumer in the form of higher prices for the product. In this event, the redistribution of the seasonal burden is not between labor and the entrepreneurs, but between labor and the consumers of its products.

Another shift of seasonal burdens suggested as advantageous from the point of view of a reasonable social policy is that imposed upon agricultural producers by the seasonal character of the inflow of their finished product. Seasonal variations in prices paid to farmers are considerable, as may be seen in the products for which quotations are available for this particular exchange link (rather than for transactions on produce exchanges or on primary markets). Since agricultural producers sell most of their products during the months ·hen prices are seasonally low, they obviously sustain a con- ıderable loss and since few are financially able to carry stocks, this is done for them, at a charge, by all the intermediate agencies between the raw material and the industrial consumers, and by the industrial consumers themselv·
suggested that the seasonal burden of these p·
could be taken over by public rather th·
cies and that the cost of this function to t·
lessened thereby. This, of course, woul·

of public credit funds for private funds in maintaining stocks of agricultural commodities as well as the prospect that the public agency would undertake all the complicated exchanges and financial transactions now carried on by private agencies on the produce exchanges. Regardless of the practical difficulties in such a redistribution of the seasonal burdens, it is easy to recognize the social advantages.

Practical problems of ways and means of reducing seasonal swings are really beyond the scope of this study. Yet, they are most important among the numerous questions which, it is hoped, this investigation has raised. Why in certain industries are the payrolls so much more seasonally stable than output while in other industries the difference is much less appreciable? Were more data available, we could ask why certain prices reflect much more definitely the seasonality in the inflow of the commodity than do others. There is a wide field for a detailed investigation which could lay the basis for a practical policy of stabilization. This study presents merely the broad outlines of the seasonal problems and can arrive only at some general inferences as to the types of stabilization policy that might be undertaken.

APPENDICES

APPENDIX I

INDEXES OF SEASONAL VARIATIONS IN THE FLOW AND STOCKS OF COMMODITIES AND IN OTHER ASPECTS OF ECONOMIC ACTIVITY IN THE UNITED STATES

Part One

The Seasonal Indexes

Series	Period Covered	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
at and Flour															
.t															
Harvest, Estimate		0	0	0	0	6	264	508	341	78	4	0	0	135.4	508
2. Marketing by Farmers....	1909–19	72	57	46	42	43	38	154	170	195	170	120	93	51.5	157
	1919–30	56	54	42	35	39	53	196	229	197	138	92	70	59.9	194
3 Marketing by Farmers, Principal Wheat Growing States	1909–21														
California		19	24	20	16	16	48	206	402	268	106	48	28	96.9	386
Colorado		60	52	32	41	48	20	40	263	247	155	155	88	69 9	243
Idaho		59	38	28	18	26	19	26	170	335	235	143	102	80.9	317
Illinois		60	56	44	37	34	30	331	263	116	100	70	59	68.3	301
Indiana		52	54	44	38	40	31	346	254	118	106	66	52	70.6	315
Iowa		67	52	42	38	46	35	150	277	185	157	79	72	61.5	242
Kansas		77	68	46	54	52	42	215	192	136	134	103	82	46.6	173
Kentucky		34	38	32	28	31	34	402	281	128	88	64	41	85.1	374
Maryland		66	44	47	40	37	30	192	227	178	137	103	100	56.1	197
Michigan ..		115	95	65	56	55	50	73	151	154	151	112	122	34.2	104
Minnesota		80	62	53	41	60	54	38	96	229	208	161	118	52.7	191
Missouri		52	44	38	31	31	32	295	258	145	118	92	62	69.5	264
Montana		90	49	42	29	25	29	13	70	205	256	221	172	75.6	243
Nebraska		89	65	47	64	73	41	184	180	128	145	90	95	39.4	143
New York		104	83	73	48	49	61	40	162	169	161	132	118	41.0	129
North Carolina .		64	67	68	68	67	80	188	180	142	106	91	78	36.1	124
North Dakota ...		65	52	48	34	44	48	28	83	252	233	192	122	66.4	224
Ohio		72	67	58	54	56	53	228	222	137	107	79	67	49.0	175
Oklahoma		56	43	35	43	38	66	356	188	114	103	86	70	60.3	321
Oregon		23	16	24	18	22	13	64	377	407	160	43	35	107.2	394
Pennsylvania		98	88	80	44	58	53	108	179	148	122	118	104	29.8	135
South Dakota		72	54	50	36	50	49	36	157	245	216	126	108	58.8	209
Texas		41	42	43	34	30	144	337	211	109	82	74	53	66.8	307

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
Virginia		67	68	65	61	50	31	164	186	164	137	118	88	44.9	155
Washington		29	18	14	20	19	12	22	199	436	270	109	52	102.3	424
4. Receipts at Primary Markets	1920–24	80	63	61	55	62	61	106	193	161	138	123	97	36.8	138
	1925–31	63	59	54	41	53	63	222	208	165	115	90	67	51.7	181
5. Receipts at Selected Markets	1906–16														
Chicago		52	57	59	43	66	31	238	287	135	82	86	64	60.0	256
Kansas City		72	62	35	44	56	42	182	191	162	122	139	93	49.3	156
Minneapolis		95	88	93	61	59	62	50	71	162	166	143	149	36.8	116
6. Shipments from Primary Markets	1920–24	75	57	63	55	88	82	100	201	155	121	106	97	30.5	146
	1925–31	61	52	59	59	96	80	152	182	147	119	117	75	36.2	130
7. Visible Supply, U. S.	1918–22	131	106	89	72	50	32	51	90	131	152	152	144	36.0	120
	1923–31	113	106	95	80	66	53	72	110	123	129	128	125	22.3	76
8. Visible Supply at Primary Markets, Derived	1920–24	149	136	119	100	59	22	30	61	93	125	154	153	39.2	132
	1925–31	111	104	91	69	44	28	87	123	145	147	133	118	30.2	119
9. Exports	1918–23	70	45	55	52	93	106	110	195	169	130	93	82	35.0	150
	1924–31	55	38	40	49	85	72	102	156	206	176	134	86	45.8	168
10. Stocks held by Flour Mills, Quarterly	1926–31														
In country elevators				80			43			144			133	38.5	101
In transit				59			90			135			116	25.5	76
In terminal elevators				81			32			139			148	43.5	116
At mills and in mill elevators				90			50			137			123	30.0	87
Total				84			50			138			128	33.0	88
Borrowings by 121 Flour Mills	1919–21	120	109	98	86	67	51	59	86	116	131	137	137	25.2	86
Wheat Grindings by Flour Mills	1923–31	101	92	95	90	91	90	99	110	113	118	104	97	7.7	28

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
.lour roduction	1918–24	101	86	96	86	86	79	91	112	121	125	113	103	12.6	46
	1924–31	101	92	96	90	90	89	99	110	113	118	104	97	7.8	29
x. Stocks held by Mills, Quarterly	1926–31			101			86			102			111	7.0	25
15. Stocks, All Positions.....	1920–31	99	96	91	92	87	88	104	108	116	116	108	96	8.6	29
16. Trade Disappearance (Consumption)	1920–31	97	91	98	88	93	83	87	110	111	120	112	110	10.5	37
17. Sales by Federal Bake Shops	1928–31	98	100	112	101	97	91	89	94	93	107	104	114	6.3	25
B. Livestock and Meats															
Cattle and Calves															
1. Births of Calves, Estimate.	1920–24	83	101	150	176	157	106	73	60	70	73	72	79	31.7	116
2. Receipts at Primary Markets	1917–22	94	73	84	86	92	91	92	106	123	139	127	93	15.8	66
	1923–31	94	77	87	91	96	88	93	104	119	140	115	94	13.2	63
3. Receipts at Chicago.....	1888–1900	101	86	94	86	95	93	98	111	115	120	102	98	8.2	34
	1900–14	110	89	91	90	88	86	90	98	110	124	114	110	11.3	38
	1915–21	112	85	81	78	88	86	83	93	110	134	136	115	17.8	58
	1922–28	106	86	92	86	97	91	91	100	102	128	117	104	9.5	42
4. Cattle, Federally Inspected Slaughter	1907–19	101	85	87	84	89	91	94	104	115	130	116	105	11.8	46
	1919–27	102	85	92	89	95	92	98	101	110	121	114	104	8.4	36
	1924–30	99	84	90	90	98	93	99	102	108	121	111	105	7.8	37
5. Calves, Federally Inspected Slaughter	1908–12	75	63	94	118	133	128	110	109	105	102	88	74	17.6	70
	1913–18	87	77	96	126	134	119	104	96	96	101	87	77	14.0	57
	1919–24	91	81	107	111	116	109	101	99	98	105	98	84	8.2	35
	1924–28	93	89	106	110	112	105	97	91	95	107	97	97	6.8	23
Beef and Veal															
6. Production	1920–31	100	84	94	94	101	100	99	103	107	116	104	99	5.1	32
7. Cold Storage Holdings....	1917–22	134	126	116	98	86	78	76	73	75	91	111	136	20.5	63
	1923–29	143	131	119	101	83	74	63	61	64	86	124	148	27.9	87

ent Consumption ..	1916–22	103	86	93	94	97	99	98	103	109	115	109	93	6.6	29
	1923–31	101	86	95	98	104	99	102	103	106	114	98	96	4.8	28
Lambs															
ths of Lambs, Estimate	1920–24	42	121	250	324	342	82	11	5	6	6	5	7	106.1	337
teceipts at Primary Markets	1917–22	83	67	71	70	78	84	94	126	151	164	122	87	27.4	97
	1923–31	84	75	78	80	95	88	91	110	148	172	97	83	21.6	97
1. Receipts at Chicago.....	1866	77	100	136	127	106	94	85	103	87	129	82	76	16.7	60
	1867	86	110	137	122	98	90	80	99	86	126	85	80	15.9	57
	1868	96	123	138	116	92	85	76	95	85	123	88	84	16.6	62
	1869	106	131	138	112	87	81	72	91	85	120	91	88	17.7	66
	1870	115	139	139	108	82	77	68	87	85	117	94	92	19.4	71
	1871	124	146	139	105	77	73	65	83	85	115	96	95	21.2	81
	1872	133	150	139	101	74	69	63	80	85	112	98	98	22.3	87
	1873	141	152	139	98	72	66	61	77	85	110	100	101	23.7	91
	1874	146	151	139	97	70	63	58	75	85	109	102	103	25.2	93
	1875	150	146	138	99	69	62	57	73	86	108	104	105	25.4	93
	[illegible]	152	141	138	104	70	61	56	72	86	106	106	106	25.7	96
		149	136	137	110	72	60	55	71	88	105	108	108	25.6	94
		146	132	136	115	74	60	54	71	89	103	109	109	25.2	92
		[illegible]	129	134	121	75	60	54	71	90	104	110	110	25.0	88
			[illegible]	132	125	76	60	54	72	92	104	111	110	24.5	84
				[illegible]	125	77	61	55	73	94	105	112	109	23.5	80
					123	78	62	57	74	95	107	112	109	22.3	74
					[illegible]	79	63	61	77	96	110	111	108	20.8	68
						81	65	65	80	98	113	111	108	18.6	61
							68	69	84	100	117	110	107	16.2	54
							73	73	89	101	122	109	106	13.4	49
								79	94	102	126	108	105	10.7	48
								82	98	104	130	106	103	9.8	48
								[illegible]	103	107	135	102	100	9.3	51
										Sept.	Oct.	Nov.	Dec.	Average Deviation	Range

														Average Deviation	Range
									ug.	Sept.	Oct.	Nov.	Dec.		
									100	108	121	91	92	6.5	33
								91	106	122	122	99	92	8.8	35
								87	106	136	159	118	101	20.2	84
							76	90	107	142	166	124	107	24.5	98
							80	85	110	139	137	93	100	15.4	59
						83	94	99	108	118	120	109	101	10.0	39
					84	86	92	99	108	117	123	108	103	10.6	39
					84	85	92	98	108	117	121	109	105	10.8	37
				88	85	83	92	97	109	117	119	110	106	11.0	36
			88	88	84	82	92	97	110	116	119	111	108	11.4	37
		83	87	88	83	81	91	98	110	115	121	112	109	11.8	40
		102	86	89	82	80	91	101	111	115	123	112	107	11.9	43
		102	85	89	82	81	92	104	112	116	123	110	103	11.8	42
	1920	102	84	89	84	84	95	105	112	116	121	106	100	10.5	37
	1921	102	85	91	86	89	98	105	111	115	117	101	97	8.8	32
	1922	103	87	92	89	93	100	104	110	114	113	97	95	7.6	27
	1923	104	88	95	92	96	101	103	108	111	111	94	95	6.5	23
	1924	104	89	98	93	97	101	102	106	110	109	93	98	5.3	21
	1925	104	90	98	94	96	100	101	104	110	110	94	100	4.8	20
	1926–30	101	94	97	93	94	97	97	105	112	115	97	98	5.5	22
Mutton and Lamb															
13. Production	1920–31	106	95	101	98	96	94	94	102	108	111	96	99	4.7	17
4. Cold Storage Holdings	1917–22	144	123	98	75	71	69	68	68	82	109	132	160	28.1	92
	1923–29	129	128	115	89	77	81	71	68	78	108	120	136	22.7	68
Apparent Consumption	1916–22	107	90	98	90	89	90	97	109	111	113	105	98	7.8	24
	1923–31	106	95	102	101	98	92	95	101	106	109	95	100	4.2	17
ns of Pigs, Estimate	1920–24	42	68	184	217	138	74	64	96	138	88	52	40	46.1	177
ots at Primary Markets	1917–22	139	112	102	92	101	103	81	70	71	90	110	128	15.9	69
	1923–31	135	109	102	94	94	93	85	77	78	99	110	124	13.3	58

at Chicago.....	1861–70	122	61	47	57	82	73	63	64	71	122	196	241	46.9	194
	1871–85	140	95	71	76	91	95	74	67	69	97	163	162	27.5	96
	1885–1900	118	98	92	82	100	105	84	77	82	106	132	123	14.1	55
	1901–14	135	119	103	87	98	98	85	81	71	86	106	132	15.8	64
	1915–24	150	120	100	82	89	94	86	70	63	82	120	144	22.3	87
mercial Slaughter ...	1880–86	129	85	70	76	95	99	76	70	72	102	165	165	26.5	95
	1887–95	146	101	72	71	98	103	81	69	63	90	142	160	25.7	97
	1895–1905	129	106	85	85	108	109	88	76	71	92	116	136	17.2	65
	1906–12	130	104	97	86	104	110	89	75	72	92	114	128	14.9	58
	1913–21	144	117	101	86	100	103	83	65	64	84	108	141	19.3	80
	1922–29	134	108	104	91	96	100	89	76	71	93	109	130	14.1	63
k Products															
0. Pork Production	1920–31	133	109	100	92	98	103	93	80	74	88	103	126	12.4	59
21. Cold Storage Holdings....	1917–22	98	116	114	119	121	125	121	104	79	61	62	76	20.3	64
	1923–29	99	113	119	121	118	121	117	104	82	64	62	83	18.6	59
Consumption ..	1916–21	117	96	80	76	100	96	95	96	100	119	114	110	10.1	43
	1922–31	109	88	94	89	101	101	96	97	99	112	105	106	5.9	24
	1920–31	120	99	98	93	99	101	95	90	87	99	102	115	6.5	33
			54	80	74	34	12	8	38	197	258	217	145	69.6	250
			77	54	23	10	23	118	227	238	181	113	68	62.9	228
				109	115	118	115	96	75	72	84	97	106	12.6	46
						24	123	104	88	77	80	81	94	13.2	47
							36	111	90	86	84	78	84	15.3	58
								109	104	99	99	96	97	4.7	21
								112	102	99	99	95	94	5.3	25
								?	106	100	100	95	95	5.8	25
										Sept.	Oct.	Nov.	Dec.	Average Deviation	Range

									g.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
								)	102	98	99	95	96	5.0	21
								.11	107	100	97	92	95	5.9	23
								107	102	101	101	95	96	4.2	18
							.11	109	103	98	99	94	94	5.3	23
						.32	153	143	125	101	82	75	70	25.7	84
					3	138	163	154	123	98	77	72	66	29.7	98
				96	147	157	153	120	96	80	70	67	29.5	92
			79	97	147	158	151	122	97	80	69	67	29.6	93
		3	79	98	147	159	149	124	98	79	69	66	29.8	95
		68	79	100	146	161	148	126	99	78	69	65	29.9	97
	63	68	79	101	146	162	148	128	100	76	68	63	30.7	99
	62	67	79	102	145	164	149	129	101	74	66	61	31.8	103
16	60	67	80	103	145	167	151	130	101	72	64	59	32.9	108
1917	58	67	80	104	144	168	153	131	101	70	62	59	33.8	110
1918	57	67	81	105	144	168	153	130	101	71	62	60	33.6	111
1919	57	68	82	105	144	168	152	127	101	74	62	61	32.8	111
1920	58	68	83	106	144	167	149	123	101	77	62	62	31.7	109
1921	60	69	84	107	144	166	146	120	101	78	63	63	30.6	106
1922	62	69	85	107	143	165	143	118	100	78	64	64	29.5	103
1923	64	70	86	108	143	164	142	117	98	77	66	65	29.0	100
1924	65	71	87	108	142	163	141	117	98	76	67	65	28.5	98
1925	66	72	88	108	141	161	140	117	97	75	67	66	28.0	95
1926	68	73	89	108	139	159	140	116	98	76	68	66	27.0	93
1927	69	75	90	108	138	157	139	113	98	77	70	67	25.8	90
1928	70	77	91	107	137	154	138	111	98	78	71	68	24.5	86
1929	71	78	93	107	137	151	136	109	97	79	72	70	23.3	81
1930	72	80	94	106	138	147	133	107	96	81	72	72	22.0	75
1931	74	82	96	105	139	143	129	105	95	83	73	75	20.2	70
Wholesale Sales, Y. C.	1920–24														
B, quarts		81	81	85	91	100	114	129	129	115	100	89	83	14.8	48

15.

