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Chapter Title: Timing, Duration, and Amplitude of Individual Price Changes during General Price Movements

Chapter Author: Frederick C. Mills

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tutes a normal relation between commodity prices, but of the alterations in relations which are to be expected in the future. When such expectations are not realized, as in the case of farmers in general in 1921 and succeeding years, there arises the feeling that normal price relations have been shattered. Though the concept of normal relations be illusory, the feeling of disturbance and unsettlement arising from the failure of past tendencies to continue may be a very real one.[1]

The figures presented in Table IX may be used in determining what were the expectations, in 1913, of those producing and handling the various commodities there listed.[2]

IV Timing, Duration and Amplitude of Individual Price Changes During General Price Movements

During the major cyclical swings of commodity prices there are pronounced differences in the movements of individual commodities, though the general movement may affect all commodities in some degree. A study of these differences may be expected to yield information concerning the price behavior of individual commodities, and should, at the same time, throw some light on the price aspects of business cycles. A detailed investigation of this type, based upon reports concerning quantities and prices from a great many markets, representing important commodities at all industrial stages, should enable the incidence of the business cycle and its propagation throughout the industrial system to be more effectively studied. Such a broad survey must wait, however, upon the compilation of adequate data. The present inquiry is re-

all relevant price and quantity series, and future plans are based upon careful projections of these trends. All this is but a conscious and more accurate application of processes upon which all careful business planning has been based.

[1]The present discussion is confined to the case in which the feeling of unsettlement is an enduring one, as it has been in the field of agriculture in recent years. During every price cycle there are pronounced alterations in relations, exemplified by the case in which the cost of a good may exceed its selling price. But such cyclical disturbances are temporary, quite different in character from the more enduring changes which result from differences in long-term trends. More fundamental economic readjustments are necessitated by changes of the latter type.

[2]A concept having some relation to that discussed above serves as the foundation of the theory of business crises developed by Dr. Emanuel H. Vogel. (*Die Theorie des volkswirtschaftlichen Entwickelungsprozesses und das Krisenproblem*, 1917.) The moving equilibrium between economic processes which is necessary to prosperity is ruptured periodically, according to Vogel, because of differences in the rates of growth of the various elements in this equilibrium. (A summary of Vogel's theory is given in Chapter I of *Business Cycles*, by Wesley C. Mitchell, National Bureau of Economic Research, 1927.) The present inquiry has been confined to rates of change in commodity prices, with merely incidental reference to other economic series. Vogel's theory emphasizes the general economic importance of differences between these rates of change.

stricted to the commodities for which price quotations at wholesale are available, by months, from 1890 to 1926, in the publications of the United States Bureau of Labor Statistics.

1. The Measurement of Cyclical Fluctuations in Commodity Prices

The customary procedure in studying cyclical movements involves the measurement of trend and of seasonal fluctuations, and the correction of the original data for changes due to these factors. The residue, a composite of cyclical and accidental fluctuations, is the material ordinarily used in tracing cyclical movements in time series. This procedure has not been followed in the present study, for several reasons.

Perhaps the most important of these reasons is that we are not trying to measure true "cyclical movements" in commodity prices, though that term is used frequently for convenience. We are seeking to describe the movements of individual prices during the general price swings which have accompanied cycles in American business. The individual price series fail, in many cases, to conform to the general movement. Some may be quite unaffected by given cycles; some may precede or lag behind the general index by such a long period of time as to raise a doubt concerning the connection between their movements and the business cycle. Smooth and unmistakable cyclical movements are conspicuously absent in many of the price series studied. Yet it is none the less desirable to know how the prices of individual commodities behave during the general business cycle. There is need here of a technique better adapted than the orthodox method to the analysis of miscellaneous series.

The presence of technical and practical difficulties connected with the measurement of trend and of seasonal variations provided additional reasons for a modification of the usual procedure. The technical difficulties in the way of securing a complete elimination of the effects of trend and of seasonal movements need not be elaborated. The practical difficulties were connected with the time available and the material to be covered. A prohibitive amount of time would have been required to analyze several hundred series after the orthodox method. The method actually employed has the advantage of permitting a considerable number of series to be analyzed in a limited time and affords, in addition, certain useful measures which the other method does not yield. The procedure adopted requires explanation and illustration.

It is possible to secure measures relating to eight aspects of the behavior of individual commodity prices during each business cycle. Three of these pertain to behavior during the revival and prosperity stages of the cycle, three to behavior during the stages of recession and depression, and two relate to the cycle as a whole. These measures are the following:

Date of low point preceding revival.
Duration of rise during revival and prosperity.
Percentage of rise during revival and prosperity.
Date of high point preceding recession.
Duration of decline during recession and depression.
Percentage of decline during recession and depression.
Duration of cycle.
Amplitude of cyclical movement.

Such measures, relating to specific phases of revival and recession and to specific cycles, enable the characteristics of given cyclical movements to be determined, and permit comparison of different cycles. From these measures, moreover, may be derived figures describing the average behavior of individual commodities.

a. *The Timing of Revival and Recession.* In studying the timing of individual price changes it is necessary to get away from specific dates. This has been done by selecting as reference points the dates of the last low preceding revival and of the last high preceding recession in the general wholesale price index number. Thus the measure defining the time of change in the price of a given commodity in a given stage of revival or recession is the difference, in months, between the date of turn in the general price index and the date of turn in the price of the commodity in question. If the commodity precedes the general index a negative sign is attached to this deviation; if the commodity lags behind the general index a plus sign is used.

The selection of reference points during the period 1900-1925 offered no difficulty, as the index of the Bureau of Labor Statistics is available on a monthly basis for these years. For the period 1890-1899 use was made of Falkner's quarterly index, supplemented by Persons' ten-commodity index when it was necessary to interpolate between quarters. The greatest difference between the turning points shown by Persons' monthly index and by Falkner's quarterly index during this period was two months, and this occurred only once.

During the period 1890-1925 wholesale price index numbers show 21 turning points which may be identified with definite revival or recession phases of ten American business cycles.[1] These cycles were of varying intensity and duration, but it does not seem legitimate, in the light of contemporary records, to exclude any of them from the list. The turning points noted have been numbered from 1 to 21, for convenience of reference. The dates of these reference points are given in column (3) of Table 17. In some instances given values of the index number persisted for several months without change or with only minor fluctuations. In such a case the date given relates to the last observation preceding a distinct turn.

The first task was the study of the individual price series for the purpose of locating in these series the turning points that correspond to the turns in the general price index. For some commodities, which clearly reflect all the major movements in the general index, this was a fairly simple matter. As indicated above, the time of each of the cyclical turns in the specific price series is expressed as a deviation, in months, from the corresponding turn in the wholesale price index. In recording the movements of the individual price series the date given in each case is that of the last low preceding a rise in price, or the last high preceding a price decline. No attempt was made, in locating turning points, to allow for seasonal movements or for trend. The actual low and the actual high which appeared to be identified with given cyclical phases were accepted as the significant turning points for the present purpose.

But many commodities fail to conform in all respects to the scheme of movements outlined in Table 17. Their prices may reflect some of the cycles, but may be quite unaffected by others. The present problem, as has been pointed out, is not essentially that of tracing cycles in individual price series, but that of observing and measuring the behavior of individual commodity prices during the major swings which are found in the general price index. Accordingly, behavior which does not conform to the general movements must be described, as well as that which does so conform.

In a case in which a given series took no turn which could be identified with the prevailing movement in general prices, its behavior could be classified under one of three heads. If, instead of reaching a low and rising, during revival, or reaching a high and

[1]The reference points selected have been checked against the phases of American cycles between 1890 and 1925, as defined by Wesley C. Mitchell and Willard L. Thorp. There is agreement throughout in regard to the cycles marked off.

declining, during recession, the given price series declined consistently, it was classed as *sagging*. If, instead of experiencing the turn to be expected, the commodity rose in price throughout the prevailing cyclical phase, it was classed as *rising*. If no turn were recorded, the commodity remaining unchanged in price throughout the period in question, the entry *constant* was employed. The latter class contains a subdivision consisting of commodities which were *irregularly constant* in price. This classification was employed when a commodity experienced minor price fluctuations about a constant level during a given period. These fluctuations might be seasonal or accidental; they did not appear to the investigator to be manifestations of the general price swing under way during that period.

Each entry in the general table consists, therefore, of a specific figure, or one of the symbols S, R, C or I C. The figure measures the number of months by which the turn in price of the commodity in question preceded (—) or lagged behind (+) the turn in the wholesale price index; the symbol indicates whether the given price series *sagged, rose,* or remained *constant* during the period to which the entry refers.

In locating turning points in the prices of the various commodities studied an attempt was made to set limits within which a given rise or decline in price might be expected to fall if it were related to a particular turn in general prices. It did not seem desirable to set any fixed limits on either side of a given reference point, since the duration of price cycles varies considerably. Variable limits were set, therefore, and these limits were so chosen as to include, roughly, three phases of the current cycle (a cycle being assumed to include the four phases, revival, prosperity, recession and depression). Thus the limits to a period in which the low price preceding revival would usually fall were given by the approximate dates of the beginning of the preceding depression and the end of the succeeding phase of prosperity. Similarly, the limits to a period in which the high price preceding recession would be expected to fall were set by the first date of the preceding phase of prosperity and the last date of the ensuing period of depression.[1] The limits which have been employed are given in column (4) of Table 17.

[1]The limits employed are those defined in the previously mentioned summary of the phases of American cycles, prepared by Wesley C. Mitchell and Willard L. Thorp, with a few modifications for the immediate purpose. The only material changes were made in defining the limits to periods 15 and 17, covering the war and post-war years. Some adjustment was necessary here in order to include certain of the exceptional price movements of these years in the periods to which they apparently belonged. In the original summary, it may be noted, phases of the various cycles were defined by overlapping dates.

TABLE 17

DATES OF TURNING POINTS IN AMERICAN PRICE CYCLES, AND LIMITS EMPLOYED IN STUDYING CYCLICAL TURNS IN COMMODITY PRICES

(1) Period	(2) Phase	(3) Reference date	(4) Limits
1	low	May, 1892	Oct., 1890–June, 1893
2	high	February, 1893	Oct., 1891–Feb., 1895
3	low	March, 1895	July, 1893–Jan., 1896
4	high	October, 1895	Mar., 1895–Feb., 1898
5	low	May, 1897	Feb., 1896–Dec., 1899
6	high	April, 1900	Mar., 1898–Mar., 1901
7	low	July, 1901	Jan., 1900–Jan., 1903
8	high	October, 1902	April, 1901–Dec., 1904
9	low	July, 1904	Feb., 1903–Oct., 1907
10	high	October, 1907	Jan., 1905–May, 1909
11	low	February, 1908	Nov., 1907–May, 1910
12	high	April, 1910	June, 1909–Dec., 1911
13	low	June, 1911	June, 1910–Oct., 1913
14	high	September, 1913	Jan., 1912–May, 1915
15	low	November, 1914	Nov., 1913–Aug., 1917
16	high	September, 1918	June, 1915–June, 1919
17	low	February, 1919	Sept., 1917–Sept., 1920
18	high	May, 1920	July, 1919–Mar., 1922
19	low	January, 1922	Oct., 1920–June, 1923
20	high	April, 1923	April, 1922–Dec., 1924
21	low	June, 1924	July, 1923– 1926

Although there are wide divergences from any common pattern in the behavior of individual commodity prices, the above limits include most of the price changes which could be related to particular movements of general prices. For a small number of industrial products and for a somewhat larger number of agricultural products and foods, important price movements fell beyond these limits. Entries relating to such cases are designated in the general table (Table X). For 26 agricultural products and foods the failure to conform to the standard schedule was pronounced, and it was difficult to locate turning points corresponding to the cyclical movements of general business. The names of these exceptional commodities are indicated in the table.

Another problem connected with the construction of the general table arose, in some instances, in determining whether a turning point could be defined or whether a price should be classed as *constant* or *rising* (or *constant* or *sagging*) during a given period. As a rough working rule it was classed as constant if it neither rose nor fell within a period of twelve months on each side of the reference date. But, again, because of varying cycle lengths, there are exceptions to this rule. In general, the entry *constant* means that a

price neither rose nor fell during the time when the forces of revival or recession were actively present. Similar general explanations apply to the entries *sagging* and *rising*. After working through a number of price series it was possible to make fairly objective the tests upon which these classifications were based.

It will be obvious to one who looks through the original price quotations that an element of personal judgment must have entered into some of the decisions upon which the entries in the general table are based. A similar analysis of the same data by another person would doubtless yield some differences in detail, but it is not likely that the averages and the general results would differ materially from those secured in this study.

b. *Interpretation of Typical Results.* Table X provides a summary of these results, giving measures descriptive of the behavior of 209 commodities during the 21 turning points listed above. Selected measures from this table, relating to a number of representative commodities, are shown below. Similar figures for seven general economic series are included for purposes of comparison.

This table and Table X present a bird's-eye view of the behavior of a number of commodities during ten cycles in American business. Considerable information is yielded by these tables, whether they be read horizontally or vertically. In studying the behavior of individual commodities a horizontal reading indicates whether the commodity in question was affected by the several major turns in general prices and, if so, the relation in time between the turns of this commodity and the turns in the general index. The prices of anthracite coal, for example, were clearly affected by all the major turns in price during the first seven periods. Following the revival of period 7 (a revival for which the reference date was July, 1901) there were no further cycles in anthracite coal prices. During all other periods of general price change anthracite coal prices were either constant or rising. (For the 13th and 15th periods specific dates appear, since the increase in anthracite coal prices in these periods occurred during phases of revival.) Similarly, steel rail prices reflect all the general movements through the 7th period. These prices were constant thereafter at each major turning point until the general rise following the outbreak of the war. The normal price changes took place during the next four periods, but after the 1922 rise steel rails entered another era of constant prices. Detailed comment on the behavior of other series is not necessary.

A vertical reading of Table 18 (or of Table X) throws light on

TABLE 18

MEASURES DESCRIBING THE BEHAVIOR OF WHOLESALE PRICES OF FIFTEEN COMMODITIES AND OF SEVEN GENERAL ECONOMIC SERIES DURING PERIODS OF REVIVAL AND RECESSION IN AMERICAN BUSINESS, 1890-1925.

(The figures in the various columns indicate the number of months by which the price turns of specific commodities precede (—) or lag behind (+) the major turns of the general price index. The symbols I C, C, S and R represent, respectively, irregularly constant, constant, sagging and rising prices. The dates of the reference points are given at the heads of the several columns.)