16. Birt ogs

No.	Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
	.....		79	81	88	99	113	127	127	118	106	94	85	80	15.4	48
	B, ...ilk.....		90	93	97	100	104	114	116	108	101	96	92	90	7.1	26
	A, quarts.....		90	92	98	102	105	112	110	107	104	97	91	90	6.8	22
	milk		48	47	56	72	107	192	223	164	106	76	58	51	48.7	176
	, Wholesale Sales, . Y. C.	1920–24														
	ght cream		78	80	88	99	117	146	141	115	96	84	78	77	19.9	69
	xtra heavy cream.....		81	85	94	108	129	131	117	105	95	88	83	80	15.3	51
	Milk, Retail Sales, N. Y. C.	1919–24														
	Grade B, quarts.....		98	98	99	100	102	104	101	98	101	102	99	98	1.7	6
	Grade B, pints.....		92	91	92	97	103	110	109	106	103	102	99	95	5.6	19
	Grade A, quarts.....		98	99	102	104	105	105	96	89	100	103	100	99	3.2	16
	Certified, quarts		102	101	101	104	105	101	93	91	97	102	101	102	3.2	14
	Buttermilk		64	67	75	90	114	156	170	139	104	82	70	65	30.8	106
	. Cream, Retail Sales, N. Y. C.	1919–24														
	Light cream		103	103	104	104	107	104	92	83	92	102	104	104	5.7	24
	Extra heavy cream.....		97	99	102	106	116	116	94	85	93	98	98	97	6.6	31
	porated Milk															
11.	Bulk Goods, Production..	1922–30	64	66	85	103	139	164	158	128	99	75	61	58	32.0	106
12.	Case Goods, Production...	1918–23	81	80	93	107	135	152	122	107	92	88	72	72	20.4	80
		1924–31	79	80	100	116	147	159	130	98	80	78	63	69	25.4	96
13.	Case Goods, Mfrs'. Stocks															
	Total	1923–31	75	67	67	76	97	124	139	127	119	113	103	93	20.8	72
	Unsold	1922–31	69	65	66	77	98	122	132	135	119	116	110	91	22.3	70
14.	Case Goods, Shipments, Derived	1924–31	103	91	100	104	119	123	110	114	91	86	76	82	12.2	47
Condensed Milk																
15.	Production															
	Bulk Goods	1923–31	82	75	97	114	156	167	115	94	83	81	64	71	25.4	103
	Case Goods	1923–31	98	89	113	124	132	118	101	81	78	95	82	90	14.6	54
16.	Sales															
	Wholesale	1920–24	69	74	83	97	116	143	149	135	108	83	71	68	25.5	81

No.	Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
16.	(Continued)															
	Retail	1919–24	107	109	110	110	110	100	83	75	88	100	104	106	9.2	35
17.	Total Mfrs'. Stocks															
	Bulk Goods	1923–31	64	58	61	74	110	149	149	138	123	105	93	76	29.0	91
	Case Goods	1923–31	68	64	60	70	108	137	146	140	124	108	93	80	27.3	86
18.	Unsold Mfrs'. Stocks															
	Bulk Goods	1922–31	71	64	70	71	109	162	143	135	117	100	80	77	27.8	98
	Case Goods	1922–31	60	48	48	63	112	145	156	152	128	112	93	81	34.3	108
19.	Shipments, Derived															
	Bulk Goods	1923–31	94	81	94	101	120	128	115	105	98	99	76	88	11.6	52
	Case Goods	1923–31	119	96	120	107	67	68	86	91	106	123	108	112	15.6	56
utter																
0.	Factory Production	1917–22	73	67	80	91	135	158	146	123	100	88	68	68	27 2	91
		1923–31	81	77	88	99	131	146	135	115	94	87	72	75	21.2	74
.	Factory Production, by States	1921–25														
	Arizona		84	86	106	134	133	117	97	98	94	95	68	87	15.1	66
	California		87	85	111	129	125	110	103	108	98	83	80	83	14.2	49
	Colorado		82	79	90	94	119	148	140	125	97	82	69	75	22.0	79
	Idaho		95	88	92	101	119	125	112	100	89	99	86	95	9.4	39
	Illinois		77	69	72	88	136	145	133	123	101	99	76	79	23.2	76
	Indiana		77	67	73	82	129	143	131	122	108	103	84	81	22.7	76
	Iowa		76	72	80	92	134	154	144	120	100	90	69	71	25.2	85
	Kansas		82	76	86	102	141	149	143	117	85	75	66	79	25.2	83
	Kentucky		68	58	60	78	123	139	150	140	117	111	79	77	30.0	92
	assachusetts		81	69	89	108	140	199	144	91	85	80	56	59	31.8	143
	igan		82	75	83	88	128	154	133	115	102	95	73	73	21.9	81
	esota		88	84	96	97	128	152	139	117	88	75	63	72	22.8	89
	sippi		54	49	61	94	143	137	148	149	116	98	82	69	32.2	100
	ri		73	62	67	86	140	145	145	128	103	97	77	76	26.9	83
	a		74	67	71	78	108	163	165	136	107	93	71	67	29.8	98
			77	74	84	95	136	161	149	128	90	74	62	69	29.1	99

		86	76	90	102	114	123	124	107	101	104	87	86	12.5	48
		61	56	79	98	155	184	133	119	102	94	63	58	32.0	128
		73	55	67	75	114	182	204	158	107	82	54	49	44.2	155
			63	69	79	129	153	139	128	110	103	81	74	27.0	90
			71	81	104	147	155	148	114	85	79	64	72	28.1	91
			77	89	112	144	144	119	95	83	89	80	81	20.0	67
			)	93	98	128	134	114	112	102	97	76	79	15.1	58
				82	127	124	165	163	129	92	68	54	61	34.7	111
				68	84	132	137	141	145	121	103	75	66	29.8	84
				84	119	146	134	125	98	84	93	85	84	20.7	78
				90	102	124	142	115	101	90	87	79	87	14.0	63
				62	72	112	139	142	152	133	113	78	64	31.8	91
				86	101	136	139	122	103	96	92	81	85	16.8	65
				87	94	132	150	136	119	98	90	70	72	22.8	80
				69	72	114	158	159	137	108	99	77	73	29.3	96
			73	87	85	120	170	149	118	97	84	68	71	26.1	102
			83	95	98	123	149	136	108	89	83	74	77	19.3	75
			37	19	11	26	108	178	197	187	160	125	88	59.2	186
		46	27	15	12	37	123	193	210	193	158	114	73	65.1	198
	23	84	76	88	94	124	121	116	115	106	100	88	88	13.7	48
	24–31	90	82	92	98	121	115	108	109	103	100	89	92	9.4	39
.....	1919–24	92	106	106	102	104	103	98	98	104	102	95	90	4 5	16
Consumption..	1922–31	108	100	106	98	92	81	79	86	103	116	114	116	10.6	37
ction	1920–31	108	101	108	99	91	80	78	88	103	116	115	115	10.8	38
onsumption	1920–31	108	102	106	98	89	78	74	89	105	117	119	115	12.0	45
oduction al	1920–31	69	70	87	100	133	153	134	116	103	96	73	67	23.1	86
ies	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range

ries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
inued)															
merican	1920–24	58	61	83	95	137	164	148	126	109	98	65	56	30.7	108
	1925–29	65	67	83	99	135	163	148	123	104	88	63	60	29.0	103
All other, Derived.....	1920–29	82	82	94	106	128	134	106	98	98	102	90	84	12.3	52
s at 5 Primary Mar-															
.....	1920–24	75	73	90	90	113	139	136	115	99	105	89	77	17.9	66
	1925–31	85	82	86	90	103	126	131	120	109	106	86	77	15.8	54
s															
.	1917–23	85	65	51	44	52	96	138	160	150	135	119	105	34.5	116
	1924–31	89	78	68	64	73	98	125	137	130	123	112	102	21.6	73
	)	80	60	41	38	38	95	145	168	164	144	122	105	41.3	130
		81	62	44	40	42	95	143	165	160	142	121	105	39.3	125
		79	63	47	43	46	95	141	162	157	140	120	104	37.3	119
			65	49	45	49	95	139	159	154	138	119	104	35.6	114
			67	52	48	53	96	138	156	150	135	119	103	33.5	108
			2	55	51	56	96	136	152	147	133	118	103	31.6	101
				58	53	60	96	134	149	144	132	117	102	29.7	96
				61	56	64	96	132	146	141	129	116	102	27.8	90
				63	58	68	97	130	143	137	127	115	101	25.7	85
				66	61	71	97	129	140	134	125	114	100	23.8	79
				69	64	75	97	127	137	131	123	113	100	21.8	73
				72	66	79	97	125	133	128	121	112	99	20.0	67
				74	69	83	97	123	130	125	119	111	99	18.1	61
				82	82	89	100	107	118	107	111	104	107	9.0	36
				99	103	117	104	86	98	109	113	98	90	7.8	31
			0	69	93	130	167	194	170	114	71	52	44	45.8	150
		0	0	0	0	1	30	86	150	332	546	54	0	121.4	546
		72	71	57	32	20	11	29	39	161	419	209	80	81.5	408

		65	62	52	32	22	10	30	36	184	426	209	72	86.5	416
		[illegible]	84	87	56	43	18	34	68	131	269	206	128	55.8	251
			0	0	0	1	5	90	301	533	258	12	0	132.0	533
			6	4	1	0	22	251	372	332	164	30	10	119.8	372
				5	1	28	190	324	371	166	78	24	7	108.3	370
				0	0	0	1	42	182	576	358	41	0	136.0	576
				0	0	0	2	24	99	433	535	101	6	128.2	535
				0	0	0	1	26	110	476	485	98	5	128.4	485
				0	0	19	95	281	412	323	71	0	0	119.2	412
				0	0	5	98	411	422	253	11	0	0	131.0	422
			0	0	0	4	78	470	416	209	23	0	0	132.5	470
			0	0	0	0	184	455	256	237	68	0	0	122.0	455
		0	0	0	13	318	467	287	114	1	0	0	0	131.0	467
	[illegible]–26	0	0	0	0	38	310	203	312	304	34	0	0	121.4	312
	1924–31	126	120	138	130	113	79	67	60	54	59	108	144	30.0	90
	1924–26	133	130	144	139	102	79	55	46	44	40	130	158	39.3	118
[illegible]ipments	1924–26	64	60	101	115	191	182	144	107	62	62	52	60	40.0	139
[illegible]arlot Ship-	1924–26	170	182	174	164	103	23	8	2	4	73	172	124	64.9	180
[illegible] Fruits, Carlot Shipments															
[illegible]ll	1920–31	133	124	145	135	117	83	64	49	43	65	111	132	32.8	102
[illegible]ixed	1924–26	175	162	159	127	79	51	44	25	19	26	121	213	59.4	194
[illegible]eries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
Cantaloupes															
Harvest Estimate		0	0	0	1	22	104	251	440	343	36	0	0	123.2	440
' t Shipments	1924–26	0	0	0	0	119	394	348	233	102	5	0	0	115.9	394
12 Markets....	1918–22	0	0	0	0	0	204	400	321	203	61	10	0	121.4	400
*e		0	0	0	0	5	62	328	478	289	38	0	0	132.5	478
...	1924–26	0	0	0	0	10	246	610	277	55	2	0	0	138.8	610
	924–26	0	0	0	0	4	140	295	232	356	151	19	2	112.4	356
		0	0	0	58	283	593	220	37	7	1	1	0	132.7	593
		?	13	16	161	659	310	29	1	0	0	0	0	138.2	659
			7	40	201	645	305	0	0	0	0	0	0	141.8	645
				0	0	0	0	0	88	805	307	0	0	152.0	805
				6	0	0	0	0	0	216	412	446	104	129.7	446
				0	1	22	185	571	325	74	20	1	0	130.2	571
				0	0	6	198	701	260	34	1	0	0	143.2	701
				0	2	16	40	82	145	404	470	40	1	119.8	470
				107	94	96	113	99	80	113	165	89	63	16.3	102
			3	80	92	109	159	120	90	102	128	122	73	-23.3	97
			9	11	53	148	337	358	166	61	21	14	11	• 101.4	349
		-5	122	140	102	73	25	12	46	130	225	119	82	43.8	213

		0	0	1	0	1	20	74	258	589	247	8	132.5	589
		71	70	36	13	4	25	88	223	257	172	140	65.6	253
			0	20	53	104	151	206	390	263	12	0	102.4	390
			67	102	120	43	69	94	166	186	99	72	29.2	143
			68	90	110	36	72	94	151	200	116	78	29.8	164
			90	88	154	96	66	88	124	148	124	77	25.0	88
			0	37	16	46	137	350	476	116	18	4	113.2	476
			63	85	173	279	141	77	206	113	30	2	68.7	277
			47	64	152	283	140	83	238	118	26	5	71.8	278
			109	145	193	305	202	89	33	27	32	15	75.7	290
			0	50	28	56	82	109	217	485	168	5	96.5	485
		101	116	114	116	70	25	38	108	192	121	82	30.8	167
		102	140	150	180	112	24	25	49	100	136	90	36.8	156
		0	0	0	0	0	0	10	166	659	323	43	0	141.2	659
		0	0	0	1	8	41	101	265	521	245	18	0	122.0	521
....	1924–26	50	14	24	197	270	343	34	19	17	103	78	50	85.6	329
uents	1924–26	152	120	142	115	50	18	23	32	65	144	161	178	52.0	160
12 Markets ...	1918–22	113	150	198	124	60	23	24	45	60	100	133	170	48.0	175
. Carlot Shipments.	1924–26	124	115	128	120	107	58	76	89	88	92	89	115	18 1	70
aragus, Carlot Shipments	1924–26	0	4	314	502	247	125	5	0	0	2	1	0	131.3	502

eries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range

ies	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
oers, Carlot Shipments	1924–26	0	0	8	62	286	394	286	90	61	8	4	1	111.0	394
lant, Carlot Shipments	1924–26	16	20	16	91	259	325	259	46	5	36	91	36	90.5	320
er, Carlot Shipments	1924–26	169	209	208	44	18	4	2	32	66	151	143	154	72.3	207
Shipments	1924–26	164	96	102	126	155	104	12	26	56	86	161	110	37.2	152
ments	1924–26	125	76	52	40	18	29	28	53	125	335	229	92	68.8	317
ts	1924–26	145	205	245	258	68	2	1	1	4	28	101	142	82.7	257
	924–26	41	18	32	50	108	194	139	74	187	202	89	64	55.2	184
		83	88	106	127	142	101	97	116	112	86	64	79	17.2	78
				0	0	0	1	1	18	190	340	520	131	130.1	520
				94	66	82	87	69	79	79	79	111	164	27.4	98
				11	69	69	93	80	87	86	89	91	143	22.7	81
				97	155	101	88	62	47	44	46	55	99	43.2	153
				59	47	55	60	64	62	70	95	202	279	51.4	232
				58	52	60	69	69	77	83	104	216	239	43.4	187
				127	98	75	64	53	50	52	74	105	164	38.8	127
				121	87	68	60	56	57	62	81	124	167	38.3	111
			78	142	198	197	148	101	83	69	57	36	37	47.7	162
			87	146	191	177	138	100	79	70	54	42	48	41.9	149
			2	14	78	152	191	194	185	161	122	69	25	67.4	192
		7	2	24	89	151	186	195	184	158	114	66	25	64.6	193

		6	87	110	95	98	112	125	132	118	110	86	61	17.8	71
			64	37	16	10	9	5	37	190	345	248	145	87.9	340
			5	34	13	9	9	7	53	224	335	220	149	88.1	328
				64	33	17	9	7	24	109	209	242	217	74.3	235
				65	29	14	9	6	29	114	210	229	216	74.6	223
				127	87	60	31	14	14	61	134	176	169	55.5	162
				125	87	54	31	14	23	83	139	159	156	51.4	159
				123	87	59	42	26	15	54	157	172	170	52.8	157
				116	82	52	33	22	18	71	172	183	167	53.7	165
				146	149	134	119	90	57	32	45	69	103	34.3	117
				143	140	125	104	79	54	41	59	85	110	30.3	102
				103	89	86	80	78	74	100	132	125	111	15.7	58
			0	0	0	0	7	90	325	632	145	0	0	133.8	632
		179	132	61	17	7	5	5	82	157	181	197	178	70.6	192
..	1920–31	101	87	97	93	104	111	110	110	105	107	92	81	8.2	30
acco															
.....	1920–30	103	97	105	98	102	104	100	107	105	107	92	79	5.6	28
s	1920–30	82	83	94	92	99	105	104	108	109	123	114	84	10.8	41
n *Manufacturers*															
al Dealers, Quarterly															
hewing, Smoking, Snuff, etc.	1920–31			112			98			92			99	5.8	20
ar types	1920–31			109			106			97			88	7.5	21
eries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range

ries	Period Covered	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
ipts	1920–30	74	121	154	142	121	103	96	92	85	76	76	61	23.4	83
eltings	1924–31	79	86	119	110	101	111	114	105	103	104	85	82	11.2	40
Stocks	1920–30	55	49	86	105	145	154	146	124	113	92	67	63	31.2	105
	1920–30	108	106	115	103	89	88	93	93	87	104	103	111	8.3	28
	1920–30	95	109	109	102	93	98	103	104	97	94	98	101	4.4	16
	1923–29			74			122			113			91	17.5	48
	29			101			100			101			98	1.0	3

II. TEXTILES

and Cotton Textiles

0	0	0	0	17	138	379	413	192	56	120.3	413
0	0	0	0	0	95	350	403	198	80	108.6	403
48	35	32	27	25	51	186	280	238	153	76.2	255
55	47	51	37	39	49	135	220	223	177	60.3	186
54	44	33	15	12	53	171	293	230	162	75.9	281
09	98	82	68	52	50	79	130	144	140	28.7	94
09	94	76	58	40	43	77	134	149	156	35.3	116
92	73	65	50	44	47	106	170	175	161	38.8	131
109	83	76	64	53	54	98	155	153	134	28.4	102
24	110	96	81	66	54	52	86	119	138	141	27.4	89
121	100	82	67	52	41	45	91	143	159	158	37.0	118
121	98	77	59	45	34	35	106	162	167	155	42.2	133
40 120	99	77	62	50	40	45	102	153	159	154	37.0	119

		'52	141	129	108	84	65	46	31	44	100	139	161	38.3	130
		')	131	119	102	83	68	54	43	63	111	137	148	31.4	105
			119	121	122	116	109	97	85	71	68	80	98	16.8	54
			16	126	127	119	109	99	84	74	66	72	96	18.2	61
				119	119	110	97	83	58	65	82	104	121	19.2	65
				122	114	104	93	80	66	67	86	105	119	18.0	56
				128	115	96	77	60	37	60	100	122	130	28.2	102
				26	115	98	80	64	41	55	101	122	130	26.8	95
				22	112	106	90	75	55	56	92	114	126	22.2	74
				.32	122	109	90	73	47	47	80	105	125	27.2	88
				.22	117	110	100	90	82	72	73	89	109	15.3	50
				118	114	109	101	92	89	77	76	92	108	12.2	42
					109	105	103	94	88	92	95	104	102	96	5.7	21
					108	106	105	97	86	92	94	103	103	94	6.5	26
				.03	110	106	103	94	86	93	95	105	102	95	6.3	24
				106	110	105	103	93	85	88	95	104	104	93	7.8	31
				102	108	104	99	92	86	94	96	105	104	98	5.9	27
			107	100	109	104	98	88	83	96	96	111	104	102	6.3	28
			109	100	104	102	95	92	81	98	100	113	100	104	5.5	32
		1921–31	108	99	108	104	102	97	88	94	96	104	102	97	4.8	20
	.....	1926–31	102	98	114	97	107	100	80	89	101	99	105	108	6.2	34
	.....	1926–31	104	105	115	92	100	93	87	99	111	100	95	98	5.9	28
ers' Stocks																
uted	.....	1926–31	104	98	94	98	104	107	104	99	90	93	100	108	4.6	18
ived	.....		103	98	97	100	105	110	105	98	91	90	97	104	4.7	20
ew Orders																
omputed	.....	1926–31	113	104	122	84	85	79	81	109	128	113	85	95	15.0	49
ived	.....		110	104	118	85	76	92	88	98	136	109	85	99	12.8	60
ries		Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range

eries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
ed Orders	1926–31	108	107	109	104	88	87	88	87	104	110	103	104	8.2	23
Cotton Goods															
ings (Production)	1921–31	98	102	118	110	102	97	84	89	93	108	97	102	7.0	34
ts	1921–31	104	104	117	104	103	95	90	93	97	104	94	97	5.8	27
s' Stocks	1921–31														
.....		99	95	96	100	100	102	102	100	97	100	103	105	2.1	10
.....		99	97	99	105	105	107	101	96	91	96	100	105	3.8	16
...	1924–31	109	109	119	105	97	85	89	95	100	106	93	93	8.0	34
	1924–31	115	116	118	104	93	76	85	95	106	101	100	91	10.0	42
	··	104	98	114	99	102	98	88	93	93	103	102	107	5.2	26
		100	113	110	104	102	86	95	96	110	101	90		6.6	27
		93	107	91	90	93	90	115	122	122	101	84		11.2	38
			98	108	114	118	120	112	96	86	80	85		12.2	40
			96	110	121	128	125	109	89	80	80	85		15.5	48
			09	86	92	94	76	99	108	124	104	85		11.4	48
			09	85	90	95	77	106	103	120	99	80		12.3	51
			12	109	109	110	103	98	88	87	86	84		9.5	28
			98	100	100	98	86	96	100	111	105	95		4.3	25
			06	97	95	100	85	104	112	117	110	96		8.2	32
			101	100	105	105	106	103	98	96	94	93		3.5	13
			106	107	105	104	104	100	95	92	90	90		5.4	17
		91	102	101	102	103	82	94	112	121	110	88		8.6	39
		89	106	100	103	104	78	97	109	125	111	81		9.8	47
	38	97	97	99	105	108	103	98	96	102	103	92		3.7	16

	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
Working Clothes															
33. Number Cut	1923–30	102	104	112	103	97	96	92	102	108	114	95	75	7.5	39
34. Net Shipments	1924–30	101	103	111	101	100	95	95	110	114	110	88	72	8.3	42
35. Stocks at Plants															
Computed	1923–27	102	106	106	108	103	103	99	91	91	92	96	103	5.2	17
Derived	1924–30	102	102	103	104	102	103	101	96	92	95	99	101	3.0	12
Artificial Leather															
36. Pyroxylin Spread	1923–31	93	99	123	106	109	112	95	98	98	98	82	86	8.4	41
37. Shipments Billed															
Total	1923–31	95	99	126	106	108	106	93	97	97	101	84	86	8.0	42
Light Goods	1925–31	92	104	123	110	106	98	88	90	100	108	91	90	8.5	35
Heavy Goods	1925–31	90	99	132	106	113	114	98	104	99	90	72	82	11.6	60
38. New Orders, Derived	1923–31	115	112	123	105	102	105	84	95	97	93	83	84	10.5	40
39. Unfilled Orders	1924–31	103	115	112	111	106	105	97	95	95	88	87	85	8.8	30
Fresh-Water Pearl Buttons															
40. Production	1922–31	96	108	111	109	105	101	79	90	97	105	105	97	7.1	32
41. Stocks at Manufacturers	1922–31	101	100	100	100	101	102	99	98	99	99	100	101	0.8	4
Elastic Webbing															
42. Shipments	1922–31	98	103	117	107	104	98	90	96	100	109	94	85	6 6	32
B. Production, Shipments and Stocks of Other Textiles, Leather and Leather Products															
Wool															
1. Receipts, Domestic and Foreign, Boston	1915–27	97	88	122	114	112	114	158	125	64	57	61	86	24.3	101
2. Consumption	1918–23	96	96	107	104	110	101	92	99	98	106	99	94	4 5	18
	1924–31	105	100	103	97	93	91	93	99	105	113	104	96	5.1	22
3. Woolen, Spindle Hours Active	1921–31	97	99	100	99	102	102	96	97	103	106	102	96	2.6	10
Worsted, Spindle Hours Active	1921–31	105	104	97	91	91	91	93	99	108	113	110	99	6.6	22
ets and Rugs, Loom urs Active	1924–31	101	103	106	105	102	97	89	96	100	103	104	96	3.8	17

ries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
rts	1918–29	103	90	84	86	101	92	102	110	108	107	108	109	8.0	26
ocks at Warehouses	1920–29	125	117	91	78	84	81	82	89	104	106	118	126	15.9	48
Deliveries to American Mills	1920–28	109	100	109	96	95	94	94	108	104	105	98	92	5.5	17
9. Percentage of Broad Looms Active	1922–31	104	105	105	100	96	94	95	95	98	101	103	103	3.6	11
10. Percentage of Narrow Looms Active	1922–31	95	99	103	104	106	105	97	98	100	98	100	94	3.1	12
11. Stocks at Manufacturing Plants	1921–28	114	108	103	104	95	87	85	93	98	104	107	103	7.1	29
Leather															
12. Total Production, Upper	1921–31	104	99	106	96	94	97	94	103	100	107	96	102	3.8	13
13. Calf and Kip, Upper Production	1922–30	103	97	100	88	86	87	98	111	108	115	101	105	7.2	29
14. Sole and Belting Leather, Production	1921–31	100	94	101	102	99	103	102	104	98	106	95	97	2.9	12
15 Bag, Case and Strap Leather Production	1921–31	97	101	108	101	91	90	96	105	106	115	101	89	6.2	26
16. Glove Leather, Sheep and Cabretta, Production	1922–30	102	104	106	104	100	91	85	99	96	112	107	96	5.7	27
17. Shoes, Production	1922–26	99	99	112	106	96	91	87	103	106	113	97	92	6.6	26
	1926–31	91	96	109	101	93	94	98	120	117	114	89	77	10.2	43
Rubber Heels	1923–31														
18. Production		96	97	103	95	97	95	91	101	108	120	100	100	5.1	29
19. Stocks at Dealers		100	101	105	107	110	107	100	97	92	93	93	95	5.0	18
Gloves															
20. Production	1924–29	93	97	106	104	102	102	94	109	102	110	98	84	5.8	26
C. Wholesale and Retail Sales of Textiles, Leather and Other Products															
1. Cotton Goods Sales, N. Y. F. R. D. Jobbers	1923–31	74	97	97	89	87	91	94	111	123	131	106	99	11.9	57

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
Commission Houses	1924–28	99	100	112	88	91	101	87	97	113	103	102	107	6.3	26
2 Dry Goods Stocks at Wholesalers, 3 Federal Reserve Districts															
Philadelphia	1924–31	96	101	101	100	98	98	102	107	109	104	96	89	3.9	20
Richmond	1925–31	100	101	100	99	95	104	111	107	101	107	91	86	5.0	25
Dallas	1924–31	99	99	101	101	100	105	119	111	104	96	85	80	6 8	39
3. Sales of New England Department Stores, by Departments and Specialty Stores															
Cotton Dress Goods....	1923–25	91	95	120	115	138	176	127	72	59	67	62	77	29.4	117
	1926–30	102	98	127	119	140	153	108	66	61	76	71	79	24.8	92
Woolen Dress Goods. ..	1923–25	106	89	130	108	73	46	30	48	132	182	142	115	35.8	152
	1926–30	109	85	131	110	74	56	34	55	132	179	132	103	32.7	145
Silks and Velvets, Dress Goods	1923–25	90	88	127	116	131	124	80	61	85	103	95	100	16.8	70
	1926–30	110	97	132	121	125	115	77	59	78	101	91	95	17.2	73
Linens	1923–25	150	80	88	70	83	90	71	68	106	107	104	184	25.1	116
	1926–30	161	80	81	67	86	92	70	73	92	119	111	178	26.6	111
Women's Dresses	1923–25	113	83	88	104	125	154	86	62	86	109	102	88	17.8	92
	1926–30	114	80	98	125	142	149	81	58	80	100	90	83	21.7	91
Misses' Dresses	1923–25	89	83	91	107	118	138	73	61	110	124	103	103	17.2	77
	1926–30	95	78	92	109	127	134	70	61	108	116	103	108	17.4	73
Women's Coats	1923–25	121	56	96	174	128	55	30	43	72	163	163	97	41.7	144
	1926–30	132	59	87	155	119	73	35	83	84	163	129	81	33.0	128
Misses' Coats	1923–25	89	42	86	211	140	61	32	44	74	170	150	98	45.4	179
	1926–30	85	42	92	157	110	67	40	101	106	187	131	81	32 1	147
Juniors' and Girls' Ready-to-Wear	1923–25	78	56	103	156	100	94	46	46	92	136	143	151	31.4	110
	1926–30	72	56	101	136	106	99	52	55	105	137	131	150	27.7	98