Ref. No.	Commodity	Periods																			
		(1) Low (May 1892)	(2) High (Feb. 1893)	(3) Low (Mar. 1895)	(4) High (Oct. 1895)	(5) Low (May 1897)	(6) High (Apr. 1900)	(7) Low (July 1901)	(8) High (Oct. 1902)	(9) Low (July 1904)	(10) High (Oct. 1907)	(11) Low (Feb. 1908)	(12) High (Apr. 1910)	(13) Low (June 1911)	(14) High (Sept. 1913)	(15) Low (Nov. 1914)	(16) High (Sept 1918)	(17) Low (Feb. 1919)	(18) High (May 1920)	(19) Low (Jan. 1922)	(20) High (Apr. 1923)	(21) Low (June 1924)
13	Cattle	+ 1	0	—10	— 6	—12	— 6	—15	— 2	—12	— 3	0	+ 2	— 1	+12	+ 5	+ 4	+ 4	— 6	— 7	— 5	‡—14
25	Cotton	— 2	— 2	— 1	0	+18	+ 5	+ 4	+17	+ 6	— 2	+10	+ 4	+ 5	+ 1	+ 1	0	0	— 1	—10	+ 8	S
64	Beef	+ 1	+ 6	—12	— 6	—13	— 7	— 4	— 3	+16	— 2	0	0	+ 1	+11	+ 5	— 3	+ 4	+ 4	0	+ 8	+15
195	Print cloths	— 9	— 2	0	0	+12	— 3	— 1	+17	+10	0	+ 7	— 2	+ 5	— 9	+ 1	— 5	+ 1	— 1	— 6	+ 8	S
202	Cotton yarns	—12	— 6	0	+ 3	+25	+ 6	+ 4	+16	+10	— 2	+ 8	+ 8	+ 7	+ 1	+ 4	— 3	+ 1	— 1	— 9	+ 8	S
233	Anthracite coal	— 3	— 4	+ 6	+13	+ 8	+10	+ 9	IC	IC	IC	IC	IC	+ 1	IC	+13	R	R	R	IC	R	IC
236	Bituminous coal	0	0	—11	+ 2	+22	— 3	+ 7	+ 5	+20	+ 2	‡ +32	+11	+24	+ 3	+21	—15	—16	+ 7	+ 3	— 7	C
239	Coke	+ 7	+ 1	—10	+16	0	0	— 4	+ 5	10	— 8	+ 8	— 6	+ 5	— 8	0	—14	+ 3	+ 3	— 1	— 8	+ 1
247	Petroleum	+ 5	+16	— 7	— 6	+ 8	— 1	— 1	+14	+14	+19	S	S	+ 6	+ 7	+ 9	R	R	+ 7	— 5	— 1	— 7
259	Pig iron	+11	+ 5	+ 1	0	+14	— 3	+ 3	+ 1	0	— 9	+ 6	— 3	+ 8	— 8	0	—14	+ 8	+ 4	+ 1	— 7	+ 4
276	Steel billets	+ 9	+ 2	— 2	— 1	0	— 6	— 9	— 4	+ 3	— 5	+17	— 1	+ 6	— 5	+ 1	—14	+ 8	+ 2	+ 2	0	+ 5
280	Steel rails	—17	— 2	+ 3	+14	+18	+ 4	— 3	C	C	C	C	C	C	C	+18	+ 5	+10	+ 6	+ 8	C	C
293	Copper, ingot	— 2	— 1	— 9	0	— 8	—11	+14	+ 6	— 7	— 5	+14	— 2	— 1	—11	0	—18	+ 1	— 9	— 5	0	+ 1
441	Leather	+ 9	+12	0	— 1	— 6	— 2	— 2	— 8	0	— 9	‡ — 7	+ 2	— 4	R	R	— 9	— 3	— 9	+ 4	+ 3	+ 1
451	Rubber	— 8	0	— 7	+ 1	—15	0	+13	R	R	—28	+ 1	+ 1	+ 1	—17	0	0	+ 4	— 6	+ 2	— 2	0
	Index of wholesale prices (U. S. B. of L. S.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Index of general business conditions (A. T. & T.)	—12	+ 1	— 9	0	— 7	— 2	— 7	— 1	— 7	— 3	+ 4	— 1	— 2	— 8	+ 1	— 1	+ 1	— 4	— 6	+ 1	0
	Index of industrial stock prices (Dow-Jones)	—17	— 1	—19	— 4	— 9	— 7	—10	—16	— 8	—21	— 3	— 5	—11	—11	+ 1	—22	—14	— 7	— 5	— 1	— 8
	Discount rate on 60-90 day commercial paper	+ 1	+ 5	+ 3	+12	— 3	— 4	— 5	+11	0	+ 2	+16	+ 6	— 1	— 2	+12	+ 1	0	+ 5	+ 7	+ 5	+ 4
	Interest rate on call loans	+ 1	+ 4	— 5	+12	+ 2	— 4	—11	— 1	+ 1	0	+ 6	— 4	—10	— 9	+10	+ 1	+ 1	— 6	+ 7	— 1	+ 2
	Yield on fifteen railroad bonds	+ 1	+ 6	+ 6	+10	+25	— 4	+10	+10	+13	+ 1	+15	+ 4	+ 8	+24	+26	0	— 3	0	+ 7	— 1	+12
	Pig iron production	—13	—11	— 9	+ 2	— 7	— 2	— 8	+ 7	— 7	0	— 1	— 4	— 5	— 4	+ 1	+ 1	+ 8	+ 5	— 6	+ 1	+ 1

‡ Entries relating to turning points beyond the limits defined in Table 17.

the order of change in various price series during the several periods of revival and recession between 1890 and 1925. For the first period, the revival of the early 90's, the dates of recovery for the fifteen commodities shown in Table 18 range from 17 months before the reference date to 11 months after that date. The corresponding limits in the general table, covering 209 commodities, are 18 months before the reference date to 17 months after the basic turning point. These limits vary considerably for the different cycles, but this is a matter for more detailed consideration in the sections dealing with prices in combination.

In studying the characteristics of individual commodities it is necessary to present these results in another form. In doing so, use can be made of other measures not shown in the above summary. The procedure followed in the analysis of an individual commodity may be exemplified by pig iron, the prices of which reflect all the cyclical movements of general business during the years from 1890 to 1925. A summary such as the following was compiled for each of 209 commodities.[1]

TABLE 19

SUMMARY OF CYCLICAL MOVEMENTS IN THE PRICES OF PIG IRON*
1890-1925

(1) Periods	(2) Deviation of *low* from reference date (mos.)	(3) Deviation of *high* from reference date (mos.)	(4) Duration of rise (mos.)	(5) Duration of fall (mos.)	(6) Duration of cycle (low to low) (mos.)	(7) Percentage change: Rise as percentage of preceding low	(8) Percentage change: Rise as percentage of ensuing high	(9) Percentage change: Fall as percentage of preceding high	(10) Index of cyclical variability (8) + (9) / 2
1– 2	+11	+ 5	3	21	24	2.9	2.8	20.0	11.4
3– 4	+ 1	0	6	33	39	20.8	17.2	22.4	19.8
5– 6	+14	— 3	18	21	39	122.2	55.0	38.0	46.5
7– 8	+ 3	+ 1	13	20	33	60.5	37.7	39.9	38.8
9–10	0	— 9	30	19	49	84.1	45.7	38.2	41.9
11–12	+ 6	— 3	17	25	42	14.7	12.8	21.3	17.0
13–14	+ 8	— 8	11	22	33	23.8	19.2	23.7	21.4
15–16	0	—14	32	27	59	320.7	76.2	51.0	63.6
17–18	+ 8	+ 4	11	17	28	88.4	46.9	63.4	55.1
19–20	+ 1	— 7	7	25	32	83.8	45.6	41.8	43.7
21	+ 4								
Averages	+5.1	—3.4†	14.8	23.0	37.8	82.2	35.9	36.0	35.9

*Foundry No. 1, 1890-1913; basic, 1914-1925.
†This average becomes —2.2 if the price turn due to war-time regulation (the entry for period 16) be omitted.

[1]Space limitations prevent the inclusion of detailed figures, of the type shown in Table 19, for all the commodities analyzed. In Table XI, of the Appendix, such figures are given for a selected list of 24 important commodities.

The method of entering the various measures given in this table requires some explanation. The entries on each line relate to the two periods the numbers of which appear in the first column, and to the interval between these periods and the interval immediately following. Thus, considering the entries in the first line, the figure in column (2) shows that the low of pig iron prices in the first period came 11 months after the low of the all-commodities index. From column (3) we read that the high of the second period came 5 months after the high of all commodities. The entry in column (4) shows that the rise in prices following the low of the first period lasted for 3 months before the next high was attained.[1] The entry in column (5) indicates that the decline in pig iron prices following the high of the second period lasted for 21 months. The duration of the cycle[2] in pig iron prices between the low of the first period and the next succeeding low (that of the third period) is shown in the first line of column (6). This entry measures the combined duration of a period of rising prices and the ensuing period of falling prices.

The average of the entries in columns (8) and (9) has been used as an *index of cyclical variability*. This appears in column (10). The two percentages which are averaged in each case are computed from the same base and are, therefore, perfectly comparable. Moreover, the different entries in column (10), which relate to different cycles, may be compared in determining whether the violence of the cyclical fluctuations in a given series is increasing or decreasing. Each entry is a percentage computed from the "high" of a given cycle; cyclical variability is expressed in terms of the maximum

[1]This particular entry suggests one of the difficulties of this general type of analysis, and serves to illustrate the procedure employed. It may seem questionable whether account should be taken of a 2.9 per cent rise in price which lasted for but 3 months. This can hardly be called a phase of a cycle. But, on the other hand there was a distinct revival in American business during this period. The American Telephone and Telegraph Company's composite index shows a gain of about 20 per cent from the low point. Falkner's index (supplemented by Persons' in defining turning points) rose for 9 months, the increase being slightly over 3 per cent. During this period pig iron prices sagged, in general, the decline being broken only by the 3 months rise, of 2.9 per cent, which is recorded above. There is no evidence that this rise was seasonal in character. It was a reflection of the general revival taking place at this time and, brief though it was, account should be taken of it in any study of those movements of individual commodity prices which accompany cyclical movements of general business and of general wholesale prices. It is, of course, exceptional that the movement should be so brief. The other pig iron price movements recorded are all of much longer duration.

[2]The term "cycle" is used for convenience in referring to these movements. Since the given measures relate to price movements accompanying cycles in general business there is justification for using this term, but in some ways it is misleading. Thus, if a commodity rose steadily in price, or remained constant, for a number of years, unaffected by several successive business cycles, the duration of the "cycle" might be given as 100 months, or more. Such a long movement does not accord with the usual definition of the term.

values attained in successive cycles. The effect of a consistent upward or downward trend is thus eliminated. In securing an index of the average cyclical variability of a particular series the figures measuring the mean percentage of rise and the mean percentage of fall have been averaged.[1]

During the ten cycles covered in this study the general trend of the index of cyclical variability in pig iron prices has been upward. The upward movement has itself been cyclical in character, however. During the first two cycles (culminating in 1893 and 1895) the variability was low. A much higher figure was recorded for the cycles which reached their peaks between 1900 and 1907. Between 1907 and the war period the variability of pig iron prices was much lower. During the last three cycles wide fluctuations have again been recorded.

For convenience of reference the various averages computed from figures in Table 19 may be summarized in a table of the type shown on the opposite page. Measures describing the behavior of the general index of wholesale prices are included, for comparison with the pig iron figures.

During revival the price of this particular grade of pig iron has started upward, on the average, 5.1 months after general wholesale prices. The entire period of rising prices has lasted, on the average, 14.8 months, as compared with 23.4 months for the wholesale price index. The average percentage of rise has been 82.2, as compared with 24.6 for the general index. (When the rise is computed as a percentage of the high, the pig iron figure is 35.9 as compared with 16.7 for the price index.) In interpreting these figures it must be recalled that no attempt has been made to eliminate the effects of the upward trend of prices from 1896 to 1920. In so far as this trend affects the comparison of the upward and downward swings it is taken account of by expressing each rise as a percentage of the ensuing high value.

During recession pig iron prices have started downward, on the average, 3.4 months before general prices. (This figure is reduced to 2.2 if the exceptional period of price regulation be omitted from the calculations.) The difference of approximately eight and one-half months between the duration of rise of general prices and of pig

[1]The use of the "high" in each cycle as the base of the percentages which are averaged in securing an index of cyclical variability, instead of an average of low and high values, lessens slightly the relative weight given to wide cyclical fluctuations, as compared with smaller movements.

TABLE 20

TIMING DURATION AND AMPLITUDE OF CYCLICAL MOVEMENTS IN AN INDEX NUMBER OF WHOLESALE PRICES AND IN PIG IRON PRICES, 1890-1925.

(The month is the unit in all measures relating to time)

(1) Price series	(2) No. of cycles observed	(3) Behavior during revival: Average deviation from reference date (mos.)	(4) Behavior during revival: Average duration of rise (mos.)	(5) Behavior during revival: Average percentage of rise (based on preceding low value)	(6) Behavior during recession: Average deviation from reference date (mos.)	(7) Behavior during recession: Average duration of fall (mos.)	(8) Behavior during recession: Average percentage of fall (based on preceding high value)	(9) Average duration of cycle, low to low (mos.)	(10) Average percentage of: rise (based on ensuing high value)	(11) Average percentage of: fall (based on preceding high value)	(12) Index of cyclical variability Average of cols. (10) and (11)
Wholesale price index[1]	10	0	23.4	24.6	0	15.1	11.8	38.5	16.7	11.8	14.2
Pig iron prices	10	+5.1	14.8	82.2	−3.4[2]	23.0	36.0	37.8	35.9	36.0	35.9

[1]The measures for this series are based upon Falkner's index, from 1890 to 1899, and upon the index of the U. S. Bureau of Labor Statistics, from 1900 to 1925.
[2]This average becomes −2.2 if the price turn due to war-time regulation be omitted.

iron prices is thus accounted for by a lag of pig iron of roughly 5 months on recovery and a lead of some 3 months on recession. That these averages relating to the lag and lead of pig iron are representative is clear from a consideration of the individual measures in Table 19. Not once in 11 revivals has pig iron started upward before the general index. Only 3 times in the 10 recessions recorded have pig iron prices started downward after the general index.

The average duration of decline of pig iron prices has been 23.0 months, as compared with 15.1 for the general index. The cyclical swings of pig iron prices include a sharp and relatively brief upward movement and a downward movement lasting, on the average, half as long again. During only 2 of the 10 cycles included in this study has the duration of the upward movement exceeded the duration of the ensuing decline. In this respect pig iron prices stand in pronounced contrast with the general wholesale price index. For this index the duration of rise is equal, on the average, to about one and one-half times the duration of fall. Only twice in the 10 cycles recorded has the duration of rise for the general index been less than the duration of the ensuing fall. The percentage of decline has averaged 36.0 for the pig iron, as compared with 11.8 for the wholesale price index.

The indexes of cyclical variability, constructed by averaging the percentages of rise and fall (both rise and fall being expressed as percentages of the same high), appear in column (12). This index is 35.9 for pig iron, and 14.2 for the wholesale price index. The price of pig iron is about two and one-half times as variable, in its cyclical movements, as the general price index.

The average duration of the cycle is slightly less for pig iron prices than for the wholesale price index. This is a somewhat accidental result, in the present instance, for every cycle in general prices during the period 1890-1925 was reflected in pig iron prices. This fact should result in approximate equality of the two averages. The difference is due to the relatively late revival of pig iron in the first period.

In making the above comparison use has been made, in every instance, of pig iron averages based upon all the data, including those for the period of war-time regulation. The only average materially affected by regulation is that relating to the date of the turn downward from a high. The average of —2.2 secured by omitting the entry for the regulated period is probably more representative

than that of —3.4 which is based upon all the entries. In all other respects it seems desirable to include all the data, since all the periods have been included in securing the price index averages.

Considerable space has been given to this comparison in order to illustrate in some detail how the measures in the general table (XII) are to be interpreted. It is, of course, out of the question to include similar discussions of the measures for other commodities.

In the above illustration use was made of a commodity which offered few difficulties to analysis of this type, since all the cycles between 1890 and 1925 are defined in the movements of pig iron prices. A few modifications of the method are necessary in handling commodities which do not follow all the cyclical movements of the general index. These modifications are enumerated in the following section.

§The Measurement of Cyclical Price Movements: Special Cases

(1) In measuring the duration of a rise the whole time between a turn upward from a low and the next succeeding turn downward from a high is counted, whether the rise extends over one or more cycles in general business. The same principle applies in measuring the duration of a price decline.

(2) In measuring the duration of a cycle the full time elapsing between a specific low entry and the next specific low entry is counted, regardless of intervening periods of constant, sagging or rising prices. A price cycle for a given commodity might thus cover several of the cycles marked out by the general price index. The same principle applies in counting the number of observed cycles. (In the computation of the averages given in Table 33, however, account has been taken only of "normal" cycles, i. e., movements corresponding to specific cycles in general business.)

(3) In measuring the average deviation of the time of recession from the reference dates, two averages have been secured for each commodity. The first average in each case is based upon all the entries, the second upon all the entries but that for period 16 (the period of recession for which the reference date is September, 1918). This second average (given in Table XII) is not affected by price regulation during the war, nor by other unusual factors connected with the war-time disturbances.

A second average for the timing of revival has been computed for each of four articles, for which price regulation extended into period 17 (the period of revival for which the reference date is February, 1919). The entry for period 17 has been omitted in computing the second average in each of these cases.

(4) In computing the average time of revival or recession as a deviation from the reference date, account is taken only of the actual turns observed. Thus an entry of C, S or R is disregarded in arriving at these

averages. The number of turns observed is noted, however, in connection with each average.

(5) In computing the average duration of rise, in cases where entries of C, S or R have intervened between specific dates, two averages have been secured. The first is based upon all the duration figures, including those (mentioned in point 1 above) which may extend through one or more cycles. The second average is based only upon those entries relating to adjoining periods. In this last computation periods of rise covering more than one "normal" cycle are excluded.

Second averages have been computed on the same principle in measuring the duration of fall, the duration of cycles, the percentage of rise and fall, and the amplitude of cyclical movements.

2. Cycles in Commodity Prices: General Measures

Measures relating to 209 commodities have been computed according to the above rules, and are summarized in Appendix Table XII. An extract from this general table appears in Table 21 below. In addition to the commodity price averages there are included in this table measures describing the cyclical movements of seven other economic series. A first inspection of these other measures may make clearer the significance of the commodity price averages.

All the series relating to data other than specific commodity prices reflect each of the ten cycles in American business which occurred between 1890 and 1925. Of these seven series the earliest to revive after depression, on the average, was the index of industrial stock prices which started upward 9.4 months before general wholesale prices recovered. Next came pig iron production, 4.2 months before the price index, and the American Telephone and Telegraph Company index of general business conditions, with an average movement just 4 months before wholesale prices. The interest rate on call loans lagged .4 of a month after the price index on revival, the rate on 60-90 day paper 3.1 months, and the yield on railroad bonds 10.9 months. (The figure for bond *prices* would, of course, represent movements just reversing those of bond *yields*.)

Some of these averages are changed rather materially for the recession phase of the cycle. The stock price index precedes the wholesale price index by about the same interval (9.5 months). The lead of pig iron production is reduced from 4.2 months to .5 of a month, and that of the general business index from 4 months to 1.8 months. The lag of .4 of a month for call loan rates is changed to a lead of .8 of a month on recession; the lag of 3.1 months for the 60-90 day paper rate, is changed to a lag of 4.1 months; the lag

of 10.9 months on railroad bond yields is changed to a lag of 5.0 months. These figures indicate that the sequence of change in different economic series is in many cases not the same at the recession phase of the cycle as it is during the stage of revival. A measure of average lag or lead which does not discriminate between different cyclical phases may be quite inaccurate.