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
ntinued)															
Aprons and House Dresses	1923–25	86	74	86	103	137	179	124	74	65	67	72	132	29.2	114
	1926–30	89	75	84	87	131	154	107	65	69	78	86	176	27.9	111
Waists and Blouses	1923–25	90	88	114	143	144	136	84	65	80	85	73	98	22.8	79
Waists, Blouses and Sweaters	1926–30	97	62	87	100	128	127	88	78	109	93	85	147	18.4	85
Petticoats	1923–25	84	80	89	97	104	119	71	59	68	84	101	244	28.0	185
Men's Clothing	1923–25	92	91	102	118	107	103	60	66	92	125	126	118	16.5	66
	1926–30	121	73	104	112	101	105	72	57	94	119	126	116	17.3	69
Boys' Wear	1923–25	67	58	107	133	100	109	50	53	104	120	125	174	28.7	124
	1926–30	66	55	105	133	97	105	51	51	108	117	128	184	30.0	133
Infants' Wear	1923–25	68	61	89	109	101	86	61	65	104	136	120	199	28.2	138
	1926–30	74	61	90	106	99	87	59	66	102	137	125	195	27.4	136
Muslin Underwear	1923–25	89	62	77	91	115	142	94	78	66	77	89	223	29.8	161
Silk and Muslin Underwear	1923–25	94	70	76	94	106	137	92	67	66	78	95	227	28.2	161
	1926–30	92	71	73	85	105	123	85	69	67	78	100	252	30.0	185
Knit Underwear	1923–25	124	67	67	77	94	103	64	50	70	122	152	210	35.2	160
	1926–30	100	68	74	78	93	99	69	57	69	117	134	242	32.2	185
Women's and Children's Hosiery	1923–25	71	62	89	103	106	114	80	71	82	101	112	210	24.2	148
	1926–30	75	69	92	98	106	108	77	70	85	103	114	202	22.2	133
Corsets and Brassieres	1923–25	103	88	109	113	116	128	96	83	92	95	85	91	11.6	45
	1926–30	107	87	104	109	117	125	91	82	93	99	91	95	10.3	43
Men's Furnishings	1923–25	73	59	70	79	90	118	80	65	76	94	108	288	35.7	229
	1926–30	80	63	72	80	82	107	79	66	75	90	109	297	35.5	234
Laces and Trimmings	1923–25	112	80	98	104	109	124	65	50	79	121	126	131	21.2	81
	1926–30	114	86	105	118	112	99	51	53	82	114	119	147	21.5	96
Ribbons	1923–25	78	72	92	113	114	118	82	61	76	95	104	196	24.1	135
	1926–30	86	75	93	109	109	113	64	55	71	95	120	208	26.7	153

	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
Handkerchiefs	1923–25	58	49	56	54	48	60	46	49	61	73	115	530	74.2	484
	1926–30	62	49	54	58	52	69	43	54	57	79	126	497	70.5	454
Neckwear and Veilings..	1923–25	67	72	89	118	119	115	86	65	72	91	95	211	27.2	146
	1926–30	93	72	90	109	104	88	58	51	72	91	109	264	30.9	213
Millinery	1923–25	64	66	138	160	108	101	55	64	148	138	92	67	32.1	105
	1926–30	60	55	116	159	125	117	60	67	138	139	95	68	32.4	104
Domestics	1923–25	132	76	92	72	89	97	74	83	122	125	103	134	19.4	62
	1926–30	171	72	84	63	89	95	70	82	113	124	106	132	24.2	108
Notions	1923–25	96	88	101	97	103	125	95	71	90	104	96	134	11.2	63
	1926–30	99	90	101	96	107	121	92	74	89	105	95	130	10.8	56
Art Goods, including Needlework	1923–25	106	91	96	74	76	70	62	71	104	124	134	192	26.7	130
	1926–30	110	89	94	73	75	74	57	72	97	124	139	197	28.2	140
Women's and Children's Shoes	1923–25	95	60	102	119	113	121	78	68	94	110	101	139	17.5	79
	1926–30	81	69	101	119	107	117	70	69	101	113	106	148	18.6	79
Men's and Boys' Shoes..	1923–25	100	71	96	114	106	107	68	61	90	106	102	181	19.2	120
	1926–30	86	73	97	101	91	107	65	63	95	96	104	220	22.2	157
Women's and Children's Gloves	1923–25	97	67	103	125	89	58	23	19	58	124	142	296	48.2	277
	1926–30	86	65	100	129	85	57	28	29	74	123	139	286	46.1	258
Leather Goods	1923–25	62	58	72	80	83	84	70	73	88	89	104	337	40.2	279
	1926–30	67	50	72	95	90	87	65	67	84	92	114	318	38.6	268
Luggage	1923–25	72	60	65	72	108	144	104	97	106	70	74	228	31.7	168
	1926–30	77	59	64	69	91	142	96	99	94	65	79	267	34.7	208
Furs	1923–25	150	142	47	40	24	13	19	148	64	193	216	145	65.6	203
	1926–30	201	107	46	34	26	9	31	181	65	148	190	162	64.8	192
Umbrellas, Parasols and Canes	1923–25	59	46	79	68	90	83	65	68	82	74	85	400	50.1	354
	1926–30	74	53	62	61	82	76	63	63	65	93	118	389	51.2	336
rniture, Beds, etc.....	1923–25	106	119	79	82	88	83	79	170	103	114	83	94	18.7	91
	1926–30	120	119	80	81	88	79	77	183	92	109	87	85	21.8	106
ies															

ries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
nued)															
oor Coverings	1923–25	94	84	106	100	107	89	64	104	128	138	107	80	14.9	74
	1926–30	124	78	96	96	106	82	62	114	119	142	111	68	19.5	80
Draperies, Lamps, etc...	1923–25	78	71	89	91	104	92	62	73	118	152	137	132	23.9	90
	1926–30	93	74	91	93	107	96	61	68	112	153	135	117	20.7	92
Housefurnishings	1923–25	80	72	91	107	108	108	74	74	125	118	110	132	18.1	60
	1926–30	103	73	97	100	112	97	59	69	106	111	108	165	17.5	106
Silverware and Jewelry.	1923–25	72	70	72	74	77	96	60	66	80	100	107	326	38.8	266
	1926–30	78	66	63	78	79	100	60	74	81	106	111	304	36.8	244
Toilet Articles and Drugs	1923–25	90	80	94	84	78	100	83	80	91	96	95	229	21.5	151
	1926–30	94	79	94	79	88	97	79	75	87	98	103	226	21.6	151
Toys and Sporting Goods	1923–25	32	38	48	55	65	78	61	54	56	61	118	533	75.2	501
	1926–30	30	30	42	49	65	89	58	44	49	59	125	560	80.8	530
Musical Instruments ..	1923–25	85	118	115	79	79	59	56	82	88	115	113	211	28.7	155
Musical Instruments and Radios	1926–30	307	74	62	53	55	38	40	68	85	124	134	160	54.2	269
Books and Stationery..	1923–25	72	66	65	56	59	64	53	50	77	83	124	432	59.2	382
	1926–30	75	65	67	59	59	65	48	53	69	91	136	413	58.2	365
Sales of Cleveland Department Stores	1924–25														
Cotton Dress Goods....		87	106	113	114	128	185	138	75	54	64	54	81	30.8	131
Aprons and House Dresses		101	112	103	101	125	188	112	67	49	59	67	115	26.2	139
Waists and Blouses.....		81	105	112	164	145	116	84	67	82	91	59	95	23.6	105
Petticoats		97	93	81	84	86	135	99	52	55	80	97	241	29.3	189
Underwear, Muslin and Silk		102	74	66	81	109	134	93	73	59	76	82	250	32.6	191
Underwear, Knit		106	66	67	81	86	101	64	47	62	146	160	215	37.9	168
Hosiery, Women's and Children's		63	76	85	108	104	107	86	80	82	109	102	198	21.3	135
Infants' Wear		74	79	87	114	93	84	68	73	108	140	106	176	23.8	108
Handkerchiefs		62	48	48	51	56	55	53	54	61	75	108	529	72.8	481

Domestics		124	94	82	67	92	98	77	94	107	126	103	138	16.2	71
Notions		94	93	100	97	105	114	95	76	93	101	95	138	9.6	62

III. AUTOMOBILES AND RELATED PRODUCTS

A. Crude Rubber and Its Products

Crude Rubber

1. Imports	1919–24	109	121	110	110	89	99	85	86	76	102	104	109	10.8	45
	1925–31	116	94	107	111	98	92	98	90	92	96	104	102	6.7	26
2. Stocks	1925–30														
Total Domestic															
Computed		105	109	112	111	108	99	99	92	88	88	91	96	7.7	24
Derived		110	108	108	109	104	97	97	90	88	89	96	104	7.2	22
Manufacturers'		103	107	114	110	110	103	103	93	84	85	90	97	8.4	30
Dealers'		120	122	111	113	102	87	90	79	94	93	97	92	11.3	43
Afloat		104	105	101	97	94	97	93	94	99	101	101	113	4.2	20
3. Consumption															
Total	1925–30	103	99	108	111	111	109	99	108	95	92	86	78	8.4	33
In Tires	1921–31	100	100	110	112	114	110	99	106	93	94	80	78	9.0	36
Inner Tubes															
4. Production	1921–26	99	99	106	98	100	99	95	110	105	104	94	91	4.2	19
	1925–31	93	98	110	113	115	109	99	113	99	96	76	78	10.1	39
5 Shipments	1924–31	94	79	92	102	110	116	136	132	107	85	69	76	17.3	67
6 Manufacturers' Stocks															
Computed	1921–31	94	102	109	115	117	112	99	89	87	91	93	92	9.2	30
Derived	1924–31	93	102	110	115	117	114	97	89	86	90	93	93	9.8	31
Pneumatic Casings															
7. Production	1921–31	96	101	114	113	116	112	97	104	91	91	82	83	10.0	34
Shipments	1924–31	89	81	98	110	113	120	129	123	104	87	72	74	16.5	57
Manufacturers' Stocks	1924–31														
Computed		96	105	110	112	114	111	100	94	88	89	92	91	8.5	26
Derived		96	105	113	114	116	113	99	91	85	86	90	93	10.1	31

...ies	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range

eries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
ushion Tires															
duction	1921–31	96	93	103	105	109	111	99	105	94	101	89	93	5.8	22
ipments	1921–31	78	85	107	108	112	110	107	114	106	109	86	79	12.1	36
Manufacturers' Stocks	1921–31														
Computed		102	104	103	101	103	105	101	98	96	95	95	97	3.2	10
Derived		103	105	104	103	102	103	101	99	95	93	94	98	3.5	12
Fabric															
13. Consumed in Tires	1921–25	101	101	116	110	114	103	92	103	91	94	86	89	8.0	30
	1924–31	98	98	110	115	117	114	108	107	91	91	78	73	11.8	44
14. Rubberized Automobile Fabrics, Production	1924–31	86	94	100	106	123	116	99	106	103	109	86	71	10.6	52
B. Petroleum and Gasoline															
1. Crude Petroleum Output	1913–22	96	90	102	101	102	100	104	103	101	101	100	100	2.3	14
	1923–30	97	93	100	99	104	100	104	103	100	103	98	98	2.4	11
Gasoline															
2. Production	1917–23	97	88	98	97	104	103	104	103	101	105	100	100	3.3	17
	1924–30	100	92	100	98	101	100	104	104	100	102	97	98	2.2	12
3. Domestic Consumption	1918–25	79	70	84	92	107	113	123	128	114	109	95	85	15.8	58
	1926–30	79	79	92	100	107	109	119	120	110	103	94	88	11.3	41
4. Consumption by States	1926–31														
Alabama		86	84	95	100	104	102	109	112	105	108	97	95	6.9	28
Connecticut		69	69	79	96	110	116	127	125	113	109	98	89	16.7	58
Florida		112	109	120	104	99	98	86	88	85	91	98	108	9.0	35
Indiana		76	72	90	99	109	107	118	122	115	111	95	86	13.7	50
Maine		38	40	49	68	113	135	161	174	141	122	95	64	41.0	136
Ohio		73	71	89	104	116	109	116	122	114	108	95	86	14.6	51
Oklahoma		86	79	93	96	98	110	119	114	108	104	97	96	9.2	40
Texas		90	83	96	96	101	105	111	111	104	105	99	99	6.2	28
Virginia		77	72	89	100	107	106	115	121	110	110	99	94	11.5	49
Washington		69	73	94	98	107	112	124	128	112	104	92	85	14.7	59
Wisconsin		58	59	73	93	115	121	136	139	121	113	96	76	24.2	81

	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
5. Retail Distribution, 41 States	1922–31	81	76	85	97	106	109	118	120	112	109	97	91	12.2	44
6. Refineries' Stocks															
Computed	1919–24	100	112	123	127	122	114	101	85	76	72	76	87	16.9	55
Derived	1918–24	100	109	117	120	119	114	103	88	81	79	82	90	13.5	41
Computed	1924–28	100	110	118	118	113	108	99	89	84	83	87	90	11.2	35
Derived	1924–30	104	111	115	115	111	107	99	91	85	84	85	91	10.7	31
C. Sundry Automobile Materials															
1. Steel Ingot Production Daily Average	1920–25	105	108	113	106	99	92	88	89	93	103	103	100	6.4	25
	1926–31	98	109	114	112	109	99	93	97	97	97	90	83	7.5	31
2. Steel Sheets, Production	1919–24	109	109	115	107	103	92	83	103	91	109	100	81	9.0	34
	1924–28	109	104	115	106	98	98	85	97	95	104	96	93	6.3	30
3. Steel Sheets, Shipments	1919–28	100	98	116	103	105	93	85	96	91	110	102	100	6 1	31
4. Malleable Castings	1923–31														
Production		105	109	120	112	108	99	91	92	88	98	85	95	8.8	35
Shipments		103	107	121	115	112	105	93	93	91	91	82	87	10.5	39
5. Total Hardwood	1925–31														
Production		100	104	104	99	98	100	95	102	104	103	100	91	2.8	13
Shipments		98	105	106	103	102	95	95	101	105	107	98	85	4.8	22
6. Upholstery Leather, Splits.	1922–30														
Production		91	101	112	114	100	98	88	95	100	107	97	95	5.8	26
Shipments		85	103	122	105	105	94	94	101	92	115	94	90	8.5	37
Automobile Parts and Accessories															
7. Sales to Dealers	1919–26	81	90	89	97	105	98	113	128	115	100	97	87	10.2	47
8. Shipments	1925–31														
Replacement Parts		90	85	95	104	111	100	101	109	113	112	93	87	8.3	28
Accessories		80	86	108	114	112	107	98	103	108	105	93	87	9.4	34
Original Equipment		92	105	127	127	124	108	98	101	98	87	66	69	15.2	61
Service Equipment		91	103	130	130	120	110	92	95	91	89	76	73	15.5	57
omobile Rims, Produc- on	1924–31	91	100	124	133	126	109	102	104	101	88	63	59	16.5	74

ries	Period Covered	Jan.	Feb.	Mar	Apr.	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
es: Production, Sales, Registration and Exports															
nger Cars, Production	1919–25	76	85	109	115	117	118	110	108	98	102	86	76	13.2	42
	1925–31	79	100	127	137	136	117	107	108	93	84	56	57	21.9	81
Trucks, Production	1915–27	80	89	113	112	113	103	99	106	109	108	89	78	10.8	35
3. Taxicabs, Production	1925–31	112	98	113	97	69	72	62	65	62	109	152	189	29.2	127
4. G. M. Cars Sold to Dealers	1924–31	83	104	130	140	137	117	97	109	103	79	49	51	23.4	91
5. G. M. Cars Sold to Users	1922–31	64	80	119	152	144	122	105	109	97	92	62	54	25.2	98
6. Automobile Financing, Retail	1928–31														
New Cars		56	70	108	136	133	136	129	115	97	88	69	65	26.0	80
Used Cars		70	77	107	124	126	125	118	110	91	98	78	76	18 3	56
New Passenger Cars															
7. Registration, Total	1925–31	70	73	112	146	145	122	124	112	90	91	62	52	26.9	94
8. Registration by Price Groups	1925–29														
First Highest		64	60	106	150	139	114	110	109	104	110	73	59	23.8	91
Second Highest		65	64	106	143	135	117	122	132	106	96	63	51	26.8	92
Third Highest		66	68	111	148	146	127	132	112	93	87	62	48	29.3	100
Lowest		72	73	109	143	142	122	129	113	88	94	65	49	26.4	94
9. Registration, High Price Group	1926–31														
Lincoln		77	67	110	151	142	108	111	97	99	110	74	54	22.0	97
Cadillac		79	66	107	150	136	104	87	74	103	126	97	71	21.0	84
Packard		63	66	106	145	125	105	119	118	114	114	69	54	24.5	91
10. Registration, Medium High Price Group	1926–31														
Nash		65	61	106	147	136	117	139	120	99	94	66	50	27.5	97
Buick		69	62	100	132	124	100	97	158	122	110	70	56	24.3	102
Chrysler		66	60	106	147	153	129	119	109	101	96	65	49	27.3	104
11. Registration, Medium Price Group	1926–31														
Hupmobile		69	72	114	149	148	122	121	111	93	86	63	50	27.7	99
Dodge		72	76	119	155	149	122	120	103	82	82	67	51	28.2	104
Hudson		80	83	129	155	143	117	122	102	84	74	57	54	28.0	101

12. Registration, Low Price Group	1926–31														
Ford		75	74	114	146	150	119	123	109	93	85	60	52	26.8	98
Chevrolet		70	85	122	150	150	124	120	104	84	87	57	47	28.3	103
Essex		68	83	129	170	158	131	124	97	71	67	53	48	35.4	122
New Trucks															
13. Total Registration	1925–30	78	78	110	130	120	102	118	116	106	111	75	56	18.8	74
14. Registration by Makes	1926–31														
Mack		73	67	106	145	145	111	120	108	88	102	73	62	22.8	83
Chevrolet		73	82	110	128	119	100	114	120	116	120	71	47	21.2	81
Exports															
15. Passenger Cars	1923–31	94	105	136	139	122	86	88	93	83	83	81	88	17.2	58
16. Trucks	1923–31	103	92	111	125	110	89	94	102	90	91	108	84	9.9	41

IV. CONSTRUCTION AND CONSTRUCTION MATERIALS

A. Construction Activity

1. Building Permits Issued, 20 Cities	1905–14	72	72	119	132	121	124	109	102	93	93	83	79	17.9	60
	1915–21	83	91	119	133	108	106	100	102	94	94	88	82	11.3	51
	1922–28	84	96	136	116	106	108	93	96	85	98	92	94	10.7	52
Building Contracts Awarded															
2 Total Value	1911–18	74	74	111	122	117	116	104	107	101	103	88	85	13.3	48
	1919–23	71	72	113	126	127	117	115	110	94	99	81	75	18.0	56
	1923–31	77	76	113	119	113	115	105	101	102	104	88	86	12.1	43
3 Value by Groups															
a. Residential	1915–20	70	62	102	125	127	128	109	114	102	113	77	66	20.4	66
	1919–23	72	72	114	129	128	103	95	99	100	101	95	92	12.5	57
	1923–31	75	78	115	126	114	105	95	97	95	109	97	94	11.5	51
b. Commercial	1919–23	77	88	117	131	134	113	108	102	101	94	72	63	17.7	71
	1923–31	96	91	124	108	112	113	104	98	95	90	82	87	10.2	42

ries	Period Covered	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Average Deviation	Range

ries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
inued)															
Public Works and Utilities	1919–23	60	58	105	127	141	149	139	118	93	92	59	59	29.8	91
	1923–31	72	64	111	135	114	124	120	109	103	104	70	74	20.0	71
d. Educational	1919–23	54	54	108	137	121	129	152	134	95	100	55	61	30.2	98
	1923–31	57	68	110	105	118	133	134	106	104	94	86	83	18.5	77
e. Public and Semi-Public	1919–23	63	62	82	119	119	134	153	111	114	101	78	64	25.2	91
	1923–31	67	76	108	116	111	119	106	117	115	98	80	85	15.5	52
Total Construction															
4. Index of Construction Volume	1924–31	71	65	68	86	102	117	121	124	127	119	115	87	20.7	62
Federal-Aid Highways															
5. Miles Completed	1922–31														
(a) Relative Deviations.		74	63	42	51	76	123	80	98	140	164	151	140	36.2	122
(b) Absolute Deviations.		76	62	47	53	78	119	87	97	139	154	150	137	33.2	107
6. Miles Under Construction.	1922–31	94	93	94	96	100	103	106	107	108	106	100	96	4.8	15
7. Miles Initiated, Derived..	1922–31	43	48	57	82	138	169	126	113	155	133	58	78	39.0	126
Pavements															
8. Concrete, New Orders.....	1923–31	53	58	100	156	158	134	129	120	93	78	51	69	32.9	107
B. Construction Materials: Asphalt, Cement, Brick and Tile															
Petroleum Asphalt															
1. Production	1925–31	70	68	83	98	115	122	123	125	121	122	87	66	21.3	59
2. Producers' Stocks	1925–31	98	102	108	109	110	108	102	98	90	88	90	95	6.7	22
3. Shipments, Derived	1925–31	67	65	78	97	114	124	128	128	128	124	85	62	24.3	66
Portland Cement															
4. Production	1912–24	64	61	80	102	117	116	113	120	117	119	108	85	18.5	59
	1924–30	64	58	76	96	118	121	122	127	120	118	99	79	21.2	69
5. Shipments	1912–24	43	45	82	107	121	128	125	136	134	130	93	54	30.3	93
	1922–28	45	48	75	102	129	133	135	142	132	129	84	46	33.7	97

	Period Covered	Jan.	Feb.	Mar.	Apr	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
6. Shipments to Selected States	1924–30														
Alabama		75	83	96	107	108	102	127	129	106	105	91	71	14.0	58
Arizona		108	89	108	101	100	102	88	103	102	100	96	102	4.4	20
California		95	82	99	100	110	107	103	110	105	111	94	84	7.7	29
Florida		102	99	104	104	104	96	95	97	96	107	104	92	4.2	15
Illinois		26	34	56	91	133	141	158	164	152	146	69	30	49.0	138
Kansas		26	57	93	122	133	117	116	133	128	142	89	43	31.9	116
Louisiana		82	93	108	109	102	102	110	118	106	105	91	74	10.0	44
Maryland		38	44	76	103	126	124	131	148	135	135	92	46	33.8	110
Missouri		26	43	75	103	128	123	142	150	140	142	90	38	38.0	124
New Jersey		41	40	77	113	127	129	131	126	132	139	96	49	32.8	99
New York		39	39	71	101	125	141	141	146	137	127	83	51	36.2	107
Ohio		30	35	63	98	129	141	150	159	145	138	78	34	43.7	129
Pennsylvania		36	36	64	95	123	142	144	155	147	132	85	42	40.4	119
Texas		74	82	103	111	110	109	119	121	102	106	91	72	13.5	49
7. Producers' Stocks															
Computed	1911–24	114	125	126	126	123	112	98	82	68	58	70	96	21.2	68
Derived	1912–24	114	126	124	120	117	107	97	85	73	64	75	98	18.0	62
Computed	1924–30	116	123	126	124	118	107	95	81	69	63	77	101	19.2	63
Derived	1924–30	115	122	123	119	112	104	95	84	76	69	79	102	16.2	54
8. Producers' Stocks, Clinker	1923–31	99	119	137	142	133	119	104	84	68	58	62	78	25.4	84
Common Brick															
9. Shipments	1924–31	64	68	99	116	114	117	110	111	93	108	112	88	14.7	53
10. Producers' Stocks	1921–31														
Burned		114	106	95	85	80	81	83	95	105	113	126	117	13.5	46
Unburned		72	74	81	87	98	96	109	112	125	124	129	92	16.6	57
11. Production, Derived	1924–31	57	49	73	92	102	119	115	140	117	127	143	66	27.2	94
Unfilled Orders	1921–31	83	92	108	122	111	115	103	99	92	86	96	93	9.8	39
New Orders, Derived	1924–31	49	82	124	138	97	123	92	105	82	99	127	83	19.4	89
[illegible]tion	1923–31	72	78	95	108	108	109	110	122	103	113	98	84	12.2	50

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
..ments	1923–31	48	63	102	128	134	126	120	115	106	110	88	58	23.7	86
oducers' Stocks	1923–31														
Computed		111	115	112	105	98	95	91	91	91	93	96	104	7.7	24
Derived		110	114	112	106	98	93	90	93	92	93	96	103	7.5	24
17. Unfilled Orders	1923–31	97	96	116	119	118	117	106	102	93	88	77	72	12.9	47
18. New Orders, Derived	1923–31	87	61	133	133	132	124	103	109	92	102	71	50	22.9	83
Floor and Wall Tile															
19. Production	1924–31	89	90	99	99	99	103	104	107	106	111	98	95	5.2	22
20. Shipments	1924–31	80	84	97	103	103	107	107	115	111	112	92	89	9.7	35
21. Producers' Stocks	1924–31														
Computed		101	104	107	105	103	100	99	96	94	95	95	100	3.4	13
Derived		102	104	105	103	102	101	100	97	95	95	97	99	2.8	10
C. Construction Materials: Lumber and Flooring															
Southern Yellow Pine															
1. Production	1917–23	94	93	105	102	109	100	103	105	101	100	96	88	4.5	21
	1923–31	99	95	106	103	105	97	99	103	100	104	98	91	3.5	15
2. Shipments	1922–31	97	94	105	106	107	95	100	106	103	108	97	85	5.6	23
3. Mill Stocks	1922–29														
Computed		101	102	102	101	100	99	100	99	99	98	97	101	1.2	5
Derived		101	102	102	101	100	100	100	100	99	98	98	100	0.9	4
4. New Orders	1922–31	105	97	103	104	101	92	101	106	103	106	95	86	4.9	20
Western Pine															
5. Production	1917–24	45	50	83	113	133	136	128	134	119	114	92	53	29.5	91
	1924–31	52	60	99	118	123	125	120	126	110	108	92	68	21.6	74
6. Shipments	1921–31	84	85	102	104	109	108	107	116	107	110	88	81	10.4	35
7. Mill Stocks	1922–31														
Computed		98	95	94	96	98	100	102	102	103	104	105	104	3.2	11
Derived		98	94	94	96	98	100	102	104	104	104	105	103	3.5	11
Maple Flooring															
8. Production	1923–31	106	99	105	100	91	93	91	102	105	106	97	105	4.8	15

	Period Covered	Jan.	Feb	Mar.	Apr.	May	June	July	Aug	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
9. Shipments	1924–31	84	86	100	106	108	109	116	124	111	102	82	73	12.6	51
10. Producers' Stocks	1923–31														
Computed		106	109	110	107	105	101	97	92	90	90	93	101	6.4	20
Derived		108	112	114	112	107	102	94	87	85	86	91	101	9.4	29
11. New Orders	1923–31	105	98	99	102	104	103	104	123	98	93	86	85	6.8	38
Lumber															
12. Retail Sales															
Chicago F. R. D.	1926–31	69	61	87	109	119	116	106	114	122	129	97	72	19.1	68
Minneapolis F. R. D.	1920–31	45	38	63	89	119	148	129	138	129	142	108	52	35.5	110
Kansas City F. R. D.															
All Lumber Building Materials and Supplies	1926–31	85	83	105	112	110	94	98	105	110	121	102	75	10.8	46
Lumber	1926–31	79	82	104	108	108	98	106	109	110	121	103	73	11.4	48
13. Stocks at Retailers															
Chicago F. R. D. Derived	1927–31	97	100	103	103	103	103	103	103	100	96	95	96	2 8	8
Minneapolis F. R. D.	1922–31	97	103	105	109	107	104	103	103	99	93	88	89	5.7	21
Kansas City F. R. D.	1926–31	99	101	102	103	103	102	101	101	100	98	95	95	2 2	8
14. Sales at Wholesale															
Chicago F. R. D. (dollars)	1925–31	83	92	109	109	109	111	102	108	101	104	89	83	8 8	28
Chicago F. R. D. (board feet)	1927–31	78	87	108	111	117	117	106	115	100	99	84	76	12 5	41
Minneapolis F. R. D., Derived	1922–31	109	86	79	121	103	124	121	138	97	94	68	60	19 3	78
Kansas City F. R. D., Derived	1926–31	108	96	111	115	108	91	99	109	103	107	81	73	10.1	42
nstruction Materials: Heating and Plumbing Fixtures															
'ors															
oduction	1925–31	108	109	116	104	100	92	85	101	102	114	92	77	9.0	39
ments	1925–31	75	65	60	65	81	85	104	130	138	164	133	102	28.3	104

ries	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
ers' Stocks															
mputed	1926–31	80	91	104	112	118	119	115	108	101	90	83	78	12.9	41
Derived	1925–31	84	93	105	113	117	118	114	108	101	90	81	77	12.6	41
New Orders	1926–31	70	62	67	69	87	89	107	132	138	157	130	91	27.4	95
st Iron Boilers, Square															
5. Production	1925–31	99	105	111	102	93	94	85	105	104	133	94	73	10.2	60
6. Shipments	1925–31	69	62	58	61	75	80	103	132	155	187	127	93	33.8	129
7. Producers' Stocks															
Computed	1926–31	88	94	104	110	115	116	112	107	100	90	84	79	10.8	37
Derived	1925–31	87	94	103	110	113	116	113	108	99	90	85	82	10.5	34
Cast Iron Boilers, Round															
8. Production	1925–31	89	102	109	111	104	94	84	97	105	132	104	69	11.2	63
9. Shipments	1925–31	70	64	67	75	88	84	99	119	139	178	125	92	26.8	114
10. Producers' Stocks															
Computed	1926–31	88	96	104	107	110	113	110	107	102	92	87	85	8.8	28
Derived	1925–31	88	95	102	108	111	113	110	106	100	92	88	84	8.6	29
Baths															
11. Shipments	1917–24	84	85	100	94	109	107	112	116	112	100	102	82	9.4	34
	1924–30	86	85	104	109	115	115	116	118	104	98	79	71	13.5	47
12. Producers' Stocks	1919–24	111	128	140	132	120	100	83	70	62	69	82	104	22.4	78
	1924–30	107	113	116	114	104	95	88	84	86	92	98	103	9.5	32
13. Production, Derived	1919–24	89	98	109	88	100	92	99	106	106	105	112	99	6.1	24
	1924–30	92	95	109	106	99	100	105	112	107	108	89	79	7.8	33
14. New Orders	1918	55	35	58	99	157	193	157	134	111	78	69	55	41.9	158
	1919	70	54	70	101	141	166	137	126	108	85	74	70	29.7	112
	1920	85	72	78	102	128	142	122	118	105	91	78	78	19.6	70
	1921	97	88	86	103	118	124	111	111	101	95	80	86	11.3	44
	1922	109	100	94	105	109	109	105	105	97	94	82	92	6.9	27
	1923	113	107	103	107	103	99	101	101	96	93	83	97	5.6	30
	1924	115	107	109	109	99	95	99	99	94	91	84	95	7.0	31
	1925	111	105	115	113	101	95	101	101	93	91	81	91	8.0	34