The average duration of rise for these seven series varies from 17.6 months for bond yields to 27.6 months for pig iron production. These extremes are reversed in the duration of fall column. Pig iron production, with a figure of 12.3 months, has the shortest average time of fall, while bond yields, with an average of 22 months, have the longest. With the single exception of bond yields the duration of rise exceeds the duration of fall. (Bond *prices* would conform to the other series in this respect.) For these general economic series the typical cyclical movement during the period between 1890 and 1925 has consisted of a rise averaging about two years, and a decline averaging from 12 to 16 months. The average cycle length has been a trifle less than 40 months.

The degree of cyclical variability, as measured by the indexes given in column (21), ranges from 11.2 for bond yields to 75.0 for call loan rates. The variability of the price index is relatively low, as is also that of the general business index. Industrial stocks, commercial paper rates and pig iron production stand on a rising scale of variability.

In interpreting the entries in the table below relating to commodity prices, it should be remembered that the second average in column (14) has been computed, in each case, by excluding the entry for period 16, which covers the time of war inflation and price regulation. Where a second entry appears in other columns it relates to figures for successive cyclical turns. As explained in note 5 on page 90 such averages were computed for commodities which did not reflect, in their price movements, all the cycles which affected general business between 1890 and 1925.

a. *Number of Price Cycles Recorded.* The information to be obtained from Table XII, in the Appendix, and from Table 21, may be most clearly presented by summarizing the figures in several supplementary tables, in which the commodities are arranged in order of magnitude of the various types of averages. The first question of interest relates to the number of cycles observable in the prices of the different commodities studied. The fifteen com-

TABLE 21

MEASURES DESCRIBING THE BEHAVIOR OF WHOLESALE PRICES OF FIFTEEN COMMODITIES AND OF SEVEN GENERAL ECONOMIC SERIES DURING PERIODS OF REVIVAL AND RECESSION IN AMERICAN BUSINESS, 1890-1925

Averages relating to Timing, Duration and Amplitude of Cyclical Movements[1]

(1) Ref. No.	(2) Commodity	(3) No. of cycles observed	(4) Behavior during revival: Constant	(5) Sagging	(6) Rising	(7) Turns observed	(8) Av. time as a deviation in months from the reference date	(9) Av. percentage of rise based on preceding low value	(10) Behavior during recession: Constant	(11) Sagging	(12) Rising	(13) Turns observed	(14) Av. time as a deviation in months from the reference date	(15) Av. percentage of fall based on preceding high value	(16) Average duration of: Rise in mos.	(17) Fall in mos.	(18) Cycle in mos.	(19) Av. percentage of: Rise (based on ensuing high value)	(20) Fall (based on preceding high value)	(21) Index of cyclical variability
13	Cattle	10				11	— 5.5	52.0				10	— 1.0 — .5	26.7	27.1	9.9	37.0	32.0	26.7	29.3
25	Cotton	9½		1		10	+ 3.2	114.7				10	+ 3.0 + 3.3	42.2	23.2	16.5	38.7	47.3	42.2	44.7
64	Beef	10				11	+ .3	46.6				10	+ .8 + 1.2	25.3	24.4	14.5	38.9	30.2	25.3	27.7
195	Print cloths	9½		1		10	+ 2.0	108.7				10	+ .3 + .9	42.0	21.7	19.0	39.9	43.5	42.0	42.7
202	Cotton yarns	9½		1		10	+ 3.8	82.9				10	+ 3.0 + 3.7	34.8	22.6	18.3	39.9	36.8	34.8	35.8
233	Anthracite coal	3	4		1	6	+ 5.7	39.7	4		3	3	+ 6.3 + 6.3	22.5	19.7	21.0	40.7	28.3	22.5	25.4
236	Bituminous coal	9½	1			10	+10.2 +13.1	59.4				10	+ .5 + 2.2	27.5	13.7	25.2	39.9	31.2	27.5	29.3
239	Coke	10				11	+ .8	215.2				10	— 1.9 — .5	58.2	20.7	17.2	37.9	58.2	58.2	58.2
247	Petroleum	8		1	1	9	+ 2.4	124.4 91.9		1	1	8	+ 6.9 + 6.9	39.9 41.8	29.9 25.0	16.7 14.7	46.6 37.7	50.1 46.2	39.9 41.8	45.0 44.0
259	Pig iron	10				11	+ 5.1	82.2				10	— 3.4 — 2.2	36.0	14.8	23.0	37.8	35.9	36.0	35.9
276	Steel billets	10				11	+ 3.6	103.2				10	— 3.2 — 2.0	40.2	16.7	21.4	38.1	40.1	40.2	40.1

280	Steel rails	5	4			7	+ 5.3	45.7 32.5	5			5	+ 5.2 + 5.5	26.7 26.7	57.6 18.5	18.6 18.6	76.2 39.2	25.3 19.8	26.7 26.7	26.0 23.2
293	Copper, ingot	10				11	— .2	65.0				10	— 5.1 — 3.7	33.2	18.6	20.2	38.8	33.6	33.2	33.4
441	Leather	9			1	10	— .8	33.0 22.0			1	9	— 2.3 — 1.5	19.8 19.8	26.2 19.2	15.7 15.7	41.9 35.5	21.4 17.3	19.8 19.8	20.6 18.5
451	Rubber	9			1	10	— .9	67.8 64.4			1	9	— 5.7 — 6.4	41.0 41.0	23.7 22.4	20.0 20.0	43.7 40.7	31.5 29.3	41.0 41.0	36.2 35.1
Index of wholesale prices (U. S. B. of L. S.)		0				11	0	24.6				10	0 0	11.8	23.4	15.1	38.5	16.7	11.8	14.2
Index of general business conditions (A. T. & T.)		10				11	— 4.0	29.4				10	— 1.8 — 1.9	23.0	26.0	13.7	39.7	22.1	23.0	22.6
Index of industrial stock prices (Dow-Jones)		10				11	— 9.4	67.6				10	— 9.5 — 8.1	32.8	23.4	16.0	39.4	38.1	32.8	35.4
Discount rate on 60-90 day commercial paper		10				11	+ 3.1	106.6				10	+ 4.1 + 4.4	46.5	24.5	14.3	38.8	47.3	46.5	46.9
Interest rate on call loans		10				11	+ .4	644.6				10	— .8 — 1.0	74.2	22.4	16.2	38.6	75.9	74.2	75.0
Yield on fifteen railroad bonds		10				11	+10.9	13.0				10	+ 5.0 + 5.5	11.3	17.6	22.0	39.6	11.2	11.3	11.2
Pig iron production		10				11	— 4.2	153.3				10	— .5 — .5	50.6	27.6	12.3	39.9	56.5	50.6	53.5

[1]For an explanation of the second entries in certain columns, see points (3) and (5) on pp. 89-90.

modities used for illustrative purposes are ranked below, in the order set by these measures.

TABLE 22

RANKING OF FIFTEEN COMMODITIES ACCORDING TO THE NUMBER OF CYCLES OBSERVABLE IN THEIR PRICE MOVEMENTS, 1890-1925

(1) Ref. No.	(2) Commodity	(3) No. of cycles
233	Anthracite coal	3
280	Steel rails	5
247	Petroleum	8
441	Leather	9
451	Rubber	9
236	Bituminous coal	9½
25	Cotton	9½
202	Cotton yarns	9½
195	Print cloths	9½
64	Beef	10
13	Cattle	10
239	Coke	10
293	Copper, ingot	10
259	Pig iron	10
276	Steel billets	10

Table XII, in which appear figures of this type for all commodities, shows a wide range of variation in the number of cycles recorded. At one extreme stand three commodities (cross-cut saws, hand saws and trowels) which passed through but one complete price cycle between 1890 and 1925. During most of this period these articles were constant in price. The one complete cycle in their prices began with the low preceding the war-time rise, attained its peak in 1921, and reached a new low in 1922 (for trowels, in 1923). Of the 209 commodities studied, 53 reflected in their price movements all the cycles between 1890 and 1925—10 in number. Many articles were not affected by the minor cycles, but more than two-thirds of the total number passed through 7 or more complete cycles. The sensitivity to cyclical movement, it is apparent, varies greatly as between the different commodity groups. This is a matter for more detailed consideration in a later study.

b. *The Duration of Cycles in Commodity Prices.* Figures relating to another phase of price behavior are summarized in the next table. Here the fifteen representative commodities are arranged in order, according to the average duration of the cycle.

(In computing these averages the duration of the cycle was measured from low to low, in all cases.)

TABLE 23

RANKING OF FIFTEEN COMMODITIES ACCORDING TO THE AVERAGE DURATION OF PRICE CYCLES, 1890-1925

(1) Ref. No.	(2) Commodity	(3) Average duration of cycle, in months
13	Cattle	37.0
259	Pig iron	37.8
239	Coke	37.9
276	Steel billets	38.1
25	Cotton	38.7
293	Copper, ingot	38.8
64	Beef	38.9
236	Bituminous coal	39.9
202	Cotton yarns	39.9
195	Print cloths	39.9
233	Anthracite coal	40.7
441	Leather	41.9 (35.5)
451	Rubber	43.7 (40.7)
247	Petroleum	46.6 (37.7)
280	Steel rails	76.2 (39.2)

A warning should perhaps be voiced concerning the conclusions to be drawn from these figures. What constitutes a cycle in a time series may be a debatable point, in many cases. Ten cycles were distinguished in the movements of the general price index between the low of 1892 and the low of 1924. As far as possible the individual price series were fitted into the framework set by the changes in the general index. There was a clear tendency in the method, in other words, to place upon individual series the impress of the general price cycles. There seems to be no doubt, as an objective fact, that these general cycles are reflected in the movements of a great majority of the individual price series, and that the equality of most of the averages relating to cycle duration is due to the presence of common cyclical movements. It is probable, however, that the use of a common framework is to some extent responsible for the rough equality of the averages, which cluster in the neighborhood of 40 months. The only great departures from the general average occur when given commodities fail to reflect some of the major price cycles.

In cases where the average cycle length has been affected by missed periods, (i.e., by the failure of the commodity to reflect the

successive cyclical turns in general prices) a second average, which appears in parentheses after the main entry, has been computed. This is based only upon entries relating to successive periods of revival and recession. Thus the steel rail average of 76.2 months becomes 39.2 months if we take account only of the cycles which were completed without missed phases intervening.

Table XIII, in the Appendix, shows the average cycle lengths for all the commodities studied. The commodities are arranged by groups, and in order of magnitude of the averages within the several groups. The smallest average recorded is 36.8 months, for one grade of muslin. Most of the commodities which passed through all ten cycles have averages not greatly in excess of this figure. The largest figure is 279 months, for kitchen tables, a commodity which passed through but one cycle during the period here studied.

For the seven general economic series listed in Table 21 the average duration of the cycle varied from 38.5 months to 39.9 months.

c. *Cyclical Variability of Commodity Prices.* Individual differences between commodities are more marked in the matter of cyclical variability of prices than they are in respect to duration of price cycles. The following table shows these differences for the fifteen commodities which have been used for illustrative purposes.

TABLE 24

RANKING OF FIFTEEN COMMODITIES ACCORDING TO THE CYCLICAL VARIABILITY OF THEIR PRICES, 1890-1925

(1) Ref. No.	(2) Commodity	(3) Index of cyclical variability
441	Leather	20.6 (18.5)
233	Anthracite coal	25.4
280	Steel rails	26.0 (23.2)
64	Beef	27.7
236	Bituminous coal	29.3
13	Cattle	29.3
293	Copper, ingot	33.4
202	Cotton yarns	35.8
259	Pig iron	35.9
451	Rubber	36.2 (35.1)
276	Steel billets	40.1
195	Print cloths	42.7
25	Cotton	44.7
247	Petroleum	45.0 (44.0)
239	Coke	58.2

In interpreting these figures the number of cyclical movements upon which they are based should be borne in mind. These are given in Table 22. That the measures of cyclical variability are not to be considered perfect indexes of the sensitivity of the different commodities to general cyclical movements is brought out by a comparison of the pig iron and petroleum figures. The index of variability for pig iron is 35.9; that for petroleum is 45.0. The former commodity passed through ten complete cyclical movements, the latter through only eight. The range of price variation during the average cycle was greater for petroleum prices, but this commodity sagged throughout one whole cycle and rose throughout another.

Corresponding measures relating to certain general economic series are given in Table 21. The variability of pig iron prices, with an index of 35.9 is distinctly less, it may be noted, than the variability of pig iron production, for which the index is 53.5.

All the commodities studied are arranged by groups in Appendix Table XIV, in order of magnitude of the indexes of cyclical variability. The range of these indexes extends from 12.8 for shovels and grain alcohol to 77.4 for onions, but the great bulk of the entries fall between 15 and 45. There are notable differences between the values found in the different commodity groups.

In computing the averages upon which the commodities are ranked in Table XIV, all percentages of rise and percentages of fall between cyclical turning points have been included, whether the period of rise or fall extended over one complete cycle or more. In most cases such an average serves as a representative measure of the cyclical variability of a commodity, but in a few instances it does not. If a commodity rose from 1897 to 1920, and then fell to a low in 1922, the latter change might well be considered a true cyclical movement, but the former could not. A second average, based only upon percentages of rise and fall relating to successive phases of individual cycles, appears in parentheses after some of the entries in Table XIV and in Table 24. In cases where the two differ materially the second may be accepted as more representative than the first.

3. Behavior of Commodity Prices During Revival

The three preceding tables have dealt with measures relating to the cycle as a whole. Certain of the figures given in the general

tables relate to the behavior of commodities during specific phases of the cycle. Attention may first be given to the phase of revival.

a. *Degree of Conformity to General Price Movements during Revival.* During the period between 1890 and 1925 there were eleven fairly pronounced revivals in American business. The entries in column (7) of Appendix Table XII indicate the number of definite price revivals recorded for specific commodities. A ranking of commodities according to the number of revivals observed would be much the same as a ranking based on the total number of cycles through which given commodities passed. The same would be true of a ranking based upon the entries in column (13) of Table XII, showing the number of price recessions recorded. There are a few noteworthy differences, however. Anthracite coal, which reflected 3 of the 10 cycles, shared in 6 of the 11 upward price movements between 1890 and 1925. It moved downward in price during but 3 of the 10 down-turns in general prices. Similarly, steel rails moved upward during 7 of the 11 general upward movements and downward during but 5 of the 10 recessions. A few of the more stable commodities display a certain responsiveness to a general upward movement in prices, but are somewhat less sensitive to the forces of recession.

Considerable light is thrown upon the characteristics of different price series by a study of their behavior at such times as they did not share in general price revivals. This may have been because prices were *constant* during revival, *sagging* during revival or because the price of a given commodity continued during revival a general upward course which had prevailed during the preceding period of depression. In such a case it is tabulated as *rising*.

Only a few of the fifteen commodities which have been used in illustrating the results failed to conform in general to the cyclical swings of the wholesale price index. Three of these articles were constant in price during general price revivals. These were bituminous coal (constant during one period of revival), anthracite coal and steel rails (each constant during 4 of the 11 general revivals). Four articles from this list, cotton, print cloths, cotton yarns and petroleum, sagged in price during 1 of the 11 revivals. Four commodities, anthracite coal, petroleum, leather and rubber, are recorded as rising during a period of price revival (i. e. the prices of these articles did not follow the general course in showing a turn upward from a low, at revival, but continued a rise which had prevailed during the preceding period of depression.)

Information of this type for all the commodities studied may be had from Table XII. We have data relating to 209 commodities during 11 price revivals, making 2299 entries in all. These entries fall in the classes shown below.

TABLE 25

BEHAVIOR OF ALL COMMODITIES DURING PRICE REVIVALS

(1) Nature of entry	(2) No. of entries	(3) Percentage of total
Specific date (for beginning of revival)	1830	79.6
Constant	239	10.4
Sagging	121	5.3
Rising	109	4.7
Total	2299	100.0

This table indicates that in approximately 80 per cent of all cases the prices of individual commodities showed an increase during revival which could be associated with the general movement. In about 10 per cent of all cases prices were constant, in about 5 per cent sagging and in about 5 per cent rising. These figures relate to a specific era in a single country. Within this era and country periods of price revival have differed materially in their pervasiveness, and we should expect the percentages relating to constant, sagging and rising entries to vary somewhat from cycle to cycle. The figures for the separate cycles are discussed in Chapter IV.

b. *Sequence of Change in Commodity Prices during Revival.* In comparing the figures showing the order of price revival it must be recalled that we are dealing here only with averages, and that these averages should be supported by evidence as to the consistency of the movements they represent. Such evidence is provided by the figures in column (5) of Table 26. These are the standard deviations of the original figures which measure the differences, in months, between the dates of revival in the general price index and the dates of revival in the prices of the commodities named. The measure would, of course, be zero if this difference were constant, that is, if the time relation between general price movements and movements in the price of a given commodity were unvarying. Since higher values mean less consistency in the behavior of the original prices, the figures may be called measures of inconsistency.[1]

[1]The measure of inconsistency is expressed in months, just as is the average deviation from the reference point. In comparing the measure of inconsistency with this

The measure of inconsistency, it should be noted, is based upon entries for periods during which prices rose. If prices were constant, sagging or rising during certain periods of revival, no account was taken of such entries. A perfect measure of consistency should take account of such failures to conform to the general movement. Because the present measure does not include such periods of nonconformity it should be interpreted in connection with the entries in column (7) of Table 21 showing the number of periods of general revival during which price up-turns were recorded for specific commodities.