	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
	1926	104	100	120	118	106	98	106	104	93	91	80	84	9.3	40
	1927	94	92	121	122	110	104	112	106	92	91	78	78	12.5	44
	1928	80	86	123	127	116	107	119	111	92	91	76	72	17.2	55
	1929	67	79	124	129	121	109	126	116	92	91	75	69	21.0	62
	1930	54	72	126	134	126	111	134	122	92	91	73	65	25.5	80
Lavatories															
15. Shipments	1919–24	90	93	107	100	100	103	103	109	103	112	96	88	5.8	24
	1924–30	95	90	107	110	109	111	105	115	106	99	79	73	10.6	42
16. Producers' Stocks	1919–24	93	102	115	115	112	107	104	96	87	82	90	96	9.2	33
	1924–30	99	105	109	108	106	102	99	94	89	92	96	101	5.2	20
17. Production, Derived	1919–24	86	104	123	100	96	97	99	99	92	106	106	95	6.2	37
	1924–30	91	102	115	108	105	103	99	105	96	105	87	83	7.2	32
18. New Orders	1918–30	100	97	112	109	105	110	101	106	95	97	80	87	7.2	32
Sinks															
19. Shipments	1919–24	89	87	107	95	104	103	106	108	100	112	100	90	6.6	25
	1924–30	93	87	106	108	111	110	106	112	105	105	81	76	10.5	36
20. Producers' Stocks	1919–24	108	106	116	115	111	109	100	94	86	79	83	94	10.8	37
	1924–30	99	106	114	114	109	102	99	93	87	90	91	96	7.5	27
21. Production, Derived	1919–24	106	85	119	94	99	101	95	101	90	104	105	103	6.3	34
	1924–30	100	103	125	108	99	94	99	98	91	112	83	88	8.0	42
22. New Orders	1918	68	62	95	118	155	157	122	107	85	85	70	71	26.9	95
	1919	82	72	99	114	139	139	112	105	87	91	76	82	18.3	67
	1920	94	82	103	110	126	124	103	103	88	93	80	90	11.8	46
	1921	104	91	106	107	117	112	97	101	89	95	83	96	8.0	34
	1922	112	100	108	104	109	103	92	99	90	95	85	99	6.3	27
	1923	118	105	110	103	106	97	90	98	91	96	86	100	7.0	32
	1924	118	105	112	105	103	94	91	99	93	96	87	98	7.1	31
	1925	113	104	113	108	102	95	93	101	94	96	86	94	6.9	27
	1926	107	100	114	112	103	97	97	103	96	95	85	89	6.7	29
	1927	99	96	114	116	105	99	103	107	97	94	83	83	7.8	33
	1928	90	92	114	120	108	102	109	113	98	93	81	76	11.3	44

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
ıtinued)	1929	82	87	114	124	112	105	115	119	100	92	79	70	14.9	54
	1930	72	82	114	127	117	109	122	125	102	91	76	64	19.2	63
ous China, Plumbing Fixtures															
23. Shipments	1926–31	107	103	106	100	105	108	103	108	98	102	82	78	7.0	30
24. Producers' Stocks	1926–31	100	98	99	100	102	102	100	97	96	99	101	107	1.9	11
25. Production, Derived	1926–31	91	99	108	102	109	108	99	101	96	109	86	91	6.2	23
26. New Orders	1926–31	108	140	96	85	92	102	99	102	92	100	93	90	8.8	55
E. Construction Materials: Miscellaneous															
1. Sand, Gravel and Stone, Car Loadings	1923	48	37	58	84	113	142	133	145	130	137	110	64	34.9	108
2. Lime, Sales by 15 Manufacturers	1923	54	55	89	108	138	118	133	126	118	109	91	61	25.0	84
Fabricated Structural Steel															
3. Shipments	1924–31	84	86	94	100	101	105	109	111	107	112	96	97	7.3	28
4 New Orders	1915–21	76	78	103	99	102	99	105	97	96	107	111	125	9.0	49
	1922–28	82	92	100	104	101	103	108	106	100	101	93	108	5.3	26
Dry Roofing Felt															
5. Production	1923–31	88	84	103	110	111	109	107	106	112	111	86	72	11.6	40
6. Producers' Stocks	1924–31	111	113	110	100	90	87	98	97	92	99	100	103	6.2	26
7. Shipments, Derived	1924–31	87	84	104	112	113	110	105	106	113	110	86	71	12.1	42
Roofing															
8 Prepared, Shipments	1920–23	79	78	107	100	106	107	96	118	126	120	90	74	13.9	52
	1928–31	69	64	111	119	120	112	99	110	128	125	83	60	20.8	68
Paint, Varnish and Lacquer															
9. Sales	1928–31														
Total		80	84	108	124	128	121	100	105	102	100	80	67	14.8	61
Industrial		87	91	107	115	118	110	103	108	101	102	80	78	10.7	40
Trade		74	83	107	130	147	127	96	99	98	97	80	62	18.5	85

Furniture																
10. Plant Operations, Grand Rapids	1923–31	100	100	98	97	97	98	94	101	102	107	104	102	2.7	13

V. MISCELLANEOUS

A. Prices

1. Wheat, Chicago	1885–1900	101	101	101	102	107	99	95	98	98	100	99	99	2.0	12
	1919–27	98	101	102	101	105	101	100	99	98	98	98	99	1.7	7
2. Flour, Wholesale, Minneapolis	1913–17	101	100	99	104	113	103	100	103	97	95	94	91	4.0	22
	1919–23	92	96	99	102	107	105	109	103	102	99	94	92	4.7	17
	1924–31	99	99	99	99	101	102	104	100	98	99	99	100	1.2	6
3. Flour, Retail, Minneapolis	1914–23	97	99	100	103	104	103	103	103	99	98	96	94	2.8	10
	1924–30	99	98	98	96	98	99	103	103	102	102	101	101	2.0	7
4. Corn, Chicago	1901–14	91	92	95	97	103	102	104	109	109	104	102	97	5.1	18
	1915–27	89	90	93	97	102	105	110	113	106	100	98	97	6.0	24
5. Cattle, Chicago	1912–24	96	96	98	98	98	101	102	106	108	104	98	96	3.4	12
	1924–28	95	94	97	97	98	100	104	103	105	107	103	98	3.6	13
6. Hogs, Chicago	1908–24	95	98	102	103	100	100	103	105	108	102	94	92	3.7	16
	1924–28	98	99	101	103	100	100	103	103	108	101	93	92	3.1	16
7. Lard, Wholesale, N. Y. C.	1911–15	103	101	98	101	100	98	95	98	102	100	103	101	1.8	8
	1916–21	94	92	97	96	100	97	97	101	106	109	111	100	4.5	19
	1922–31	97	97	98	96	98	100	100	103	105	105	102	99	2.5	9
8. Lard, Retail, N. Y. C.	1911–15	104	101	101	98	98	99	99	97	100	100	102	101	1.5	7
	1916–21	101	98	98	99	97	97	97	97	99	105	108	104	3.0	11
	1922–30	100	99	98	98	97	99	99	100	102	103	103	102	1.7	6
9. Bacon, Retail, Chicago	1912–16	100	96	96	99	98	100	103	102	102	103	101	100	1.8	7
	1919–26	96	95	97	100	101	101	103	104	103	102	100	98	2.3	9
	1927–30	99	98	98	98	98	100	102	101	103	103	101	99	1.7	5
Butter, Wholesale, N. Y. C.	1911–15	112	102	97	98	92	91	89	89	96	103	112	118	7.9	29
	1923–31	100	101	104	99	93	93	94	97	103	105	104	106	3.9	13
Wholesale, Chicago	1916–21	106	102	106	104	91	88	90	92	99	104	110	109	6.8	22
	1922–29	105	106	106	95	91	92	90	92	100	103	109	112	6.8	22

ries	Period Covered	Jan.	Feb.	Mar	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Average Deviation	Range

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
..er, Retail, Chicago...	1911–15	110	105	101	100	93	92	91	92	96	101	107	112	6.0	21
	1916–21	109	100	103	103	91	88	92	94	100	105	108	107	5.8	21
	1922–30	103	103	105	98	94	93	93	95	99	102	106	110	4.8	17
... Cheese, Wholesale, Chicago	1923–31	106	102	98	94	94	95	93	100	104	105	105	104	4.3	13
13. Bananas, Wholesale, N.Y.C.	1921–26	88	90	100	105	110	118	113	99	93	96	92	95	7.8	30
14. Bananas, Retail, N. Y. C...	1920–30	102	103	103	101	100	100	97	95	95	100	102	102	2.2	8
15. Oranges, Wholesale, Chicago	1920–30	81	79	85	91	96	100	105	112	121	125	118	87	13.5	46
16. Oranges, Retail, Chicago..	1919–30	94	90	93	97	100	100	101	102	107	113	107	95	5.1	23
17. Prunes, Retail, N. Y. C...	1921–29	99	99	99	99	100	101	101	102	102	101	99	100	1.0	3
18. Potatoes, Wholesale, Chicago	1913–17	99	94	91	87	95	115	121	110	107	93	93	95	8.8	34
	1918–24	96	89	75	77	100	105	129	150	120	88	87	85	17.2	75
	1925–30	91	94	95	99	111	115	95	105	101	100	99	96	5.2	24
19. Potatoes, Retail, Chicago.	1913–21	97	97	90	93	91	114	128	119	105	88	90	87	11.1	41
	1922–30	96	95	94	93	102	117	129	107	100	91	88	88	9.2	41
20. Eggs, Wholesale, New York	1923–31	120	100	79	81	80	83	84	91	102	112	134	135	17.1	56
21. Coffee, Wholesale, N. Y. C.	1913–17	98	102	104	104	107	110	102	97	97	93	94	92	4.8	18
	1921–31	98	102	104	102	100	101	100	99	99	101	99	95	1.7	9
22. Cotton, New York.....	1915–21	99	91	95	100	97	104	106	101	100	102	104	101	3.0	15
	1922–28	96	96	96	99	99	102	104	101	100	101	103	103	2.3	8
23. Anthracite Coal, Wholesale, N. Y. C.	1921–28	102	102	98	97	97	98	99	99	101	102	102	102	1.9	5
	1927–31	101	102	101	98	97	98	99	99	101	101	101	102	1.5	5
24. Anthracite Coal, Retail, N. Y. C.	1923–31	103	103	102	97	96	97	98	99	100	101	102	102	2.2	7
Retail, U. S.	1927–31	101	102	102	99	97	98	99	99	101	101	101	101	1.4	5
25. Bituminous Coal, Wholesale, U. S.	1924–30	104	102	101	96	95	95	95	100	103	104	102	103	3.2	9
26. Bituminous Coal, Retail, U. S.	1924–31	103	104	102	99	96	96	97	97	99	101	102	104	2.7	8

B. Volume of Production and Trade

	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
1. Production, Total															
Industrial	1925	100	103	104	102	101	98	96	98	100	103	101	94	2.3	10
Manufacturing	1925	101	104	105	103	101	98	94	97	100	102	101	95	2.8	11
Mineral	1925	96	95	94	89	101	103	103	105	109	109	103	96	5.2	20
2 Cars Loaded, Revenue Freight	1918–24	89	92	97	92	98	101	104	108	113	114	102	90	7.0	25
	1925–29	90	92	96	96	102	100	100	108	111	115	101	87	6.3	28
3. Passengers Carried by the Pullman Company	1915–21	95	86	97	97	99	106	112	119	112	96	86	94	8.2	33
	1921–28	98	86	92	93	94	108	109	118	111	101	91	98	7.9	32
4. Postal Receipts	1897–1912	105	95	114	100	96	94	86	89	101	106	102	115	6.9	29
	1912–24	102	95	113	102	97	93	84	89	94	106	101	120	7.7	36
	1924–29	98	93	109	101	97	94	86	88	95	107	102	130	8.2	44
5. Magazine Advertising	1907–14	83	97	109	117	118	105	80	67	87	110	114	112	14.2	51
	1915–24	79	97	107	119	119	107	82	72	89	110	111	107	13.4	47
	1924–29	79	94	106	118	120	106	88	71	92	112	114	100	12.7	49
6. Volume of Retail Trade, Copeland	1919–27	91	86	102	103	99	96	84	86	94	112	108	137	10.5	53
7. Wholesale Trade, 9 Lines	1919–27	91	96	109	94	91	91	92	112	117	119	99	86	9.8	33
8. Exports															
Crude Foodstuffs	1921–27	76	66	70	77	96	73	72	124	168	154	131	93	29.5	102
Manufactured Foodstuffs	1921–29	108	99	108	93	90	86	85	93	101	114	110	113	9.0	29
Crude Materials	1921–29	114	91	90	79	66	63	59	58	110	160	168	143	32.4	110
Semi-Manufactures	1922–29	106	93	107	106	105	103	101	96	92	96	96	98	4.8	15
Finished Manufactures	1922–28	98	91	109	112	109	102	98	103	94	96	94	94	5.8	21
Total	1921–27	104	91	101	97	92	90	86	91	102	120	117	111	9.0	34
9. Imports															
Crude Foodstuffs	1922–28	104	99	117	106	94	91	94	92	84	106	107	108	7.8	33
Manufactured Foodstuffs	1922–29	79	104	125	130	110	105	96	89	94	104	86	77	13.1	53
Crude Materials	1922–29	115	106	114	109	101	92	89	95	89	94	94	101	7.8	26
Semi-Manufactures	1922–28	106	102	110	101	94	94	94	99	94	104	97	103	4.5	16
Finished Manufactures	1924–29	94	92	104	97	94	98	97	102	103	113	105	102	4.8	21
Total	1924–28	103	101	112	105	97	94	92	96	95	103	100	101	4 2	20

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
Interest Rates and Speculation															
Bank Debits, N. Y. C.	1919–24	107	89	104	100	105	106	97	90	91	103	99	109	5.7	20
	1924–29	107	90	113	102	104	103	93	90	93	103	98	104	6.0	23
Bank Debits, Outside N. Y. C.	1919–29	104	89	104	99	99	101	100	93	96	106	98	110	4.2	21
3. Commercial Credit Advanced by the F. R. System															
Bills Discounted	1921–28	88	83	86	91	96	100	110	109	113	108	104	112	9.3	30
Bills Bought on Open Market	1922–28	120	113	108	98	88	81	73	70	80	101	126	141	18.2	71
All Bills Combined, Derived	1922–28	99	93	93	93	93	94	98	96	102	106	111	122	6.8	29
4. Total Loans, Reporting Member Banks	1919–27	99	99	99	99	99	99	99	99	101	101	102	102	1.2	3
5. Notes in Circulation															
Total	1919–30	100	99	99	99	99	99	100	100	101	101	101	102	0.8	3
Federal Reserve Notes	1919–27	99	97	98	98	98	97	98	98	101	103	104	109	2.8	12
6. U. S. Postal Savings, New Deposits	1916–21	105	99	105	94	93	91	108	111	105	96	95	98	5.7	20
	1922–28	107	100	103	96	97	100	108	105	97	102	92	93	4.2	16
7. Call Money Rates	1919	92	99	96	93	95	98	100	95	102	105	108	113	5.0	21
	1925	98	106	100	99	100	95	94	96	101	101	100	110	3.0	16
	1930	98	98	100	100	100	100	100	95	100	100	100	110	1.6	15
8. 90-day Time Money Rates	1919	95	101	98	100	101	102	100	102	100	100	101	98	1.3	7
	1925	102	102	105	102	100	95	94	97	100	101	100	103	2.4	11
	1931	98	100	100	100	100	97	97	100	104	104	100	100	1.3	7
9. Commercial Paper Rates	1919	98.1	98.6	99.1	99.1	99.5	100.2	100.3	101.3	101.2	101.1	100.2	100.6	0.9	3.2
	1922	99.2	99.4	99.6	99.7	99.8	100.1	100.1	100.5	100.5	100.4	100.1	100.3	0.4	1.3
	1925	99.8	99.9	99.9	99.9	100.0	100.0	100.0	100.1	100.1	100.1	100.0	100.1	0.1	0 3
10. Sales on the N. Y. Stock Exchange															
Number of Shares	1919–31	97	95	122	108	103	99	75	83	95	105	105	113	9.3	47
Par Value of Bonds	1919–31	114	90	108	104	102	103	87	80	91	107	102	112	8.7	34

D. Failures and Earnings

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
Failures															
1. Manufacturing Concerns															
Number	1915–21	110	95	101	92	96	93	96	98	89	105	110	115	6.8	26
	1922–30	113	96	112	101	102	96	93	95	85	102	98	107	6.2	28
Liabilities	1915–19	143	92	94	104	90	85	76	112	89	94	114	105	13.2	67
	1920–30	122	94	119	108	98	80	90	97	83	87	95	126	12.6	46
2. Trading Concerns															
Number	1915–21	132	107	103	93	98	91	92	93	87	97	95	113	9.1	45
	1922–30	139	109	108	106	99	94	90	88	79	91	92	105	11.2	60
Liabilities	1915–21	142	116	105	102	99	88	86	80	88	90	90	114	13.2	62
	1922–30	138	114	117	108	98	85	80	85	74	85	92	125	16.9	64
Earnings															
3. Dividend Disbursements, Total	1915–21	133	93	109	115	67	82	131	96	84	119	85	85	17.9	66
	1922–30	174	95	102	108	78	84	128	82	73	109	82	84	20.2	101
4. Interest Disbursements, Total	1918-26	131	46	96	131	90	108	122	49	89	133	90	115	23.3	87
	1927–30	152	61	84	120	74	106	149	58	82	123	76	115	27.5	94
5. Railroads, Net Operating Income	1919–24	77	51	93	76	86	102	118	132	131	147	110	78	23.2	96
	1925–30	67	71	92	77	90	98	104	130	138	146	104	82	20.4	79
6. Telegraph Companies, Net Operating Income	1921–29	84	77	110	95	101	107	84	107	116	119	95	103	10 7	42
7. Telephone Companies, Net Operating Income	1921–26	100	104	105	103	100	98	86	93	99	109	101	101	3.9	23
	1926–29	107	99	104	103	102	102	90	95	100	107	102	89	4.5	18
8. Gas and Electric Companies, Net Earnings	1920–29	117	108	105	102	97	94	83	82	91	99	107	116	9.1	35
U. S. Steel Corporation Net Earnings	1915–24	93	90	112	102	111	111	102	101	92	99	96	90	6.6	22
	1924–30	91	95	108	97	103	97	104	108	103	107	97	90	5.5	18

Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
ent and Payrolls															
Payrolls	1923–31														
Hour		99	99	98	94	95	96	100	103	105	107	103	100	3.1	13
2. Slaughtering and Meat Packing		105	102	96	95	97	100	100	98	99	100	102	105	2.4	10
3. Cane Sugar Refining		91	98	104	102	104	105	105	105	101	100	96	93	4.0	14
4. Cigars and Cigarettes		92	93	97	93	98	101	99	99	105	108	109	107	4.9	17
5. Cotton Goods		103	105	104	104	101	98	92	92	96	100	101	104	3.7	13
6. Dyeing and Finishing Textiles		101	106	106	103	100	94	91	94	98	102	102	103	3.8	15
7. Hosiery and Knit Goods		98	103	104	102	102	99	89	94	97	105	105	104	4.0	16
8. Woolen and Worsted Manufactures		102	103	100	97	98	98	94	98	99	103	104	105	2.8	11
9. Silk Manufactures		97	105	105	102	101	97	92	98	98	104	100	102	3.1	13
10. Men's Clothing		103	109	106	90	88	101	103	107	103	99	92	99	5.3	21
11. Women's Clothing		102	116	128	107	89	77	73	91	110	116	95	96	13.2	55
12. Leather		101	103	102	99	98	98	98	100	101	101	99	101	1.4	5
13. Boots and Shoes		99	105	105	96	93	94	103	112	109	105	89	92	6.3	23
14. Furniture (lumber)		96	101	102	99	96	94	90	98	103	109	108	105	4.6	19
15. Automobile Tires and Tubes		95	103	104	107	110	104	102	102	100	95	87	91	5.3	23
16. Petroleum Refining		97	99	99	100	101	102	101	102	100	100	99	98	1.2	5
17. Glass		94	101	104	103	103	102	92	97	98	103	103	100	3.2	12
18. Automobiles		81	105	112	116	115	103	95	98	97	100	89	88	8.6	35
19. Clay Products		87	91	96	103	106	107	102	104	103	104	101	98	4.8	20
20. Cement		85	87	93	100	105	107	106	110	107	106	100	95	6.8	25

No.	Series	Period Covered	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average Deviation	Range
21.	Lumber, Sawmills		90	93	97	100	104	105	101	102	105	105	102	98	3.8	15
22.	Steel Works and Rolling Mills, etc.		97	105	107	107	105	101	93	96	95	99	97	98	4.2	14
23.	Structural Iron Works.....		94	97	97	98	101	103	101	105	102	103	99	101	2.6	11
24.	Steamfitting		91	102	102	101	101	99	91	98	101	110	103	100	3.4	19

Part Two

Notes on the Seasonal Indexes

General

Units. All series on production, shipments, stocks, consumption, exports, new orders and unfilled orders are, unless otherwise stated, in quantity volume units, that is, in bushels, tons, cases, pieces, dozens, etc. All series on sales are, unless otherwise stated, in dollars.

Stocks and Unfilled Orders. All series on stocks (including cold storage holdings) and unfilled orders record them as of end of month or end of quarter. The terms 'manufacturers' and 'producers' are used interchangably.

Method. Unless otherwise stated, the method of computing the seasonal index is that described in Chapter II, namely, the method of positional means of relative deviations from a two- by a twelve-month moving average. When any other method has been used it is indicated or a note is made to the effect that the index has been taken from the Business Cycles study.

Derived Indexes. If seasonal indexes are available for production and shipments, or shipments and stocks, or production and stocks, a seasonal index can be derived for stocks, production or shipments, provided the comparative volumes of production, shipments and stocks are given or may be assumed. Similarly, if seasonal indexes are available for shipments and new orders, or new orders and unfilled orders, or shipments and unfilled orders, a seasonal index can be derived for unfilled orders, shipments or new orders, provided the comparative volumes of shipments, new orders and unfilled orders are given or may be assumed.

Example Showing Derivation of a Seasonal Index for Stocks from the Seasonal Indexes for Production and Shipments

	J	F	M	A	M	J	J	A	S	O	N	D	
ment, Sea- of Pro- 30 ..	64	58	76	96	118	121	122	127	120	118	99	79	(I)
Sea- n-	45	48	75	102	129	133	135	142	132	129	84	46	(II)

Production and shipments are assumed to be equal in volume. Hence the difference between the seasonal swings of the two may be obtained by direct subtraction of II from I:

Difference between Production and Shipments	19	10	1	—6	—11	—12	—13	—15	—12	—11	15	33	(III)

The ratio of stocks to production or shipments is 1.5. Hence the difference between production and shipments, when interpreted as changes in stocks, must be reduced by dividing III by 1.5:

Changes in Stocks	13	7	1	—4	—7	—8	—9	—10	—8	—7	10	22	(IV)
Changes in Stocks Cumulated, Stocks at the end of December taken as 100	113	120	121	117	110	102	93	83	75	68	78	100	(V)

The deviations from 100 of this derived index are 83 and —103. Centering the index about 100 we obtain:

Derived Seasonal Index for Stocks	115	122	123	119	112	104	95	84	76	69	79	102	(VI)

EXAMPLE SHOWING DERIVATION OF A SEASONAL INDEX FOR NEW ORDERS FROM THE SEASONAL INDEXES FOR SHIPMENTS AND UNFILLED ORDERS

Common Brick, Seasonal Index for Unfilled Orders, end of month, 1921-31	83	92	108	122	111	115	103	99	92	86	96	93	(I)
Month to Month Changes in Unfilled Orders (Net Change in Orders)	—10	9	16	14	—11	4	—12	—4	—7	—6	10	—3	(II)

The ratio of unfilled orders to shipments is 1.54. Hence the changes in unfilled orders in terms of shipments are equal to II multiplied by 1.54:

Common Brick, Seasonal Net Changes in Orders in Units of Shipments	15	14	25	22	—17	6	—18	—6	—11	—9	15	—5	(III)
Index of Shipments, 1924-31 (deviations from 100)	36	32	—1	16	14	17	10	11	—7	8	12	—12	(IV)
Seasonal Changes in New Orders in Units of Shipments (III plus IV)	—51	—18	24	38	—3	23	—8	5	—18	—1	27	—17	(V)

If we assume that the average volume of new orders is equal to the average monthly volume of shipments (which is reasonable, if ord cancellations are not extensive) then the changes described under ' seasonal variations in new orders. Hence

Derived Seasonal Index for New Orders	49	82	124	138	97	123	92	105	82	99

In this study indexes for stocks and new orders have *rived* and are so designated to distinguish them fron from original data.

SOURCE AND COMPOSITION OF SERIES, METHODS USED IN THE ANALYSIS AND OTHER COMMENTS

I. FOOD PRODUCTS

A. WHEAT AND FLOUR

1. Estimate of the U. S. Department of Agriculture, *Yearbook, 1922,* p. 988.

2. U. S. Department of Agriculture, Statistical Bulletin No. 12, *Wheat and Rye Statistics,* p. 31, and *Yearbook of Agriculture, 1931,* p. 592. The series covers percentage of year's sales as reported by about 3,500 mills and elevators. Method: selected means of relatives to annual average.

3. U. S. Department of Agriculture, Statistical Bulletin No. 12, *Wheat and Rye Statistics,* p. 31. Method: arithmetic means of relatives to annual average.

4. *Survey of Current Business,* data collected by the Chicago Board of Trade. Cover 11 principal primary markets.

5. Federal Trade Commission, *Report on the Grain Trade,* Vol. VI, 1924, pp. 83-84.

6. As under (4).

7. *Bradstreet's, Yearbook of Agriculture* and *Survey of Current Business.* The series covers grain stored at approximately 50 interior and seaboard points of accumulation and grain in transit by canals and lakes. Index computed in the Business Cycles study.

8. *Derived* from receipts and shipments. Stocks assumed to be equal to one month's receipts.

9. U. S. Department of Agriculture, Statistical Bulletin No. 12, *Wheat and Rye Statistics,* and *Survey of Current Business.*

10. Department of Commerce, Bureau of the Census. Reports cover over 1,000 mills, representing 88 per cent of the industry in 1923 and over 91 per cent in 1925. Method: selected means of relatives to the average for each calendar year.

11. Federal Trade Commission, Report on the *Wheat Flour Milling Industry,* May 19, 1924, p. 30. Method: monthly averages for three years, adjusted for trend.

12. *Survey of Current Business.* Reports cover the same area as ·nder (10).

Survey of Current Business. For 1918-July 1920, U. S. Grain ·tion; from July 1920 through 1923, Russell's estimates; prior ·0, data cover entire industry; after July 1920, Russell's figures entire industry. After 1923, data of the Bureau of the · the same area as under (10) and (12).

·1 (10) and (12). Stocks include flour owned by mills, in elevators or in transit.

·*rent Business,* Russell's estimates.

16. *Survey of Current Business,* U. S. Grain Corporation data prior to July 1920, Russell's estimates thereafter.

17. *Commercial and Financial Chronicle.*

B. LIVESTOCK AND MEATS

1. U. S. Department of Agriculture, Department Circular No. 241, *Food Animals and Meat Consumption in the United States,* by J. Roberts, April 1929, Table 4, p. 7. Index, monthly ratios multiplied by 12.

2. Data of the Bureau of Agricultural Economics as reported in the *Yearbook of Agriculture* and the *Survey of Current Business.* Cover receipts at public stockyards as reported by 60 to 70 markets.

3. *Annual Report, Chicago Board of Trade.* Covers receipts at Union Stock Yards. Computed in the Business Cycles study.

4. Data collected by U. S. Department of Agriculture, Bureau of Animal Industry, and reported in the *Yearbook of Agriculture.* The series represents number of animals; computed in the Business Cycles study.

5. As under (4).

6. Data collected by the Bureau of Animal Industry and reported in the *Survey of Current Business.* Include only meat produced under Federal inspection and exclude condemned animals—about 82 per cent of total production, according to the Census of 1919. The series represents dressed weight of beef and veal.

7. Data collected by the Bureau of Agricultural Economics and reported in the *Survey of Current Business.* Include beef frozen, cured and in process of cure.

8. Data collected by the Bureau of Agricultural Economics and reported in the *Survey of Current Business.* Include only meat produced under Federal inspection. Computed from inspected slaughter, less condemned animals, plus net imports, less exports and re-exports and the change in cold storage holdings.

9. As under (1).

10. As under (2).

11. Source as under (3).

12. Source as under (4).

13. As under (6). The series represents about 91 per cent of total production in the country, according to the Census of 1919.

14. As under (7). Include frozen mutton and lamb.

15. As under (8).

16. As under (1).

17. As under (2).

18. Source and method as under (3).

19. Prior to 1908 estimates from the Department
Bureau of Agricultural Economics. After 1908, Fe
slaughter.

20. As under (6). The series represents 68 per cent of total slaughter, according to the Census of 1919.

21. As under (7).

22. As under (8).

23. As under (6). The series includes only meat produced under Federal inspection and excludes condemned animals. In 1919 covers 82 per cent of beef produced, 91 per cent of lamb, and 68 per cent of pork products.

C. DAIRY PRODUCTS

1. Data from *Farm Economics,* No. 55, p. 981. The farms studied were in Chenango and Madison Counties in New York State. Percentages converted into seasonal indexes.

2. *Survey of Current Business.* Covers the production of whole milk by members of the Twin City Milk Association, including most of the area within a 40 mile radius of Minneapolis and St. Paul.

3. New York State College of Agriculture, Bulletin 69, p. 1496. The data are part of an unpublished study of the New York milk supply made by the New York State College of Agriculture in cooperation with the New York Central Railroad. Cover 259 plants supplying New York City.

4. Data collected by the *Milk Reporter* and published in the Department of Agriculture Statistical Bulletin 25 and the *Survey of Current Business.* Cover receipts of milk, except cream, in the New York market which includes Greater New York, Jersey City, Hoboken, Weehawken, Newark, Paterson and intervening railroad towns. Indexes for 1894-98, 1899-1903, 1904-08, 1909-13 and 1914-20 are arithmetic averages of original data, corrected for trend.

5. *Survey of Current Business.* Data collected by the Massachusetts Department of Public Utilities. Cover receipts of milk and cream at Boston by rail.

6. *The Milk Reporter.* Daily average receipts of cream and unsweetened condensed milk in New York markets, described under (4). Indexes for 1895-1904 and 1905-09 computed in the Business Cycles study. Indexes for other years computed by standard method.

7. Bureau of Agricultural Economics Technical Bulletin No. 73, *Some
rs Affecting the Demand for Milk and Cream in the Metropolitan
New York,* by H. A. Ross, pp. 28-29. Covered Greater New York,
d, Westchester County, part of New Jersey and districts
ord and Bridgeport, Connecticut. Based on sales records
st distributors. Included 64 per cent of all milk shipped
market in 1924. Method: monthly average of weekly

9. As under (7), pp. 23-24. Included 94 per cent of all milk sold in the New York market in 1924.

10. As under (7), pp. 23-24. Included 96 per cent of all cream sold in the New York market in 1924.

11. Data collected by the Bureau of Agricultural Economics and reported in the *Survey of Current Business*. Represent practically the entire industry.

12. Data collected by the Bureau of Agricultural Economics, reported in Department of Agriculture Statistical Bulletin 25, 1918-22; the *Survey of Current Business*, 1922-29, and *Crops and Markets*, 1929-31.

13. As under (11).

14. *Derived* from changes in stocks and production, assuming that monthly shipments equal monthly production.

15. As under (11).

16. As under (7), pp. 23, 29.

17. As under (11).

18. As under (11). Data not published after July 1931.

19. As under (14). Ratio of stocks to production 1923-29 is 1.72.

20. Data collected by the Bureau of Agricultural Economics, reported in the *Agriculture Yearbook, 1925*, p. 1083, 1917-19; the *Survey of Current Business*, 1920-31. Represent practically all factory production.

21. Data collected by the Bureau of Agricultural Economics, reported in Department of Agriculture Statistical Bulletin 25. Method: arithmetic means of original data, corrected for trend.