The average sequence of price change during revival for the fifteen representative commodities is shown in the following table, together with the measures of inconsistency.

TABLE 26

SEQUENCE OF REVIVAL IN SELECTED WHOLESALE PRICE SERIES, WITH MEASURES OF INCONSISTENCY

Ranking of Fifteen Commodities according to the Timing of Price Revival, 1890-1925

(The figures in column (4) measure deviations, in months, from the date when the general index of wholesale commodity prices reached its lowest point, preceding revival. The sign (—) indicates a price recovery *preceding* that in general prices; the sign (+) indicates a price recovery *lagging behind* the revival of general prices.)

(1) Ref. No.	(2) Commodity	(3) No. of price revivals	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
13	Cattle	11	— 5.5	7.2
451	Rubber	10	— .9	7.2
441	Leather	10	— .8	4.5
293	Copper, ingot	11	— .2	7.5
64	Beef	11	+ .3	7.7
239	Coke	11	+ .8	4.8
195	Print cloths	10	+ 2.0	6.3
247	Petroleum	9	+ 2.4	7.3
25	Cotton	10	+ 3.2	7.2
276	Steel billets	11	+ 3.6	6.4
202	Cotton yarns	10	+ 3.8	9.7
259	Pig iron	11	+ 5.1	4.5
280	Steel rails	7	+ 5.3	11.5
233	Anthracite coal	6	+ 5.7	5.2
236	Bituminous coal	10	+13.1[1]	13.2

[1]Excluding period 17.

average, it must be borne in mind that the reference point in each cycle has been arbitrarily selected. A date other than the turning point in the wholesale price index would have been just as satisfactory, for the general purpose of the present study. Accordingly, the significance of the average is not dependent upon its relation to the measure of inconsistency, although the consistency of the lag or lead of a particular commodity in reference to the general price index may be so determined.

The figures in the following table, relating to seven general economic series, may be compared with those given above.

TABLE 27

SEQUENCE OF REVIVAL IN SEVEN ECONOMIC SERIES, WITH MEASURES OF INCONSISTENCY

(1) Series	(2) Average deviation from reference date (in months)	(3) Measure of inconsistency
Index of industrial stock prices (Dow-Jones)[1]	— 9.4	5.5
Pig iron production	— 4.2	5.6
Index of general business conditions (A. T. & T.)	— 4.0	4.8
Index of wholesale prices (U. S. B. of L. S.)	0.0	0.0
Interest rate on call loans	+ .4	6.3
Discount rate on 60-90 day commercial paper	+ 3.1	6.1
Yield on fifteen railroad bonds	+10.5	8.5

[1]The average deviation from the reference date for Macaulay's index of railroad stock prices is -7.7, with a measure of inconsistency of 5.6.

The measures given for the wholesale price index have a value of zero, of course, because the turning points of that index provide the reference dates from which the other changes are measured.

Of the non-price series, the one which is most consistent in its time relation to the wholesale price index is the general business index of the American Telephone and Telegraph Company. Next in order is the index of industrial stock prices. The yield on railroad bonds is least consistent.

Two of the individual commodity price series listed in Table 26 have measures of inconsistency which are smaller than that of the most consistent of the non-price series. These two are pig iron prices and sole leather prices. The time relation between the cyclical movements of bituminous coal prices and the cyclical movements of general prices is least consistent. In general, the measures of inconsistency for the price series are large. Even where there is a distinct tendency to precede or lag behind general prices there is considerable variation in the degree of lead or lag. This is true, however, of most economic relations, and does not mean that principles of order cannot be found in the working of the price system. It means, only, that relations between prices are statistical and not mechanical in character, and that the interpretation and use of the

data secured from studies in this field involve the calculus of probabilities rather than the rigid formulas of mechanics.

In Table XV, in the Appendix, the average time of revival for each of 209 commodities is shown. The averages for 56 commodities are negative in sign, which means that these articles have preceded the general price index, on the average, in their upward movements. These constitute a trifle over a quarter (26.8 per cent) of the total number of commodities. An up-turn of the general index, it is apparent, is due in general to price changes in a distinct minority of the commodities included in the index. The reason for this is found, probably, in the fact that toward the end of a period of depression the bulk of commodities on sale in the wholesale markets are fairly stable in price, at levels below those prevailing during the preceding period of prosperity. Under these conditions upward price movements which affect but a few commodities would serve to move the general index upward.

The averages vary from —13.4 for wheat to +36.5 for nappies. These are both somewhat exceptional values, the former because of the erratic character of wheat price movements (erratic when fitted into the general schedule of cyclical movements), the latter because nappies shared in but two general price revivals. If nine extreme cases be ruled out, the average times of revival of the remaining 200 articles fall between —7 and +15, a range of 22 months.

The entries in this general table must be so qualified that the table as a whole does not lend itself to simple interpretation. The average date of revival, as given for a single commodity, must be interpreted in connection with the number of price revivals recorded for that commodity, and with the measure of inconsistency. In addition to the limitations which these measures impose, a certain number of commodities in the farm products and food groups (26 in all) have been classed as "exceptional." Even though dates of revival and recession were located for these commodities in most cases, many of their price changes did not appear to have any necessary connection with the business cycle. Fitting them into the framework of general cyclical movements seemed a rather arbitrary procedure. In view of these limitations, general conclusions concerning the sequence of price movements during revival must be drawn with considerable caution.

The data are in such shape, however, that the abnormal and erratic commodities may be readily eliminated, and only those retained which are fairly consistent in responding to general upward

movements of prices during revival. This has been done in preparing the table which follows. The 26 exceptional commodities have been excluded. All commodities which did not, in their price movements, reflect at least 8 of the 11 revivals which occurred during the period studied have been omitted from this list. Finally, all commodities for which the measures of inconsistency exceed 8.0 have been excluded. There remain, after these various eliminations, 66 commodities the prices of which reflected with some degree of consistency the general revivals in business. These appear below, listed in the order of their average dates of revival.

TABLE 28

SEQUENCE OF REVIVAL IN THE PRICES OF A SELECTED GROUP OF COMMODITIES, WITH MEASURES OF INCONSISTENCY

(This table is restricted to the 66 commodities which were most consistent in their price movements during revival.)

(1) Ref. No.	(2) Commodity	(3) No. of price revivals	(4) Average deviation from reference date (in mos.)	(5) Measure of inconsistency
42	Hides	11	—7.0	6.1
17	Sheep, ewes	11	—5.7	7.5
13	Cattle	11	—5.5	7.2
228	Silk, raw, extra-extra	11	—3.4	5.4
138	Lard	9	—2.6	6.0
15	Hogs, heavy	11	—2.5	7.4
302	Zinc, slab	10	—2.4	4.6
56	Wool, fine clothing	9	—2.1	4.0
382	Tallow	11	—1.6	5.9
362	Alcohol, wood	10	—1.5	7.9
16	Hogs, light	11	—1.2	5.7
440	Leather, sole oak	11	—1.2	5.9
451	Rubber	10	— .9	7.2
297	Lead, pipe	9	— .8	6.2
441	Leather, sole oak, scoured backs	10	— .8	4.5
59	Wool, medium	9	— .7	4.5
158	Cottonseed oil	11	— .5	5.4
221	Worsted yarns, 2-40's	10	— .5	5.8
296	Lead, pig	11	— .5	6.3
226	Silk, raw, Kansai No. 1	11	— .4	6.6
293	Copper, ingot	11	— .2	7.5
71	Mutton	11	— .1	8.0
217	Storm serge	9	— .1	7.1
327	Brick	10	0	6.0
300	Tin, pig	11	+ .1	4.5
64	Beef, fresh	11	+ .3	7.7
239	Coke	11	+ .8	4.8
438	Leather, harness oak	11	+ .8	3.6
455	Starch, laundry	8	+1.1	7.7

TABLE 28 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price revivals	(4) Average deviation from reference date (in mos.)	(5) Measure of inconsistency
295	Copper wire	11	+1.3	6.2
433	Cottonseed meal	10	+1.4	5.7
263	Pig iron, foundry no. 2, southern	11	+1.5	3.4
68	Beef, salt	10	+1.9	7.8
220	Worsted yarns, 2-32's	11	+1.9	5.8
195	Print cloths	10	+2.0	6.3
247	Petroleum, crude	9	+2.4	7.3
267	Bar iron, Pitts.	11	+2.9	6.1
47	Milk	11	+3.1	7.3
261	Pig iron, foundry no. 2, northern	11	+3.1	4.6
294	Copper, sheet	10	+3.1	7.9
25	Cotton	10	+3.2	7.2
260	Pig iron, Bessemer	11	+3.2	5.2
266	Bar iron, Phila.	11	+3.5	5.9
276	Steel billets	11	+3.6	6.4
289	Wire, fence	10	+3.6	5.6
317	Pine, yellow siding	8	+3.6	5.5
206	Flannels, white	9	+3.7	6.8
248	Petroleum, refined, for export	8	+4.0	7.2
173	Men's shoes, chocolate elk	8	+4.1	4.9
191	Muslin, Lonsdale	11	+4.9	5.3
180	Denims	10	+5.0	7.5
259	Pig iron, basic	11	+5.1	4.5
423	Sheetings, 10-4 Pepperell	11	+5.1	7.6
198	Sheetings, 4-4 Ware Shoals	10	+5.3	6.4
291	Screws, wood	9	+5.6	6.5
417	Carpets, Axminster	8	+5.9	4.3
179	Calico	10	+6.0	7.8
210	Suiting, Middlesex	8	+6.0	7.5
306	Hemlock	8	+6.4	6.4
197	Sheetings, 4-4 Pepperell R	11	+6.8	7.4
269	Nails, wire	10	+7.1	5.8
184	Flannel, unbleached	9	+8.1	7.4
181	Drillings, Pepperell	10	+8.3	7.7
193	Muslin, Wamsutta	10	+9.9	5.4
400	Quinine	8	+11.0	7.2
288	Vises	9	+11.1	6.8

Of the 66 commodities here listed 23, or about 35 per cent of the total, precede the general revival of prices, on the average. The values range from the entry for hides, which has moved upward 7 months before a general price up-turn, to that for vises, which has turned 11 months after the index. The averages for all but 10 of the commodities fall within a range of 10 months, from —3 to +7.

We may carry the selective process further. In making up the following table there have been excluded the 26 exceptional commodities, all commodities which fail to reflect, in their price move-

ments, all the revivals (11 in number) between 1892 and 1925, and all those for which the measure of inconsistency exceeds 6.5. The small group left includes only those of the 209 commodities which were most consistent in their movements during periods of revival. There are 20 price series in this group, representing 16 commodities.

TABLE 29

SEQUENCE OF REVIVAL IN THE PRICES OF A SELECTED GROUP OF COMMODITIES, WITH MEASURES OF INCONSISTENCY

(This table is restricted to the 20 commodities which were most consistent in their price movements during revival.)

(1) Ref. No.	(2) Commodity	(3) Average deviation from reference date (in months)	(4) Measure of inconsistency
42	Hides	—7.0	6.1
228	Silk	—3.4	5.4
382	Tallow	—1.6	5.9
440	Leather, sole oak	—1.2	5.9
16	Hogs	—1.2	5.7
296	Lead, pig	— .5	6.3
158	Cottonseed oil	— .5	5.4
300	Tin pig	+ .1	4.5
438	Leather, harness oak	+ .8	3.6
239	Coke	+ .8	4.8
295	Copper wire	+1.3	6.2
263	Pig iron, foundry no. 2, southern	+1.5	3.4
220	Worsted yarns, 2-32's	+1.9	5.8
267	Bar iron, Pitts.	+2.9	6.1
261	Pig iron, foundry no. 2, northern	+3.1	4.6
260	Pig iron, Bessemer	+3.2	5.2
266	Bar iron, Phila.	+3.5	5.9
276	Steel billets	+3.6	6.4
191	Muslin	+4.9	5.3
259	Pig iron, basic	+5.1	4.5

The metals and metal products group, within which fall 10 of the 20 series, dominate this list. Because of the selective process employed in constructing this table considerable confidence may be attached to it, as indicating a sequence which, while not invariable, seems to have held in general during revival.

The following table permits a comparison of a selected list of commodities in respect to consistency in the timing of their price movements during revival. All those commodities which were not classed as exceptional and which passed through 9 cycles or more during the period from 1890 to 1925 have been included. Eighty four price series are in this list.

TABLE 30

CYCLES IN COMMODITY PRICES, AT WHOLESALE

RANKING OF EIGHTY FOUR PRICE SERIES ACCORDING TO THE CONSISTENCY OF THEIR MOVEMENTS DURING BUSINESS REVIVALS

(The commodities for which the measures in column (4) are lowest are those which were most consistent in relation to the general price index during revival.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Measure of inconsistency in timing of revival
263	Pig iron, foundry no. 2, southern	10	3.4
438	Leather, harness oak	9	3.6
259	Pig iron, basic	10	4.5
300	Tin pig	10	4.5
441	Leather, sole oak, scoured backs	9	4.5
302	Zinc, slab	9	4.6
261	Pig iron, foundry no. 2, northern	10	4.6
239	Coke	10	4.8
260	Pig iron, Bessemer	10	5.2
191	Muslin, Lonsdale	10	5.3
158	Cottonseed oil	10	5.4
228	Silk, raw, extra-extra	10	5.4
193	Muslin, Wamsutta	9	5.4
289	Wire, fence	9	5.6
16	Hogs, light	10	5.7
433	Cottonseed meal	9	5.7
221	Worsted yarns, 2-40's	9	5.8
269	Nails, wire	9	5.8
220	Worsted yarns, 2-32's	10	5.8
382	Tallow	10	5.9
266	Bar iron, Phila.	10	5.9
440	Leather, sole oak	10	5.9
327	Brick	9	6.0
42	Hides	10	6.1
267	Bar iron, Pitts.	10	6.1
295	Copper wire	10	6.2
195	Print cloths	9½	6.3
296	Lead, pig	10	6.3
198	Sheetings, 4-4, Ware Shoals	9	6.4
276	Steel billets	10	6.4
291	Wood screws	9	6.5
226	Silk, raw, Kansai No. 1	10	6.6
25	Cotton	9½	7.2
13	Cattle, choice to prime	10	7.2
451	Rubber	9	7.2
47	Milk	10	7.3
197	Sheetings, 4-4 Pepperell	10	7.4
15	Hogs, heavy	10	7.4
180	Denims	9½	7.5
293	Copper, ingot	10	7.5
17	Sheep, ewes	10	7.5
423	Sheetings, 10-4 Pepperell	10	7.6
181	Drillings, Pepperell	9½	7.7
64	Beef, fresh	10	7.7
68	Beef, salt	9	7.8

TABLE 30 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Measure of inconsistency in timing of revival
179	Calico	9	7.8
294	Copper, sheet	9	7.9
362	Alcohol, wood	9	7.9
71	Mutton	10	8.0
190	Muslin, Fruit of the Loom	10	8.0
436	Leather, calf	10	8.1
430	Tickings	9½	8.3
69	Hams	10	8.3
348	Linseed oil	10	8.3
19	Sheep, wethers	10	8.4
319	Poplar	9	8.4
196	Sheetings, 4-4 Indian Head	9½	8.5
14	Cattle, good to choice	10	8.8
298	Quicksilver	9	8.8
345	Glass, window, B	10	8.8
186	Ginghams, Lancaster	9	8.8
203	Cotton yarns, cones 22/1	10	9.1
74	Pork, cured, salt mess	10	9.1
448	Jute	10	9.1
344	Glass, window, A	9	9.1
139	Meal, corn, fine white	9	9.2
140	Meal, corn, yellow, table	9	9.2
76	Pork, short clear sides	9	9.7
75	Pork, rough sides	9	9.7
202	Cotton yarns, cones 10/1	9½	9.7
115	Mackerel	9	9.8
53	Rice	9	9.8
130	Prunes	10	10.8
185	Ginghams, Amoskeag	10	10.8
321	Spruce	9	10.9
450	Rope	10	10.9
192	Muslin, Rough Rider	10	10.9
353	Turpentine, spirits of	9	11.2
350	Rosin	9	11.4
354	Lead, carbonate of	10	11.7
397	Opium	9	11.7
109	Coffee	10	12.5
236	Bituminous coal, Kanawha	9½	13.2
182	Drillings, Mass. D	9½	13.3

The measures of inconsistency range from 3.4 for one grade of pig iron to 13.3 for cotton drillings, the mean being 7.7. Detailed comment on the table is unnecessary.

c. *Duration of Periods of Rising Prices.* The rising prices which are initiated by the turns described in the preceding section endure for varying periods. For the fifteen selected commodities included in the following table the averages range from 13.7 months for bituminous coal to 57.6 months for steel rails. (The latter

figure relates to a commodity which went through but 5 complete cycles during the years from 1890 to 1925, which fact accounts for the extremely high average.) In presenting the individual averages the commodities are ranked in the order of magnitude of the measure of duration.

TABLE 31

CYCLES IN COMMODITY PRICES, AT WHOLESALE

Ranking of Fifteen Commodities according to Average Duration of the Period of Rising Prices

(1) Ref. No.	(2) Commodity	(3) Average duration of rising prices (in months)
236	Bituminous coal	13.7
259	Pig iron	14.8
276	Steel billets	16.7
293	Copper, ingot	18.6
233	Anthracite coal	19.7
239	Coke	20.7
195	Print cloths	21.7
202	Cotton yarns	22.6
25	Cotton	23.2
451	Rubber	23.7 (22.4)
64	Beef	24.4
441	Leather	26.2 (19.2)
13	Cattle	27.1
247	Petroleum	29.9 (25.0)
280	Steel rails	57.6 (18.5)

For comparison with the above entries the corresponding figures relating to seven general economic series are given in the next table.

TABLE 32

CYCLES IN SELECTED ECONOMIC SERIES

Ranking of Seven Series according to the Average Duration of Period of Rise

(1) Series	(2) Average duration of rise (in months)	(3) Average duration of rise as percentage of average duration of cycle
Yield on fifteen railroad bonds	17.6	44.4
Interest rate on call loans	22.4	58.0
Index of industrial stock prices (Dow-Jones)[1]	23.4	59.4
Index of wholesale commodity prices (U. S. B. of L. S.)	23.4	60.8
Discount rate on 60-90 day paper	24.5	63.1
Index of general business conditions (A. T. & T.)	26.0	65.5
Pig iron production	27.6	69.2

[1]The average duration of rise for Macaulay's index of railroad stock prices was 22.6 months, this being 56.6 per cent of the average duration of the cycle.

Measures showing the average duration of the periods of rising prices for all the commodities studied are given in Table XVI, in the Appendix. The commodities are listed by groups, in order of magnitude of the averages.

In computing the averages upon which the ranking is based all periods of rising prices, whether they extended over one or several cycles in general business, have been included. In computing the second averages in Table 31 and in Table XVI (the figures in parentheses) those periods of rise which extended over more than one phase of revival have been excluded. In using these figures, as in using all the averages given in this section, attention should be paid to the number of entries upon which a given measure is based. This information may be had from Appendix Table XII.

As with the other measures studied, the duration of the period of rise varies considerably. The shortest period, if we restrict the comparison to commodities which reflected all the cyclical movements, is that for pig iron (commodity no. 259). The price of this commodity rose, on the average, for but 14.8 months before recession set in. The longest average rise for commodities which passed through all the cycles is 27.1 months, which was recorded for the prices of cattle and raw silk.

There have been included in Table 32 figures giving the percentage relation of the average period of rise to the average duration of the cycle for individual series. As was pointed out at an earlier point, there are important differences between economic series in respect to the make-up of the complete cycle. Some series have a short period of rise and a long period of decline, while others have a relatively long period of rise and a sharp, short recession. The only one of the general series listed for which the average duration of the period of rise is less than 50 per cent of the complete cycle is that showing the yield on fifteen railroad bonds. (A measure relating to the *price* of railroad bonds would show a period of rise constituting more than 50 per cent of the complete cycle.)

Similar percentages have not been given for the price series listed in Table 31 because of the variation in the number of cycles through which the different series passed. To render such percentages comparable the effect of "missed" cycles must be eliminated. This has been done in preparing Table 33. There have been omitted from this table all those commodities (59 in number) the prices of which passed through less than 5 distinct cycles between 1890 and 1925. As defined in preparing this one table, a "cycle" consists of

a period of rise and the ensuing period of decline, the rise and decline together not extending over more than one complete cycle in general business. (As generally used throughout this study, the cycle is less narrowly defined. That term is used to describe a period of rise and the ensuing period of fall, whether this rise and fall extend over one or more than one cycle in general business.) This narrowing of the definition validates the comparison of percentages of the type given in Tables 32 and 33. Table 33 includes data relating to 150 commodities, each of which in its price movements reflected from 5 to 10 cycles. For each of these commodities there are given the number of cycles (as above defined) through which it passed, the average duration of the period of rise, the average duration of the cycle, and the percentage relation of the two latter measures.[1]

The percentages show a wide variation, ranging from 35.1 to 82.4, the figures for door knobs and wrapping paper, respectively. If the comparison be restricted for the moment to those commodities which passed through all 10 cycles, the range is from 39.2 per cent for pig iron to 73.2 per cent for cattle. The usual cycle, for pig iron prices, consists of a short period of rise and a long period of decline; for the price of cattle it consists of a long rise, covering three-quarters of the cycle, and a sharp decline.

For only 33 of the 150 commodities represented in the table is the period of rising prices shorter than the period of decline. For commodities in general the typical cycle consists of a period of rise distinctly longer than the ensuing period of fall. For the great bulk of commodity prices at wholesale the period of rise covers from 50 per cent to 70 per cent of the total length of the cycle.

In interpreting Table 33 due account should be taken of the commodities which are starred as exceptional. The description of their price movements in terms of "cycles" involves some arbitrary classifications, since their price fluctuations reflect in considerable part the influence of forces which are not closely related to cycles in industry or business.

[1]The figures for number of cycles, duration of rise and duration of cycle, as given in Table 33, do not agree, in all cases, with the entries in Tables XII, XIII and XVI. This is because of the narrower definition of the cycle and of its constituent phases which was followed in preparing Table 33.

In computing the average duration of rise given in Table 33 only those periods of rise have been included which extended over but one phase of revival (and prosperity) and which were followed by a period of fall which extended over but one phase of recession (and depression). This double condition is necessary because the object of study is the relation of the period of rise to the length of the complete cycle. Only the first of these two conditions applied in computing the second entries in Table XVI. Interest here attached only to the period of rise, as a distinct phenomenon.

TABLE 33

CYCLES IN COMMODITY PRICES, AT WHOLESALE

RANKING OF 150 COMMODITIES ACCORDING TO THE PERCENTAGE RELATION OF THE AVERAGE PERIOD OF RISING PRICES TO THE AVERAGE LENGTH OF THE PRICE CYCLE

(The commodities in this list include all those which, between 1890 and 1925, passed through five or more distinct cycles, corresponding to cycles in general business.)[1]

(1) Ref No.	(2) Commodity	(3) No. of cycles	(4) Duration of rise, average (mos.)	(5) Duration of cycle, average (mos.)	(6) Duration of rise as percentage of duration of cycle
253	Door knobs	6	13.7	39.0	35.1
236	Bituminous coal, Kanawha	9	14.7	39.9	36.8
355	Zinc, oxide of	6	13.3	35.2	37.8
259	Pig iron, basic	10	14.8	37.8	39.2
433	Cottonseed meal	8	15.1	38.0	39.7
116	Salmon	6	17.0	42.5	40.0
288	Vises	6	15.8	39.5	40.0
130	Prunes	10	16.2	39.1	41.4
173	Men's shoes, chocolate elk	6	15.2	36.7	41.4
295	Copper wire	10	16.6	39.0	42.6
152	*Tea	9	16.9	38.8	43.6
276	Steel billets	10	16.7	38.1	43.8
258	Locks	6	17.3	39.3	44.0
249	Petroleum, refined	5	18.8	42.6	44.1
261	Pig iron, foundry no. 2, northern	10	16.7	37.8	44.2
128	*Apples	8	17.6	39.7	44.3
238	Bituminous coal, Pocahontas	7	17.4	39.1	44.5
324	Shingles	6	16.5	37.0	44.6
49	*Onions	10	17.0	37.4	45.5
260	Pig iron, Bessemer	10	17.3	38.0	45.5
267	Bar iron, Pitts.	10	17.8	39.1	45.5
129	*Currants	9	18.4	39.9	46.1
400	Quinine	6	19.8	42.5	46.6
22	*Beans	10	18.3	38.4	47.7
293	Copper, ingot	10	18.6	38.8	47.9
294	Copper, sheet	9	18.7	38.7	48.3
301	Zinc	7	17.6	36.1	48.8
274	Shovels	5	18.6	38.0	48.9
115	Mackerel	9	20.6	41.9	49.2
181	Drillings, Pepperell	9	18.9	38.3	49.3
251	Butts	6	18.5	37.5	49.3
141	Molasses	5	22.8	45.8	49.8
263	Pig iron, foundry no. 2, southern	10	19.2	38.5	49.9
198	Sheetings, 4-4 Ware Shoals	8	20.3	40.4	50.2
179	Calico	8	19.9	39.6	50.3
436	Leather, calf	10	20.1	39.7	50.6
44	*Hops	6	22.5	44.3	50.8
5	*Rye	7	19.3	37.9	50.9
266	Bar iron, Phila.	10	20.1	39.2	51.3
302	Zinc, slab	9	20.1	39.2	51.3
2	*Corn	9	20.4	39.7	51.5
269	Nails, wire	8	20.0	38.7	51.7

TABLE 33 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Duration of rise, average (mos.)	(5) Duration of cycle, average (mos.)	(6) Duration of rise as percentage of duration of cycle
327	Brick	8	20.0	38.5	51.9
119	*Flour, wheat	7	21.7	41.6	52.2
220	Worsted yarns, 2-32's	10	19.9	38.1	52.2
195	Print cloths	9	20.9	39.9	52.4
193	Muslin, Wamsutta	9	20.8	39.6	52.5
393	Alcohol, grain	7	20.6	39.1	52.7
438	Leather, harness oak	8	19.1	36.2	52.8
109	Coffee	10	19.9	37.6	52.9
53	Rice	8	21.0	39.6	53.0
37	*Hay	7	21.7	40.9	53.1
299	Silver	7	21.7	40.9	53.1
161	*Vinegar	8	20.9	39.2	53.3
424	Sheeting, 10-4 Wamsutta	7	20.6	38.6	53.4
319	Poplar	8	21.0	39.0	53.8
4	*Oats	9	22.2	41.2	53.9
16	Hogs, light	10	20.7	38.4	53.9
202	Cotton yarns, cones 10/1	9	21.6	39.9	54.1
441	Leather, sole oak, scoured backs	8	19.2	35.5	54.1
192	Muslin, Rough Rider	10	20.0	36.8	54.3
15	Hogs, heavy	10	21.2	38.8	54.6
239	Coke	10	20.7	37.9	54.6
451	Rubber	8	22.4	40.7	55.0
344	Glass, window, A	8	21.6	39.2	55.1
443	Paper, newsprint	7	21.3	38.6	55.2
74	Pork, salt mess	10	21.1	38.1	55.4
321	Spruce	8	22.1	39.9	55.4
138	Lard	6	22.2	40.0	55.5
308	Maple	5	20.4	36.6	55.7
350	Rosin	8	20.6	37.0	55.7
248	Petroleum, refined for export	5	21.4	38.2	56.0
197	Sheetings, 4-4 Pepperell R	10	22.5	40.0	56.3
146	*Salt	7	21.7	38.4	56.5
289	Wire, fence	9	22.3	39.4	56.6
450	Rope	10	22.0	38.8	56.7
25	Cotton	9	22.1	38.7	57.1
196	Sheetings, 4-4 Indian Head	9	22.4	39.0	57.4
291	Screws, wood	8	23.1	40.2	57.5
203	Cotton yarns, cones 22/1	10	23.7	40.8	58.1
247	Petroleum, crude	6	21.9	37.7	58.1
51	*Potatoes	10	22.8	39.1	58.3
296	Lead, pig	10	22.1	37.9	58.3
90	*Butter, dairy	10	23.3	39.9	58.4
158	Cottonseed oil	10	22.6	38.5	58.7
75	Pork, rough sides	8	24.4	41.4	58.9
352	Tar	8	25.0	42.4	59.0
1	*Barley	10	22.1	37.3	59.2
423	Sheetings, 10-4 Pepperell	10	23.0	38.8	59.3
180	Denims	9	23.4	39.2	59.7
300	Tin, pig	10	23.3	38.9	59.9
298	Quicksilver	8	20.2	33.6	60.1

TABLE 33 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Duration of rise, average (mos.)	(5) Duration of cycle, average (mos.)	(6) Duration of rise as percentage of duration of cycle
69	Hams	10	23.9	39.7	60.2
345	Glass, window, B	10	24.0	39.9	60.2
89	*Butter, N. Y.	10	24.0	39.8	60.3
95	*Butter, St. Louis	10	24.0	39.8	60.3
117	*Flour, rye	5	30.2	50.0	60.4
59	Wool, medium	7	22.8	37.7	60.5
210	Suiting, Middlesex	5	21.4	35.4	60.5
149	*Sugar, raw	8	25.5	42.1	60.6
448	Jute	10	23.4	38.6	60.6
297	Lead, pipe	8	24.1	39.7	60.7
76	Pork, short clear sides	8	25.0	41.1	60.8
185	Ginghams, Amoskeag	10	25.0	41.0	61.0
131	Raisins	5	26.2	42.8	61.2
430	Tickings	9	23.3	38.1	61.2
312	Oak, white quartered	7	23.9	38.9	61.4
382	Tallow	10	23.5	38.3	61.4
113	Cod	8	26.8	43.5	61.6
354	Lead, carbonate of	10	24.1	39.0	61.8
440	Leather, sole oak, in sides	10	24.1	38.9	62.0
397	Opium	9	24.4	39.2	62.2
150	*Sugar, granulated	8	26.6	42.7	62.3
145	Pepper	6	26.3	42.0	62.6
191	Muslin, Lonsdale	10	23.8	38.0	62.6
64	Beef, fresh	10	24.4	38.9	62.7
99	*Cheese	10	24.9	39.3	63.4
71	Mutton	10	25.1	39.5	63.5
56	Wool, fine clothing	7	24.0	37.7	63.7
237	Bituminous coal, New River	7	24.0	37.7	63.7
68	Beef, salt	8	23.1	36.1	64.0
17	Sheep, ewes	10	24.5	38.2	64.1
34	*Flaxseed	6	25.2	39.3	64.1
353	Turpentine	8	25.7	40.1	64.1
120	*Flour, wheat	7	26.1	40.4	64.6
42	Hides	10	24.9	38.3	65.0
221	Worsted yarns, 2-40's	8	27.0	41.5	65.1
186	Ginghams, Lancaster	8	25.3	38.8	65.2
19	Sheep, wethers	10	24.8	38.0	65.3
182	Drillings, Mass. D	9	25.4	38.9	65.3
216	Serge, French	5	30.2	46.2	65.4
396	Glycerine	7	22.9	34.9	65.6
14	Cattle, good to choice	10	25.7	38.9	66.1
31	*Eggs	6	24.0	36.2	66.3
47	Milk	10	25.5	38.4	66.4
313	Pine, white boards	5	28.4	42.4	67.0
217	Serge, storm	7	29.0	43.1	67.3
348	Linseed oil	10	25.9	38.5	67.3
226	Silk, raw, Kansai No. 1	10	26.5	39.1	67.8
139	Meal, corn, fine white	9	27.4	40.3	68.0
183	Flannel, colored	7	26.1	38.1	68.5
190	Muslin, Fruit of the Loom	10	26.3	38.2	68.8

TABLE 33 (Conc)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Duration of rise, average (mos.)	(5) Duration of cycle, average (mos.)	(6) Duration of rise as percentage of duration of cycle
417	Carpets, Axminster	5	29.6	42.8	69.2
228	Silk, raw, extra-extra	10	27.1	39.0	69.5
184	Flannel, unbleached	8	26.9	38.5	69.9
362	Alcohol, wood	8	27.4	38.6	71.0
206	Flannels, white	7	27.0	37.7	71.6
140	Meal, corn, yellow table	9	29.1	40.3	72.2
13	Cattle, choice to prime	10	27.1	37.0	73.2
444	Paper, wrapping	5	31.8	38.6	82.4

*The commodities marked with an asterisk have price movements which are irregular, in the sense that they do not conform in any systematic fashion to the cyclical movements of general prices.

[1]It seems desirable to give, for the remainder of the 209 commodities included in this analysis, the number of recorded cycles, as defined in preparing the above table. The following list includes 59 commodities the prices of which passed through less than five cycles, as defined for the present purpose.