22. Data collected by the Bureau of Agricultural Economics, reported in the *Agriculture Yearbook*, 1920-24, and the *Survey of Current Business*, 1925 to date. Represent receipts at Boston, New York, Philadelphia, Chicago and San Francisco. Total of weekly figures with the first and last weeks of the month prorated.

23. As under (11). Represent about 98 per cent of stocks held in public and private cold storage warehouses.

24. As under (11). Data represent the disappearance of butter into trade. Computed from production (actual factory plus estimated farm output), imports and changes in cold storage holdings.

25. As under (7).

26. Data collected by the U. S. Treasury Department, Bureau of I
ternal Revenue, and published in the *Survey of Current Business*. R
sent total raw milk consumption.

27. U. S. Treasury Department, Bureau of Internal Rev
for 1920-24 from Department of Agriculture Statistical
Represent total output.

28. As under (27). Based on tax-paid withdrawals of
uncolored oleomargarine, consisting of all withdrawals
except for the government.

29. As under (11). Total includes cottage, pot and bakers' cheese; American represents practically all factory production from whole milk only, excluding cheese made from part skim milk (about 1 to 2 per cent); All Other *derived* from indexes for production of Total and American cheese.

30. As under (22).

31. Data collected by the Bureau of Agricultural Economics, reported in Department of Agriculture Statistical Bulletin 25, p. 134, and the *Survey of Current Business.* Total and American cover about 98 per cent of stocks held in public and private cold storage warehouses; All Other *derived* from holdings of Total and American cheese.

32. Source as under (11); composition as under (24).

33. Data computed by the Bureau of Agricultural Economics and published in the *Survey of Current Business.* Represent practically all production.

D. FRUITS

1. Harvest, U. S. Department of Agriculture, *Yearbook, 1922,* p. 988; estimates of usual harvest. Shipments, 1920-31, data of Bureau of Agricultural Economics, reported in the *Survey of Current Business;* 1924-26, Bureau of Railway Economics, Bulletin 27, p. 6, arithmetic mean of original data corrected for trend. Unloads, Department of Agriculture Bulletin 7, represent total at 12 principal markets: New York, Chicago, Philadelphia, Pittsburgh, St. Louis, Cincinnati, St. Paul, Minneapolis, Kansas City, Washington, Cleveland, Detroit; arithmetic means of original data corrected for trend.

2-4. As under (1).

5. Harvest, shipments, 1924-26, unloads, as under (1). Shipments, 1918-31, Department of Agriculture Statistical Bulletins Nos. 7, 23 and 30, and *Crops and Markets,* selected means of relatives to average of crop year.

6-7. As under (1).

8. Shipments, 1924-26, as under (1); 1924-31, as under (5).

9-17. As under (1).

E. VEGETABLES

1-4. As under (D.1).

Harvest, shipments, 1924-26, unloads, as under (D.1); shipments, as under (D.5).

under (D.1).

F. MISCELLANEOUS

he Department of Agriculture, *Yearbook, 1922,* p. 988.
f Agriculture, Statistical Bulletin 28, *Corn Statistics,*
ok of Agriculture, 1931, p. 621. The series covers

percentage of year's sales as reported by about 3,500 mills and elevators. Method: selected means of relatives to annual average.

3. *Survey of Current Business.* At primary markets, as compiled by the Chicago Board of Trade.

4. *Survey of Current Business.* Data from *Bradstreet's,* representing stock carried on Saturday nearest end of month at terminals, elevators, warehouses, docks, etc.

5. Data of Bureau of Agricultural Economics, reported in the *Survey of Current Business.* Cover receipts in Boston, New York, Philadelphia, Chicago and San Francisco. Totals of weekly figures with overlapping weeks prorated.

6. Data of Bureau of Agricultural Economics, reported in the *Survey of Current Business* and the *Yearbook of Agriculture;* cover holdings in principal warehouses.

7. Source as under (6); composition as under (5).

8. Source as under (6); absolute deviations from moving average used instead of relative deviations.

9. Data collected by the U. S. Department of Commerce, Bureau of Fisheries, and published in the *Survey of Current Business.* Fish catch represents total landings of fresh fish from vessels at Boston and Gloucester, Mass., Portland, Me., and Seattle, Wash.

10. Bureau of the Census, *Survey of Current Business.* Covers entire industry and includes seeds later destroyed at mills, but not seeds reshipped.

11. Source as under (10). Covers entire industry.

12. Source as under (10). Covers entire industry. Stocks of crude oil include holdings of crude mills and of refiners and oil in transit to refiners and consumers.

13. Source as under (10). Covers entire industry.

14. Source as under (10). Includes holdings of refineries, brokers, agents and warehousemen, and oil in transit to manufacturers of lard substitutes, oleomargarine, etc.

15. U. S. Department of Agriculture, *Yearbook, 1922,* p. 988. Estimate of usual crop harvest.

16. *Survey of Current Business.* Sales of tobacco from loose-leaf warehouses compiled by the Federal Reserve Board up to 1929, and b
the Department of Agriculture since then, from reports of Kentu
North Carolina, South Carolina and Virginia state authorities; t
states is grown about 75 per cent of the total tobacco crop.
absolute deviations from a two- by a twelve-month moving

17. Treasury Department, Bureau of Internal Reve
Current Business. The series represent withdrawals fr
houses on payment of taxes for domestic consumption
weigh 3 pounds per 1,000 or less; figures represent 9

Tobacco and snuff figures cover plug, twist, fine-cut and smoking tobacco and snuff. Large cigars weigh more than 3 pounds per 1,000; figures represent 90 per cent of total.

18. *Survey of Current Business.* Stocks of leaf tobacco held by manufacturers and dealers; compiled by Bureau of the Census up to 1929 and by the Department of Agriculture since.

19. *Weekly Statistical Sugar Trade Journal.* Covers all arrivals of sugar at the four Atlantic ports, New York, Boston, Philadelphia and Baltimore. Baltimore is included only since March 1922.

20. Source as under (19). 'Total Meltings' comprise 'meltings by refiners', all raw sugar made or being made into refined sugar, and 'receipts to trade being considered as meltings', sugar going into direct consumption without passing through a refinery.

21. Source as under (19). 'Total Stock' comprises 'importers', all raw sugar arrived in port not owned by refiners and 'refiners' stocks, all raw sugar arrived in port owned by refiners and on hand up to the actual point of melting, but not sugar purchased that is not yet in port.

22. Data collected by U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce and reported in the *Survey of Current Business.*

23. Data collected by the New York Coffee and Sugar Exchange, Inc. and reported in the *Survey of Current Business.*

24. *Survey of Current Business.* Stocks of wool held by about 400 dealers and 600 manufacturers, computed by Department of Agriculture jointly with Bureau of the Census. Stocks include wool, tops and noils and are reduced to grease equivalent.

II. TEXTILES

A. PRODUCTION, SHIPMENTS AND STOCKS OF COTTON AND COTTON TEXTILES

1. U. S. Department of Agriculture, *Yearbook, 1922,* p. 988. Estimates of the Department of Agriculture.

2. *Yearbook of Agriculture, 1931,* p. 678. Sept. 1919, 1920, 1921, 1922, 1923, and December 1924, 1925, 1926, 1927, 1928, 1929, 1930 prorated. Method: arithmetic mean of percentages of yearly totals.

3. *Survey of Current Business.* Data collected by the New Orleans
n Exchange. Linters excluded. Data calculated from receipts at
ports, overland movements north of the Ohio and Potomac
d estimates of amount taken by southern mills, less amount
outhern ports allowing for change in stocks at interior

Agriculture, 1931, p. 679. As reported by 7,500 cotton
nted by state weighers cooperative association and
thod: arithmetic mean of per cent of crop season.

5. Weekly reports of the New York Cotton Exchange. Cover supply at primary markets plus interior markets increasing in number from 41 to 57. Computed in the Business Cycles study.

6. Data collected by the U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, and reported in the *Survey of Current Business.* Linters included 1919-28, linters excluded 1929 to date.

7. *Derived* from consumption and stocks at mills, upon the assumption that consumption equals deliveries.

8. Data collected by the Bureau of the Census and reported in the *Survey of Current Business.* Domestic stocks only. Exclude linters. Total stocks (at mills and in public warehouses) represent from 85 to 90 per cent of cotton stocks in all positions. Stocks in warehouses were from 65 to 77 per cent of total stocks in the last five years. State indexes: Bureau of the Census, Bulletins on *Cotton Production.* Cover cotton in public storage and at compresses. Exclude linters. Method: arithmetic means of original data, corrected for trend.

9. Source as under (8). Exclude linters. Computed in the Business Cycles study. State indexes as under (8). Cover cotton at all consuming establishments.

10. Source as under (8). From reports of all cotton-consuming plants, textile mills for the most part. Exclude linters. State indexes as under (8).

11. Source as under (8). Represents total cotton spindle activity in hours in textile mills.

12. *Survey of Current Business.* Compiled by the Association of Cotton Textile Merchants of New York from weekly, two-weekly and monthly reports of 46 commission houses and of several additional mills through the Cotton Textile Institute, representing mills manufacturing 23 groups of textile construction. The mills reporting are believed to represent over 60 per cent of the industry and are located chiefly in the South.

13. As under (12). Computed from other series.

14. As under (12).

15. As under (12). Computed from other series.

16. As under (12).

17. *Survey of Current Business.* Compiled by the National Association of Finishers of Cotton Fabrics from reports of about three-fifths its members, who are estimated, on the basis of cotton finishing outside regular textile mills, to have an output of 70 per cent of goods, 55 per cent of dyed goods and 25 per cent of printed g goods and dyed goods each account for about 40 per cer goods for about 20 per cent of total billings. Goods ar pleted, hence billings approximate production.

18. As under (17).

19. *Computed* as under (17). *Derived* from shipments and billings upon the assumption that billings equal shipments.

20. As under (17).

21. As under (17). Represent number of days.

22. *Survey of Current Business.* Data compiled by the Fine Cotton Goods Exchange. Reported by 24 identical mills in the New Bedford district, representing about 50 per cent of the fine cotton goods industry in New England and from 20 to 30 per cent throughout the United States. Series discontinued after April 1930.

23. Source as under (8). 1925-30, data compiled from reports of 150 establishments which produced 61 per cent of the total output in 1925, according to the Census of Manufactures. Since 1930 reports have been made by 130 establishments, representing, however, 68 per cent of total output in 1931.

24. Source as under (8); composition as under (23).

25. *Computed.* Source as under (8). Compiled from the reports of 70 to 83 establishments. *Derived* from shipments and production.

26. *Computed.* Source as under (8); composition as under (23). *Derived* from shipments and month-to-month changes in unfilled orders.

27. As under (23).

28. Source as under (8). Reports from 261 identical establishments which produced 44 per cent of the total output of hosiery in 1925, according to the Census of Manufactures.

29. Source as under (8); composition as under (28).

30. *Computed.* Source as under (8); composition as under (28) *Derived* from production and shipments.

.. *Computed.* Source as under (8); composition as under (28). *rived* from shipments and unfilled orders. Shipments are considered ual in volume to new orders.

32. Source as under (8); composition as under (28).

33. Source as under (8). 1923-24, compiled from reports of 114 es- blishments; 1924-27, 158 establishments (excludes work shirts); 1928-), data compiled from reports of 250 establishments; called 'overalls' (work pants and all sport clothes excluded).

34. Source as under (8); composition as under (33).

35. *Computed.* Source as under (8); composition as under (33). *Derived* from production and shipments, which are equal.

Source as under (8). Series compiled from the reports of 10 to 16 hments, the number gradually increasing until 1928. It repre- ducts manufactured by spreading nitrocellulose or pyroxylin n gray goods.

under (8); composition as under (36).

om billings (shipments) and unfilled orders. Billings me to new orders.

der (8); composition as under (36).

40. *Survey of Current Business.* Data compiled by the National Association of Button Manufacturers. The series is compiled from reports of 17 firms representing 95.2 per cent of the machine capacity of the association members and is given in terms of per cent of capacity used.

41. As under (40). The series is given in gross of buttons on hand.

42. *Survey of Current Business.* Data compiled by the Webbing Manufacturers' Exchange, 1920-27. The series is based upon reports from 8 manufacturers and given in yardage. Shipments for 1923 represent 27 per cent of total production. November 1927-31 data are collected from 19 manufacturers and given in dollars.

B. PRODUCTION, SHIPMENTS AND STOCKS OF OTHER TEXTILES, LEATHER AND LEATHER PRODUCTS

1. Data compiled by the Boston Chamber of Commerce to 1925 and the Boston Grain and Flour Exchange thereafter, and published in the *Record Book of Business Statistics, Part I,* and the *Survey of Current Business.* Represent receipts at Boston railroad and steamship terminals, all classes of wool being combined without reduction to grease equivalent. Index computed in the Business Cycles study.

2. Data compiled by the Bureau of Agricultural Economics, 1918-22, and the Bureau of the Census thereafter, and published in the *Survey of Current Business.* The data cover the entire industry until September 1920 and about 80 per cent of it thereafter. The original data are reduced to grease equivalent. The reports include all grease, scoured or pulled wool entering into the process of manufacture.

3. Data compiled by the Bureau of the Census and reported in the *Survey of Current Business.* Given in terms of hours active as per cen of total normal hours of factory operation.

4. As under (3).

5. As under (3).

6. Data compiled by the Department of Commerce, Bureau of F eign and Domestic Commerce, and published in the *Survey of Cur Business.* Represent total imports of manufactured silk, including silk, cocoons and waste.

7. Data compiled by the Silk Association of America and re in the *Survey of Current Business.* Represent stocks of raw silk at pal warehouses in New York City and at railroad terminals.

8. Source as under (7). Delivery figures are computed from on stocks and trade figures on imports through New York ports, allowing time for Pacific imports to reach New Yor assumed to represent consumption by American mills p

9. Data compiled by the Silk Association of America the *Survey of Current Business.* Collected from manuf ing about 50 per cent of the industry they cover the p

hours to the total hours normally worked. They are weighted averages of each section of the silk industry for which details are given in the association's monthly reports, *i. e.*, New Jersey, Pennsylvania, New England and all other.

10. As under (9).

11. Source as under (7). Data cover from 35 to 60 per cent of the silk manufacturers and throwsters but are prorated up to 100 per cent to make the series consistent.

12. Data compiled by the Bureau of the Census and reported in the *Survey of Current Business*. The data embrace returns from packers, tanners, dealers, importers and manufacturers.

13. Data compiled by the Department of Commerce and published by the Trade Service Bureau of the Tanners' Council of America.

14. As under (12).

15. As under (13).

16. As under (13).

17. Source as under (12). Based upon reports from over 1,000 firms each month.

18. *Survey of Current Business*. Compiled by the Rubber Manufacturers' Association, from reports of from 13 to 16 manufacturers each month, who made 63 per cent of the total output of rubber heels for sale as such, in 1925 and 1927, and 79 per cent in 1929 (Census of Manufacturers). Only salable heels are included.

19. As under (18). Stocks include merchandise constituting domestic stock in factory and in transit to, or at, warehouses, branches, or in possession of dealers on consignment basis, and represent all merchandise still owned by manufacturers as domestic stocks.

20. Source as under (12). Based upon reports by 206 identical factories representing 87 per cent of the leather-glove industry, according to the Census of Manufactures of 1921.

WHOLESALE AND RETAIL SALES OF TEXTILES, LEATHER AND OTHER PRODUCTS

Data compiled by the Federal Reserve Bank, New York district and published in its *Monthly Review of Credit and Business Conditions*.

Data compiled by the Federal Reserve banks of the three districts and available in their *Monthly Reviews*. Indexes computed by relative method.

compiled by the Federal Reserve Bank of Boston. For 1923-25 available in the Bank's *Monthly Review* for October 1926, for mimeographed release. Based on sales of New England s and specialty shops and cover sales in 20 to 35 stores ommodity; average monthly percentages are converted es. For a few departments years that did not total been omitted.