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(1) Ref. No.	(2) Commodity	(3) No. of cycles
6	Wheat	4	287	Trowels	0
104	Bread, Cincinnati	0	306	Hemlock	4
106	Bread, N. Y.	3	310	Oak, white plain	2
111	Crackers, oyster	3	317	Pine, yellow	3
112	Crackers, soda	4	323	Shingles	3
114	Herring	4	335	Doors	3
148	Starch, corn	1	338	Lime	3
166	Men's shoes, black calf	2	349	Putty	3
174	Men's shoes, vici kid	0	357	Acid, muriatic	3
177	Women's shoes	3	360	Acid, sulphuric	2
199	Cotton thread	2	363	Alum	3
213	Underwear, shirts and drawers	1	377	Soda, bicarbonate of	3
214	Underwear, union suits	0	381	Sulphur, brimstone	3
215	Broadcloth	3	405	Bedroom chairs	1
218	Poplar cloth	3	406	Bedroom sets	2
219	Sicilian cloth	3	412	Kitchen chairs	4
223	Linen shoe thread	0	414	Kitchen tables	0
232	Anthracite coal, broken	3	418	Carpets, Brussels	3
233	Anthracite coal, chestnut	3	419	Carpets, Wilton	3
234	Anthracite coal, egg	2	422	Pails	2
235	Anthracite coal, stove	2	425	Nappies	0
244	Matches	0	426	Pitchers	3
250	Augers	2	427	Tumblers	2
252	Chisels	2	428	Plates, white granite	0
254	Files	2	429	Teacups and saucers	0
255	Hammers	2	431	Tubs	1
271	Planes	0	455	Starch, laundry	4
272	Saws, crosscut	0	456	Tobacco, plug	1
273	Saws, hand	0	457	Tobacco, smoking	0
280	Steel rails	4			

Reference should be made, in using this table, to the column showing the number of cycles upon which the percentages are based. The figures are, of course, most representative for those commodities which passed through all 10 cycles. The figures do not lose significance if based upon less than 10 cycles, but their

usefulness for purposes of comparison is somewhat lessened. This is so because business cycles vary in length, in the relative duration of their constituent phases, and in other characteristics.

To complete the information concerning individual commodities which Table 33 yields, there is shown in a footnote the number of cycles, as defined in the construction of this table, through which the prices of the 59 excluded commodities passed.

The only remaining figures relating to price behavior during revival are those showing the average percentages of rise. These are given in column (9) of Table XII (as percentages of the low values) and in column (19) (as percentages of the ensuing high values). With minor exceptions the ranking of commodities on the basis of this measure would be the same as the ranking on the basis of cyclical variability, which is shown in Table XIV. This ranking need not be repeated.

4. Behavior of Commodity Prices During Recession

In following the behavior of commodity prices during recession, interest will attach not only to the actual values of the individual measures, but to such differences as may be observed between the behavior of individual commodities at the time of recession and the behavior of these commodities during revival.

a. *Degree of Conformity to General Price Movements during Recession.* The exceptions to the general movements of price recession may first be noted. Two of the fifteen selected commodities were constant in price during general price recessions. These were anthracite coal (constant during 4 out of 10 recessions) and steel rails (constant during 5 of the 10 recessions). Only one of these fifteen commodities, petroleum, was marked by sagging prices during a period when a turn downward from a high point was being recorded for prices in general. Four registered rising prices during recessions. Petroleum, leather and rubber each rose during one period of general recession, and anthracite coal rose during three periods of recession.

Table XII in the Appendix gives information of this type for all the commodities studied. The various individual entries relating to behavior at recession are summarized in the following table. The data available relate to 209 commodities during 10 periods of recession. The 2090 observations are divided as follows:

TABLE 34

BEHAVIOR OF ALL COMMODITIES DURING PRICE RECESSIONS

(1) Nature of entry	(2) No. of entries	(3) Percentage of total
Specific date (for beginning of recession)	1629	77.9
Constant	241	11.5
Sagging	95	4.6
Rising	125	6.0
Total	2090	100.0

These figures correspond rather strikingly to those entered in Table 25, relating to behavior during revival. On the average, almost 80 per cent of all wholesale commodity prices have been affected by general price recessions, and in about half of the remaining cases prices have been constant. The small differences between the number entered as sagging and the number entered as rising in Tables 25 and 34 are natural. After depression a rather larger fraction would be expected to continue to sag, and after revival one would expect a somewhat larger percentage to continue to rise, than in the reverse situations.

b. *Sequence of Change in Commodity Prices during Recession.* The average order in which the prices of fifteen selected commodities have changed during general price recessions is shown below.

TABLE 35

SEQUENCE OF RECESSION IN SELECTED WHOLESALE PRICE SERIES, WITH MEASURES OF INCONSISTENCY

Ranking of Fifteen Commodities according to the Timing of Price Recession, 1890-1925

(The figures in column (4) measure deviations, in months, from the date when the general index of wholesale prices reached its highest point, preceding recession. The sign (—) indicates a price recession *preceding* that in general prices; the sign (+) indicates a price recession *lagging behind* the recession in general prices.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
451	Rubber	9	—6.4	9.9
293	Copper, ingot	10	—3.7	5.4
259	Pig iron	10	—2.2	4.8
276	Steel billets	10	—2.0	2.9
13	Cattle	10	—1.5	5.5
441	Leather	9	—1.5	6.8
239	Coke	10	— .5	7.6
195	Print cloths	10	+ .9	7.0
64	Beef	10	+1.2	6.0
236	Bituminous coal	10	+2.2	5.0
25	Cotton	10	+3.3	5.8
202	Cotton yarns	10	+3.7	6.2
280	Steel rails	5	+5.5	5.7
233	Anthracite coal	3	+6.3	7.4
247	Petroleum	8	+6.9	8.4

In the computation of the averages given in column (4) and the measures in column (5), the entries for period 16 have been omitted, though the number of recessions entered in column (3) includes all the price recessions between 1890 and 1925. Period 16 has been omitted in computing the average date of recession and the measures of inconsistency because of the abnormal conditions created by war-time expansion and price regulation. It is believed that a more representative figure has been secured by this omission.

Following are the corresponding measures for seven general economic series. Results based upon all periods are given, in addition to those in which the entries for period 16 have been omitted. The latter should be employed in making comparisons with the measures relating to commodity prices.

TABLE 36

SEQUENCE OF RECESSION IN SEVEN ECONOMIC SERIES, WITH MEASURES OF INCONSISTENCY

(1) Series	(2) Average deviations from reference date (in months)	(3)	(4) Measures of inconsistency	(5)
	All periods	All periods except no. 16	All periods	All periods except no. 16
Index of industrial stock prices (Dow-Jones)[1]	—9.5	—8.1	7.3	6.4
Index of general business conditions (A. T. & T.)	—1.8	—1.9	2.6	2.7
Interest rate on call loans	— .8	—1.0	5.5	5.8
Pig iron production	— .5	— .5	4.8	5.1
Index of wholesale prices (U. S. B. of L. S.)	0	0	0	0
Discount rate on 60-90 day commercial paper	+4.1	+4.4	4.8	5.0
Yield on fifteen railroad bonds	+5.0	+5.5	7.7	8.0

[1]Corresponding measures for Macaulay's index of railroad stock prices, in the order in which the above items appear, are −8.8, −7.2, 6.7 and 5.0. It is worthy of note that both measures of inconsistency are lower than for industrial stock prices.

It is a significant fact that with one exception the measures of inconsistency relating to the dates of recession in these general series are lower than the corresponding measures relating to dates of revival. During periods of recession these general series, with the single exception of the stock price index, move with greater consistency (i. e. there is less variation in the observed sequence from cycle to cycle) than at the phases of revival.

Similar changes are observable in the relations between the price series listed in Tables 26 and 35. There are some notable dif-

ferences between the degrees of lead and lag observable in the prices of individual commodities during revival and recession, and there are a few radical shifts in time relationships. None of the four commodities that lead during revival lags during recession, but three important commodities that lag on revival undergo a price recession before the general index. These are pig iron, which lags by 5.1 months on revival and leads by 2.2 months during recession; steel billets, that lag by 3.6 months on revival and lead by 2.0 months on recession; and coke, that lags by .8 of a month on revival and leads by .5 of a month on recession. It is worthy of note that pig iron production, which on revival leads pig iron prices by 9.3 months, lags behind pig iron prices during recession by 1.7 months. Iron and steel prices appear to pick up tardily on revival, but feel the influence of impending recession before the general price structure is affected.

For 8 of the 15 commodities listed above the measures of inconsistency are smaller for the recession phase than for the phase of revival. The inconsistency measure for steel billets is the smallest in the group, having a value of 2.9. This is materially below the value of 6.4, recorded for the same commodity during revivals.

The average time of recession for each of the commodities included in the general study is given in Appendix Table XVII. Of the total number of commodities (209) 74 have, on the average, preceded the general index during periods of price recession. These constitute 35.4 per cent of the total. This figure is somewhat greater than the corresponding entry for periods of revival, which was 26.8 per cent. In both cases the bulk of the commodities lag behind the general index, but the proportion thus lagging varies from about three-quarters during revival to about two-thirds during recession.

The extreme entries in this table range from —16.4, for wheat (one of the exceptional commodities) to +14.0, for trowels and manila wrapping paper. Ruling out five somewhat abnormal cases, the remaining 204 entries fall between —7 and +14, a range of 21 months.

As in studying the sequence of turns during revival, it seems desirable to concentrate attention on those commodities which have been most consistent in their cyclical movements. In Table 28 there were shown figures relating to the dates of revival of the 66 most consistent commodities. It will be of interest to compare the behavior of these commodities during recession with their behavior during revival.

TABLE 37

SEQUENCE OF RECESSION IN THE PRICES OF A SELECTED GROUP OF COMMODITIES, WITH MEASURES OF INCONSISTENCY

(This group includes the 66 commodities which were most consistent in their price movements during revival.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
451	Rubber	9	—6.4	9.9
42	Hides	10	—5.7	3.1
59	Wool, medium	8	—5.6	10.0
433	Cottonseed meal	9	—4.9	7.1
56	Wool, fine clothing	8	—4.6	9.9
15	Hogs, heavy	10	—4.2	4.1
295	Copper, wire	10	—4.2	5.4
267	Bar iron, Pitts.	10	—4.0	7.7
17	Sheep, ewes	10	—3.9	3.3
16	Hogs, light	10	—3.8	3.8
293	Copper, ingot	10	—3.7	5.4
302	Zinc slab	9	—3.7	6.2
138	Lard	8	—3.3	6.1
173	Men's shoes, chocolate elk	7	—2.4	4.5
327	Brick	9	—2.4	9.5
259	Pig iron, basic	10	—2.2	4.8
261	Pig iron, foundry no. 2, northern	10	—2.2	4.1
263	Pig iron, foundry no. 2, southern	10	—2.0	4.5
276	Steel billets	10	—2.0	2.9
220	Worsted yarns, 2-32's	10	—1.9	6.7
382	Tallow	10	—1.8	5.3
221	Worsted yarns, 2-40's	9	—1.6	4.1
226	Silk, raw, Kansai No. 1	10	—1.6	5.4
13	Cattle, choice to prime	10	—1.5	5.5
441	Leather, sole oak, scoured backs	9	—1.5	6.8
317	Pine, yellow siding	5	—1.4	3.2
294	Copper, sheet	9	—1.2	5.7
260	Pig iron, Bessemer	10	—1.1	3.7
297	Lead pipe	8	—1.0	5.1
158	Cottonseed oil	10	— .6	4.6
239	Coke	10	— .5	7.6
296	Lead, pig	10	— .4	6.4
266	Bar iron, Phila.	10	— .3	4.2
228	Silk, raw, extra-extra	10	— .1	5.6
300	Tin, pig	10	+ .4	7.4
438	Leather, harness oak	9	+ .6	7.5
455	Starch, laundry	7	+ .7	4.9
195	Print cloths	10	+ .9	7.0
440	Leather, sole oak,	10	+ .9	6.1
64	Beef, fresh	10	+1.2	6.0
71	Mutton	10	+1.8	8.8
68	Beef, salt	9	+1.9	7.3
179	Calico	9	+2.0	3.0
198	Sheetings, 4-4 Ware Shoals	10	+2.1	7.4
289	Wire, fence	9	+2.2	5.0
362	Alcohol, wood	9	+2.5	7.0
210	Suiting, Middlesex	7	+3.0	4.8

TABLE 37 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
400	Quinine	8	+3.1	9.5
25	Cotton	10	+3.3	5.8
217	Storm serge	8	+3.7	6.9
423	Sheetings, 10-4 Pepperell	10	+3.8	6.2
288	Vises	8	+3.9	7.3
269	Nails, wire	9	+4.2	5.8
306	Hemlock	6	+4.2	3.8
47	Milk	10	+5.7	7.6
181	Drillings, Pepperell	10	+5.9	5.5
191	Muslin, Lonsdale	10	+6.0	6.1
206	Flannels, white	8	+6.0	2.1
248	Petroleum, refined for export	7	+6.1	5.3
197	Sheetings, 4-4 Pepperell R	10	+6.3	7.0
180	Denims	10	+6.7	5.9
247	Petroleum, crude	8	+6.9	8.4
291	Screws, wood	10	+6.9	7.1
417	Carpets, Axminster	7	+7.0	3.6
193	Muslin, Wamsutta	9	+7.4	4.4
184	Flannel, unbleached	9	+11.0	8.7

On revival, it was noted, 23 of the 66, or about 35 per cent, preceded the general price index. At the recession stage 34 of the 66, or almost 52 per cent of the total, precede the general index. There is a fairly marked shift here. There are, in addition, a considerable number of changes in relative position. For the commodities in this group the correlation between the averages relating to time of revival and the averages relating to time of recession is measured by a coefficient of +.67. There is a tendency, it is apparent, for the sequence which prevails during revival to prevail also during recession, but the relationship is very far from being a perfect one. Further reference is made to this point in a later section.

A survey of the general tables shows that the commodities which were most consistent during revival were not, in all cases, the most consistent during recession. Table 37 does not, accordingly, include the 66 commodities which were most consistent during recession. These appear in the following table. In preparing this table there have been excluded all exceptional commodities, all those commodities which did not reflect at least 8 of the 10 general price recessions, and all those for which the measure of inconsistency was greater than 7.2. This leaves us with a compact group of commodities which have been fairly consistent during recessions in general business.

TABLE 38

SEQUENCE OF RECESSION IN THE PRICES OF A SELECTED GROUP OF COMMODITIES, WITH MEASURES OF INCONSISTENCY

(This table is restricted to the 66 commodities which were most consistent in their price movements during recession.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
42	Hides	10	—5.7	3.1
19	Sheep, wethers	10	—4.9	4.9
433	Cottonseed meal	9	—4.9	7.1
15	Hogs, heavy	10	—4.2	4.1
295	Copper, wire	10	—4.2	5.4
17	Sheep, ewes	10	—3.9	3.3
16	Hogs, light	10	—3.8	3.8
293	Copper, ingot	10	—3.7	5.4
302	Zinc, slab	9	—3.7	6.2
138	Lard	8	—3.3	6.1
259	Pig iron, basic	10	—2.2	4.8
261	Pig iron, foundry no. 2, northern	10	—2.2	4.1
263	Pig iron, foundry no. 2, southern	10	—2.0	4.5
276	Steel billets	10	—2.0	2.9
220	Worsted yarns, 2-32's	10	—1.9	6.7
382	Tallow	10	—1.8	5.3
221	Worsted yarns, 2-40's	9	—1.6	4.1
226	Silk, raw, Kansai No. 1	10	—1.6	5.4
13	Cattle, choice to prime	10	—1.5	5.5
441	Leather, sole oak, scoured backs	9	—1.5	6.8
294	Copper, sheet	9	—1.2	5.7
260	Pig iron, Bessemer	10	—1.1	3.7
297	Lead pipe	8	—1.0	5.1
14	Cattle, good to choice	10	— .7	6.2
158	Cottonseed oil	10	— .6	4.6
296	Lead, pig	10	— .4	6.4
266	Bar iron	10	— .3	4.2
228	Silk, raw, extra-extra	10	— .1	5.6
450	Rope	10	+ .3	3.7
195	Print cloths	10	+ .9	7.0
440	Leather	10	+ .9	6.1
353	Turpentine	9	+1.0	5.6
69	Hams	10	+1.1	6.5
64	Beef, fresh	10	+1.2	6.0
179	Calico	9	+2.0	3.0
236	Bituminous coal, Kanawha	10	+2.2	5.0
289	Wire, fence	9	+2.2	5.0
298	Quicksilver	9	+2.4	5.0
362	Alcohol, wood	9	+2.5	7.0
238	Bituminous coal, Pocahontas	8	+3.0	5.4
25	Cotton	10	+3.3	5.8
202	Cotton yarns, cones 10/1	10	+3.7	6.2
217	Storm serge	8	+3.7	6.9
423	Sheetings, 10-4 Pepperell R	10	+3.8	6.2
203	Cotton yarns, cones 22/1	10	+4.2	6.9
269	Nails, wire	9	+4.2	5.8
182	Drillings, Mass. D.	10	+4.8	5.9

TABLE 38 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of price recessions	(4) Average deviation from reference date (in months)	(5) Measure of inconsistency
192	Muslin, Rough Rider	10	+4.8	6.2
319	Poplar	9	+5.2	7.0
430	Tickings	10	+5.3	6.6
190	Muslin, Fruit of the Loom	10	+5.7	6.6
181	Drillings, Pepperell	10	+5.9	5.5
191	Muslin, Lonsdale	10	+6.0	6.1
206	Flannels, white	8	+6.0	2.1
197	Sheetings, 4-4 Pepperell	10	+6.3	7.0
180	Denims	10	+6.7	5.9
237	Bituminous coal, New River	8	+6.7	6.5
291	Screws, wood	10	+6.9	7.1
396	Glycerine	8	+7.0	4.7
193	Muslin, Wamsutta	9	+7.4	4.4
321	Spruce	9	+7.8	4.7
424	Sheeting, 10-4 Wamsutta	8	+8.0	5.0
183	Flannel, colored	8	+8.7	7.0
313	Pine, white boards	8	+9.1	5.5
196	Sheetings, 4-4 Indian Head	10	+9.2	6.2
312	Oak	9	+13.0	6.7

Of the commodities in the list of 66 which are most consistent during revival, 43 are among the 66 which are most consistent during recession. The degree of consistency is on the whole higher during recession, since the group representing this phase of the cycle all have measures of inconsistency less than 7.2 in value. (For the group shown in Table 28 the upper limit of the measure of inconsistency was 8.0.) Twenty eight of the 66 commodities (42.4 per cent of the total) moved before the general price index, on the average, while 38 lagged behind.

When the measures relating to average time of recession for the 66 series most consistent during recession are correlated with corresponding revival measures for the same articles, a coefficient of +.74 is secured.

A group of commodities still more compact in respect to their movements during recession is obtained by a further narrowing of the basis of selection. If we exclude all the exceptional commodities, all those which did not reflect all 10 recessions, and all those for which the measure of inconsistency was greater than 5.5, we have the commodities in the following list.

TABLE 39

SEQUENCE OF RECESSION IN THE PRICES OF A SELECTED GROUP OF COMMODITIES, WITH MEASURES OF INCONSISTENCY

(This table is restricted to the 20 commodities which were most consistent in their price movements during recession.)

(1) Ref. No.	(2) Commodity	(3) Average deviation from reference date (in months)	(4) Measure of inconsistency
42	Hides	—5.7	3.1
19	Sheep	—4.9	4.9
15	Hogs	—4.2	4.1
295	Copper, wire	—4.2	5.4
17	Sheep	—3.9	3.3
16	Hogs	—3.8	3.8
293	Copper, ingot	—3.7	5.4
259	Pig iron, basic	—2.2	4.8
261	Pig iron, foundry no. 2, northern	—2.2	4.1
263	Pig iron, foundry no. 2, southern	—2.0	4.5
276	Steel billets	—2.0	2.9
382	Tallow	—1.8	5.3
226	Silk, raw	—1.6	5.4
13	Cattle	—1.5	5.5
260	Pig iron, Bessemer	—1.1	3.7
158	Cottonseed oil	— .6	4.6
266	Bar iron	— .3	4.2
450	Rope	+ .3	3.7
236	Bituminous coal	+2.2	5.0
181	Drillings, Pepperell	+5.9	5.5

It is a rather peculiar feature of this list that only 3 of the 20 series (relating to 15 commodities) which are most consistent on recession lag behind the general price index. This reverses the situation depicted in Table 29 relating to revival. Thirteen of the 20 series most consistent on revival lagged behind the general index. The explanation of this may be found in the behavior of members of the metals group, with their tendency to lag on revival and lead on recession. The exceptional consistency of this group makes them dominate the two lists. The fact that the most consistent commodities lead on recession and not on revival suggests that the price conditions preceding recession are somewhat the same, from recession to recession, but that there is much less consistency in the conditions preceding revival. This requires much additional proof, however.

Eleven of the 20 series which are most consistent on revival are among the 20 which are most consistent on recession. These 11 (which include hides, hogs, tallow, cottonseed oil, copper wire, 4 pig iron quotations, steel billets and bar iron) constitute, therefore, the most generally consistent group among the commodities studied.

In summary, there is presented a list of those commodities which are particularly subject to cyclical fluctuations, ranked according to the consistency in the timing of their movements during recession. The list includes 84 commodities which passed through 9 cycles or more during the period from 1890 to 1925. The commodities classed as exceptional have been excluded.

TABLE 40

CYCLES IN COMMODITY PRICES, AT WHOLESALE

RANKING OF EIGHTY FOUR PRICE SERIES ACCORDING TO THE CONSISTENCY OF THEIR MOVEMENTS DURING BUSINESS RECESSIONS

(The commodities for which the measures in columns (4) and (5) are lowest are those which were most consistent in relation to the movements of the general price index during recession.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Measure of inconsistency in timing of recession (based on all entries but those for the 16th period)	(5) Measure of inconsistency in timing of recession (based on all entries)
276	Steel billets	10	2.9	4.5
179	Calico	9	3.0	3.6
42	Hides	10	3.1	3.2
17	Sheep, ewes	10	3.3	3.2
450	Rope	10	3.7	3.5
260	Pig iron, Bessemer	10	3.7	5.2
16	Hogs, light	10	3.8	3.8
15	Hogs, heavy	10	4.1	4.0
261	Pig iron, foundry no. 2, northern	10	4.1	5.3
221	Worsted yarns, 2-40's	9	4.1	4.0
266	Bar iron, Phila.	10	4.2	4.1
193	Muslin, Wamsutta	9	4.4	5.0
263	Pig iron, foundry no. 2, southern	10	4.5	5.2
158	Cottonseed oil	10	4.6	4.8
321	Spruce	9	4.7	4.7
259	Pig iron, basic	10	4.8	5.8
19	Sheep, wethers	10	4.9	4.7
289	Wire fence	9	5.0	6.3
236	Bituminous coal, Kanawha	9½	5.0	7.0
298	Quicksilver	9	5.0	4.8
382	Tallow	10	5.3	5.1
226	Silk, raw, Kansai No. 1	10	5.4	5.2
295	Copper, wire	10	5.4	6.4
293	Copper, ingot	10	5.4	6.7
13	Cattle, choice to prime	10	5.5	6.8
181	Drillings, Pepperell	9½	5.5	6.2
353	Turpentine	9	5.6	5.6
228	Silk, raw, extra-extra	10	5.6	5.4
294	Copper, sheet	9	5.7	7.3
269	Nails, wire	9	5.8	7.2
25	Cotton	9½	5.8	5.6
180	Denims	9½	5.9	6.6
182	Drillings, Mass. D	9½	5.9	6.0
64	Beef, fresh	10	6.0	5.8

TABLE 40 (Cont.)

(1) Ref. No.	(2) Commodity	(3) No. of cycles	(4) Measure of inconsistency in timing of recession (based on all entries but those for the 16th period)	(5) Measure of inconsistency in timing of recession (based on all entries)
191	Muslin, Lonsdale	10	6.1	5.8
440	Leather, sole oak	10	6.1	8.1
192	Muslin, Rough Rider	10	6.2	5.9
196	Sheetings, 4-4 Indian Head	9½	6.2	6.7
14	Cattle, good to choice	10	6.2	6.2
202	Cotton yarns, carded, cones 10/1	9½	6.2	6.2
423	Sheetings, 10-4 Pepperell	10	6.2	5.9
302	Zinc, slab	9	6.2	12.5
296	Lead, pig	10	6.4	7.5
69	Hams	10	6.5	6.8
190	Muslin, Fruit of the Loom	10	6.6	6.3
430	Tickings	9½	6.6	6.5
220	Worsted yarns, 2-32's	10	6.7	6.4
441	Leather, sole oak, scoured backs	9	6.8	6.8
203	Cotton yarns, carded, cones 22/1	10	6.9	6.9
319	Poplar	9	7.0	6.6
197	Sheetings, 4-4 Pepperell	10	7.0	7.4
362	Alcohol, wood	9	7.0	7.2
195	Print cloths	9½	7.0	6.9
433	Cottonseed meal	9	7.1	7.1
291	Screws, wood	9	7.1	8.5
68	Beef, salt	9	7.3	7.3
186	Ginghams, Lancaster	9	7.3	7.0
198	Sheetings, 4-4 Ware Shoals	9	7.4	7.1
300	Tin, pig	10	7.4	7.1
354	Lead, carbonate of	10	7.5	7.1
115	Mackerel	9	7.5	7.1
438	Leather, harness oak	9	7.5	7.1
239	Coke	10	7.6	8.2
47	Milk	10	7.6	7.3
267	Bar iron, Pittsburgh	10	7.7	7.9
185	Ginghams, Amoskeag	10	7.7	7.3
448	Jute	10	8.1	7.7
348	Linseed oil	10	8.1	7.7
139	Meal, corn, fine white	9	8.5	8.6
140	Meal, corn, yellow table	9	8.6	6.1
71	Mutton	10	8.8	8.6
74	Pork, cured, salt mess	10	8.8	8.4
436	Leather, calf	10	8.9	10.3
76	Pork, cured, short clear sides	9	8.9	8.6
350	Rosin	9	9.3	8.7
327	Brick	9	9.5	9.5
75	Pork, cured, rough sides	9	9.5	9.2
451	Rubber	9	9.9	9.6
130	Prunes	10	10.8	10.6
53	Rice	9	11.2	10.6
345	Glass, window, B	10	11.4	10.9
109	Coffee	10	11.4	11.8
344	Glass, window, A	9	12.1	11.5
397	Opium	9	12.2	11.7

In the computation of the measures of inconsistency given in column (4) of the above table, entries relating to the 16th period (centering at September, 1918) have been omitted, because of the influence of price regulation and war-time disturbances upon these entries. It is these measures which have been given in earlier tables. A second set of measures, in the computation of which all entries relating to recession have been employed, is given in column (5). These are comparable in all respects to the measures describing consistency of revival, which were given in Table 30. The ranking of commodities in Table 40 is based upon the entries in column (4), which are probably more representative than are those in the fifth column.

The measures of inconsistency in column (4) range from 2.9 for steel billets to 12.2 for opium, the mean value of the measures being 6.6. The measures in column (5) vary from 3.2 for sheep to 12.5 for zinc slab, with a mean value of 6.8. The limits and the averages are all lower than the corresponding measures in Table 30, relating to revival. This rough comparison indicates that price movements during recession are more consistent, from cycle to cycle, than are the movements of prices during revival. This hypothesis is tested more rigorously at a later point.

c. *Duration of Periods of Falling Prices.* The range of variation in respect to duration of periods of price recession is somewhat smaller than was the case with rising prices. When the fifteen representative commodities are ranked according to the duration of decline, we have the following arrangement.

TABLE 41

CYCLES IN COMMODITY PRICES, AT WHOLESALE

Ranking of Fifteen Commodities according to the Average Duration of the Period of Price Decline.

(1) Ref. No.	(2) Commodity	(3) Duration of price decline (in months)
13	Cattle	9.9
64	Beef	14.5
441	Leather	15.7
25	Cotton	16.5
247	Petroleum	16.7
239	Coke	17.2
202	Cotton yarns	18.3
280	Steel rails	18.6
195	Print cloths	19.0
451	Rubber	20.0
293	Copper, ingot	20.2
233	Anthracite coal	21.0
276	Steel billets	21.4
259	Pig iron	23.0
236	Bituminous coal	25.2

Corresponding measures for the six general economic series are given in Table 21. These vary from 12.3 months, for pig iron production, to 22.0 months, for the yield on railroad bonds. The ranking is, of course, just the reverse of that in Table 32, showing the average duration of rise. With the exception of the bond yield series the period of decline is much shorter than the period of rise.

In Table XVIII, in the Appendix, are given measures showing the average duration of periods of falling prices, for all the commodities studied. As in Table XVI, relating to periods of rise, the main entries are based upon all the periods of fall, whether extending over one or several general business cycles. Where the main entries are affected by periods of falling prices extending over more than one "normal" cycle, second averages are given in parentheses. These are based only upon such periods of fall as continued through but one phase of recession (and depression).

The duration of the average period of decline varies considerably, even though we restrict the study to commodities which reflected all the cycles in general business during the period under review. The smallest measure in this restricted group is that for cattle prices, for which the average period of decline lasted but 9.9 months. The longest average period of decline, 25.2 months, is found in the prices of bituminous coal.

The percentage relation of the average period of fall to the average length of the cycle may be determined directly from the figures in Table 33, for the commodities passing through 5 or more distinct cycles.

A final aspect of price behavior during recession is described by the figures showing the average percentages of decline. These appear in column (20) of Appendix Table XII. A ranking of commodities according to the magnitude of these percentages would be much the same as the ranking based upon the indexes of cyclical variability, shown in Table XIV.

5. Relations Among Measures of Cyclical Price Movements

In the last section of this chapter the general relations among commodity price characteristics are discussed. It seems fitting to introduce at this point, however, a brief account of the relationships among the various measures of cyclical price movements. Correlation coefficients describing certain of these relations are

given in the following table. The measures correlated are averages computed for individual commodities from entries relating to all observed cycles. There have been excluded from these calculations those commodities which have been classed as exceptional, and all those the prices of which passed through less than five complete cycles between 1890 and 1925. The commodities used in securing the following results numbered 149.[1]

TABLE 42

CORRELATION COEFFICIENTS MEASURING THE RELATIONSHIPS AMONG MEASURES OF CYCLICAL PRICE MOVEMENTS*

(1) Measures correlated [The measures correlated are named below and in the headings of columns (2) to (8).]	(2) Index of cyclical variability	(3) Av. time of revival	(4) Av. time of recession	(5) Av. duration of rise	(6) Av. duration of fall	(7) Av. percentage of rise	(8) Av. percentage of fall
Index of cyclical variability		—.50	—.47	+.05	—.03		
Av. time of revival	—.50		+.72	—.40	+.43	—.43	
Av. time of recession	—.47	+.72		+.13	—.15	—.33	—.43
Av. duration of rise	+.05	—.40	+.13		—.76	+.19	
Av. duration of fall	—.03	+.43	—.15	—.76			—.01
Av. percentage of rise		—.43	—.33	+.19			
Av. percentage of fall			—.43		—.01		

*These coefficients are based on measures describing the average behavior of 149 commodities which passed through at least five complete cycles between 1890 and 1925. Twenty-six "exceptional" commodities have been omitted.

a. *Relations between Measures of Cyclical Variability and Other Cyclical Measures.* There is evidence of a fair degree of negative correlation between the amplitude of the cyclical movements in commodity prices and the average date of revival in prices after a period of depression. The coefficient has value of —.50. In interpreting this coefficient the signs employed in defining the dates of turn must be borne in mind. A negative sign is used when the date of turn precedes the date of turn in general prices, and a positive sign is used when the commodity lags behind the general price index. Thus the negative coefficient of correlation means that those commodities which rose first after depression were subject, in general, to wider cyclical fluctuations than were the commodities which lagged on revival. Since the prompt revival and the wide

[1]These commodities include all those listed in Appendix Table X except the 26 which are there designated as exceptional, and those the numbers of which follow: Nos. 104, 106, 148, 166, 174, 199, 213, 214, 223, 232, 233, 234, 235, 244, 250, 254, 255, 271, 272, 273, 287, 338, 357, 381, 405, 406, 414, 422, 425, 428, 429, 431, 456, 457.

fluctuations are both evidence of sensitivity to cyclical changes, this relationship is a reasonable one.

Approximately the same degree of correlation as was observed in the preceding case is found when the index of variability is correlated with the average date of the high point preceding recession. The coefficient is —.47. In general, those commodities which started the downward movement early were the ones marked by the widest fluctuations.

There appears to be no relation between the duration of the period of rise, or the duration of the period of fall, and the index of cyclical variability. The amplitude of the swings does not depend upon the duration of the period of rising or falling prices.

As has been noted, the above coefficients have been computed from measures which describe the *average* behavior of individual commodities. Would the same relationships be found if the entries relating to the behavior of individual commodities in individual cycles were correlated? This has been tested in respect to two of the relationships described above. The following results were secured.

TABLE 43

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN CYCLICAL VARIABILITY AND OTHER CYCLICAL PRICE CHARACTERISTICS

(Based on measures describing the behavior of individual commodities in individual cycles)

(1) Series correlated with index of cyclical variability	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Time of revival	1110	—.29	10.1
Time of recession	1110	—.31	10.8

The measures which have been employed in deriving the above coefficients relate to the 149 commodity price series which entered into the computations upon which Table 42 is based. These coefficients correspond, therefore, to the entries in that table, differing only in that measures relating to individual cycles, and not averages, have been employed.

The coefficient of —.50, secured from the averages, is reduced to —.29 when the individual entries for dates of low and variability

for individual cycles are correlated. The coefficient of —.47, relating to the averages of cyclical variability and dates of high, is reduced to —.31 when the individual entries are correlated. The evidence of a true relationship between the two pairs of variables is rather stronger, however, when the individual measures are used. The probable error of the coefficient is greatly reduced by the increase in the number of observations from 149 to 1110. As a result, the coefficients based upon the individual entries differ more significantly from zero than do the coefficients computed from the averages.

The measure $\frac{r}{\sigma_r}$ indicates the significance of the given value of r, as evidence of a true relationship. If this exceeds 2.58 it may be taken as definite proof that there is a real relationship between the series correlated.[1]

b. *Relations between the Time of Revival and Other Cyclical Measures.* The fact has already been noted that there is a considerable degree of similarity between the average sequence of price change during revival and the average sequence during recession. The coefficient of correlation, based upon 149 pairs of observations, is +.72.

There is a negative correlation between the average date of revival and the average duration of rise. Bearing in mind the significance of the signs relating to the timing of revival, this means that the commodities which turned upward in price first during revival had, in general, the longest period of rise. The degree of correlation is not high ($r = -.40$). There is some positive correlation ($r = +.43$) between the average duration of fall and the average date of the low point preceding revival. The commodities which experienced the longest periods of price decline have, on the average, risen in price later than those having shorter average periods of decline. The same degree of relationship, but one which is negative in sign ($r = -.43$), is found between the time of revival and the percentage of rise. The rise is, in general, somewhat greater for those commodities which start upward first.

As in the preceding case, it is advisable to determine the degree of correlation between the entries relating to individual cycles, as well as the relation between the averages for all cycles.

[1]If the two variables were unrelated a coefficient of correlation which would cause the measure defined above to exceed 2.58 would be secured less than 1 time out of 100 trials.

TABLE 44

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE TIME OF REVIVAL AND OTHER CYCLICAL PRICE CHARACTERISTICS

(Based on measures describing the behavior of individual commodities in individual cycles)

(1) Series correlated with time of revival in individual cycles	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Index of cyclical variability	1110	—.29	10.1
Time of succeeding recession	1202	+.27	9.7
Duration of succeeding period of rise	1110	—.36	12.8
Duration of preceding period of fall	1175	+.54	22.0
Percentage rise (rise expressed as percentage of ensuing high value)	1110	—.24	8.2

The above coefficients are all significant.[1] There is a definite positive correlation between the dates of revival and the dates of recession, though the coefficient is considerably lower than that based upon the average dates of revival and recession (+.27 as compared with +.72). In a given cycle the commodities which rise first in price during revival tend to reach their high point and decline in price at an early stage of the next period of recession. Although the correlation coefficient is not high it is equal to 9.7 times its standard error, and may be accepted as evidence of a true relationship. There is clear evidence, too, that those commodities which have risen first on revival have tended to undergo a longer period of rise, and to rise by somewhat greater relative amounts, than the commodities which have lagged on revival.

In correlating the measures of duration of decline and time of revival, each pair of observations has consisted of the period of decline, in months, and the date of the low point marking the culmination of that decline. There is a distinct positive correlation (r = +.54). This means that short falls are paired with early revivals, and long falls with late revivals, a result which is quite to be expected.

The coefficient given above as measuring the relation between dates of revival and dates of recession in individual cycles was based upon entries for specific low dates and succeeding high dates. The coefficient (r = +.27, with a standard error of .027) indicates a tendency for commodities which rose early in revival to decline at a

[1]Only those relationships which appeared to be significant, in the light of the work with averages, have been tested by means of the measures for individual cycles.

relatively early date in the succeeding period of recession. Is there a similar tendency for commodities which decline early in recession to start the upward movement early in the succeeding period of revival? Another pairing of individual entries, with the date of low following the date of high, is called for. The correlation between these items (based upon 1192 individual entries) is measured by a coefficient of +.40, with a standard error of .024. This coefficient, which is high in comparison with its standard error, indicates a definite positive relation between the date of recession and the date of the succeeding revival in a given cycle. It is worthy of note that this relationship is significantly closer than that between the date of revival and the date of the succeeding recession. The order of price recession in a given cycle exercises a stronger influence upon the order of the succeeding revival than the order of revival exercises upon the order of the succeeding recession. There is evidence in both cases, however, of a significant relationship, and this is the fact to be stressed. Although each phase of a price cycle bears the imprint of novel factors, there are definite bonds which tie it to the phase that has preceded it.

c. *Relations between the Time of Recession and Other Cyclical Measures.* Two of the measures in Table 42 defining the relation between the average date of recession and other cyclical movements have been commented upon above. The correlation between the date of recession and the average duration of rise is low ($r = +.13$) and not significant. The chief point of interest lies in the fact that this relationship is distinctly less pronounced than the corresponding relation between the duration of fall and the date of revival ($r = +.43$). The length of time during which a commodity has fallen in price bears some relation to the date (considered relatively, of course) when its price turns upward. The connection between the average period of rise and the time of recession is a much more remote one.

The relation between the average time of recession and the average duration of fall is also a slight one, but negative in character. There is a slight tendency for an early recession in prices to involve a period of recession longer than the average. This relationship (measured by a coefficient of —.15) is much less marked, however, than the corresponding relation between the average time of revival and the average duration of rise. An early up-turn in price has meant, in general, a period of rise longer than the average. (The correlation coefficient in this case has a value of —.40.)

The average time of recession is negatively correlated with both the average percentage of rise and the average percentage of fall. Commodities which decline in price early in recession tend to rise and fall by greater amounts than do the commodities which are affected somewhat later in a general price recession.

When the individual observations, instead of the averages, are paired, the following results are obtained. They are based upon entries relating to 149 commodities.

TABLE 45

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE TIME OF RECESSION AND OTHER CYCLICAL PRICE CHARACTERISTICS

(Based on measures describing the behavior of individual commodities in individual cycles)

(1) Series correlated with time of recession in individual cycles	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Index of cyclical variability	1110	—.31	10.8
Time of preceding revival	1202	+.27	9.7
Duration of preceding period of rise	1110	+.20	6.8
Duration of succeeding period of fall	1110	—.33	11.6
Degree of preceding rise (rise as percentage of high value)	1110	—.20	6.8
Degree of succeeding fall (percentage decline)	1118	—.36	12.9

The first two of these coefficients have been already commented upon. The measure of correlation between the individual observations relating to date of recession and duration of period of rise is positive, and somewhat higher than the correlation based on averages (+.20 as compared with +.13). The same tendency is indicated by the two measures—a tendency for long periods of rise to involve relatively late turns during recession. Similarly, an early downturn involves a relatively long period of decline, while a late downturn involves a shorter succeeding period of fall. This relationship is a necessary resultant of the fact that the sequence of revival, after depression, is not the same as the sequence of recession, after prosperity.

There is a negative correlation between the time of recession and the percentage of the preceding rise, and between the time of recession and the percentage of the succeeding fall. Those commodities which have risen by the greatest relative amounts tend to

turn downward in price relatively early in recession. Similarly, the percentage of fall is generally greater for the commodities which have experienced an early recession.

d. *Relations among Other Measures of Cyclical Price Movements.* Most of the significant relations among measures of cyclical price movements have been touched upon above. The relatively high negative correlation between the average duration of rise and the average duration of fall ($r = -.76$) is, of course, to be expected. Given cycles of fairly constant length, those commodities with periods of rise longer than the average will have periods of fall shorter than the average. There is no significant relationship between the duration of the period of rise and the percentage of rise. (In interpreting this statement it must be remembered that the period of rise, as here defined, extends from the low point preceding revival to the high point preceding recession.) Similarly, there is no apparent relation between the average duration of price decline during recession and the average percentage of decline. A material decline may be abrupt or protracted.

e. *Consistency of the Sequence of Price Movements during Revival and Recession.* It has been established by certain of the measures presented in the preceding tables that the sequence of price movements during recession is not independent of the sequence of price changes during revival. A related subject of considerable interest remains to be investigated. This concerns the degree of consistency in the sequence of recovery during different periods of revival, and the degree of consistency in the sequence of recession in different cycles. Is there a common sequence of price movements which prevails, without much variation, from revival to revival. Is there a standard sequence of recession, a pattern to which different periods conform more or less closely?

There are several means by which the consistency of price movements during different periods may be tested. Dealing first with revival, we may measure the degree of relationship between the average time of price revival, for the commodities studied, and the times of revival during each of the cycles covered. The averages furnish a criterion, and the degree to which the sequence of revival during each cycle conforms to this criterion may be determined.[1]

[1]For example, the average time of revival in pig iron prices during the 11 revivals studied was +5.1 (i. e. 5.1 months after the turn in the wholesale price index). The time of revival in pig iron prices in period 1 was +11. (See Table 19.) These two values, together with similar observations for 111 other commodities, made up the data from which the first coefficient in Table 46 was computed.

The coefficients defining these several relations are given in the following table. The price series employed include all those studied except 26 classed as exceptional[1] and 34 others which passed through less than 5 complete cycles between 1890 and 1925. In addition, those not sharing in a given price revival are excluded from the calculations for that period.

TABLE 46

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE AVERAGE TIME OF REVIVAL IN COMMODITY PRICE SERIES AND THE TIMES OF REVIVAL DURING SPECIFIC CYCLES

(1) Series correlated with average time of revival	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Time of revival, period 1 (May, 1892)*	112	+.28	3.0
Time of revival, period 3 (Mar., 1895)	116	+.46	5.5
Time of revival, period 5 (May, 1897)	149	+.73	12.9
Time of revival, period 7 (July, 1901)	129	+.48	6.2
Time of revival, period 9 (July, 1904)	130	+.58	8.0
Time of revival, period 11 (Feb., 1908)	130	+.65	9.7
Time of revival, period 13 (June, 1911)	129	+.56	7.6
Time of revival, period 15 (Nov., 1914)	145	+.51	7.1
Time of revival, period 17 (Feb., 1919)	124	+.30	3.5
Time of revival, period 19 (Jan., 1922)	142	+.46	6.1
Time of revival, period 21 (June, 1924)	105	+.50	5.8

*The reference date for each period is given in parentheses.

All these coefficients, which vary from +.28 to +.73, are significant, when judged with reference to their standard errors. The sequence of revival during the first period (for which the reference date was May, 1892) departed most widely from the average sequence. The coefficient is almost as low (+.30) for the 17th period (reference date February, 1919). The average sequence was approached most closely in period 5 (reference date May, 1897)[2] and in period 11 (reference date February, 1908). Although there are considerable variations in the degree of correlation from period to period, it is clear that there is a tendency for the sequence of revival to follow a common pattern during different cycles. It should be noted that the various coefficients are not fully comparable, because of variations in the number of commodities entering into the

[1]See pp. 81,102 for an explanation of this classification.

[2]The relatively high coefficient for this period is in part due to the presence of exceptional cases, that is, commodities deviating widely from the mean in their up-turns. Such cases tend to distort the measure of correlation.

different calculations. This does not, however, invalidate the general conclusions reached.

In making the above test we have correlated averages with individual measures of the time of revival, these individual items being taken by periods. In each case the item paired with a given average is one of the 11 items from which that average has been derived. Although the results are significant there is present a slight degree of spurious correlation. A somewhat different test which is not open to this criticism may be applied by correlating the dates of revival in successive cycles. That is, we may measure the degree of relationship between the timing of price movements in period 1 and in period 3, in period 3 and in period 5, and so on. Carrying these calculations through for the entries defining the sequence of revival, we secure the following measures.

TABLE 47

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE TIMES OF REVIVAL IN COMMODITY PRICES DURING SUCCESSIVE CYCLES

(1) Series correlated Times of revival in periods	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
1 and 3 (May, 1892, Mar., 1895)[1]	92	+.06	.6
3 and 5 (Mar., 1895, May, 1897)	116	+.28	3.1
5 and 7 (May, 1897, July, 1901)	129	+.36	4.3
7 and 9 (July, 1901, July, 1904)	111	+.32	3.5
9 and 11 (July, 1904, Feb., 1908)	116	+.25	2.7
11 and 13 (Feb., 1908, June, 1911)	116	+.24	2.6
13 and 15 (June, 1911, Nov., 1914)	125	+.37	4.4
15 and 17 (Nov., 1914, Feb., 1919)	125	—.08	.9
17 and 19 (Feb., 1919, Jan., 1922)	121	+.27	3.0
19 and 21 (Jan., 1922, June, 1924)	100	+.29	3.0

[1]The reference dates for the two periods to which each coefficient relates are given in parentheses.

The coefficients defining the relations between price movements in successive phases of revival run materially lower than those given in Table 46. The measures in Table 47 vary from −.08 to +.37. The former coefficient measures the relation between the timing of revival in period 15 (reference date November, 1914) and in period 17 (reference date February, 1919). Not only was there no direct relation, but there was even a tendency toward negative correlation between the order of price revival following the outbreak of war and the order of revival during the first post-war boom. The highest coefficient is that of +.37, measuring the relation be-

tween the revival in period 13 (reference date June, 1911) and the revival in period 15 (reference date November, 1914). (A somewhat closer relationship, measured by a coefficient of +.41, is found between the revivals following the two major depressions of 1908 and 1921. This is based upon 126 entries.)

Although the measures listed in Table 47 are relatively low, 8 of the 10 coefficients there given are significant of real relationships between the timing of revival in successive cycles.[1] It is clear, on the other hand, that although there is a tendency to follow a common pattern during successive revivals, the departures from this common pattern are pronounced.

We may make similar tests of the consistency of price movements during recession. There are given in the following table measures of the degree of relationship between the times of recession in the prices of individual commodities in given cycles and averages of these times during ten periods of recession. The commodities included have been indicated in explaining Table 46.

TABLE 48

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE AVERAGE TIME OF RECESSION IN COMMODITY PRICE SERIES AND THE TIMES OF RECESSION DURING SPECIFIC CYCLES

(1) Series correlated with average time of recession	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
Time of recession, period 2 (Feb., 1893)*	121	+.43	5.2
Time of recession, period 4 (Oct., 1895)	117	+.61	8.2
Time of recession, period 6 (Apr., 1900)	131	+.55	7.5
Time of recession, period 8 (Oct., 1902)	126	+.57	7.7
Time of recession, period 10 (Oct., 1907)	136	+.60	8.7
Time of recession, period 12 (Apr., 1910)	126	+.50	6.4
Time of recession, period 14 (Sept., 1913)	123	+.51	6.5
Time of recession, period 16 (Sept., 1918)†	126	+.39	4.7
Time of recession, period 18 (May, 1920)	149	+.57	8.4
Time of recession, period 20 (Apr., 1923)	121	+.51	6.5

*The reference date for each period is given in parentheses.

†In deriving the average times of recession used in the above calculations all entries relating to period 16, for which the reference date is September, 1918, were omitted. It was felt that price movements in this recession were so much affected by price regulation and other war-time disturbances that more representative averages could be secured by omitting them. A coefficient for period 16 has been worked out, however, and is included in the table. Although lower than any of the other figures, this coefficient is significant. In spite of the abnormal influences affecting this recession, there was some resemblance to the average sequence of change.

[1]For each of these 8 cases the chance of securing the given coefficient, if there were no real correlation between the timing of revival in the periods in question, is less than 1 out of 100.

As in the case of revival, we find a tendency toward a common pattern in the sequence of recession. The variations are considerable, but in each of the periods here studied there is a significant relationship with the common criterion furnished by the averages.

Applying now the test based on a comparison of successive phases of recession, we secure the following measures.

TABLE 49

CORRELATION COEFFICIENTS MEASURING THE RELATIONS BETWEEN THE TIMES OF RECESSION IN COMMODITY PRICES DURING SUCCESSIVE CYCLES.

(1) Series correlated Times of recession in periods	(2) No. of observations	(3) Coefficient of correlation r	(4) $\frac{r}{\sigma_r}$
2 and 4 (Feb., 1893, Oct., [1895)[1]	97	+.36	3.8
4 and 6 (Oct., 1895, Apr., 1900)	111	+.22	2.3
6 and 8 (Apr., 1900, Oct., 1902)	111	+.36	4.0
8 and 10 (Oct., 1902, Oct., 1907)	116	+.27	3.0
10 and 12 (Oct., 1907, Apr., 1910)	116	+.18	1.9
12 and 14 (Apr., 1910, Sept., 1913)	108	+.25	2.6
14 and 16 (Sept., 1913, Sept., 1918)	105	+.28	3.0
16 and 18 (Sept., 1918, May, 1920)	128	+.20	2.3
18 and 20 (May, 1920, Apr., 1923)	121	+.36	4.2

[1]The reference dates for the two periods to which each coefficient relates are given in parentheses.

The coefficients measuring the relation between price movements during the recession phases of successive cycles range in value from +.18 to +.36, the latter value occurring in three different pairings. (A relationship somewhat closer than that indicated by this maximum value is found between the major recessions of 1907 and 1920. The coefficient of correlation, based upon 136 entries, has a value of +.40 in this case.)

When account is taken of the sampling errors to which these measures are subject, we find that six of the nine coefficients relating to the timing of recession in successive cycles are indicative of real relationships. They confirm the evidence of the preceding measures in revealing a tendency toward a common sequence of movements during price recessions. Chance does not play alone in ordering the sequence of change during each recession. There is a regularity here that reveals the presence of constant factors, operating in recession after recession, factors which impress upon each cycle traces of a pattern which is found in other cycles.

There is a suggestion in the above coefficients that the common pattern is slightly more in evidence in the data relating to recessions than in the figures measuring the time of revival. That is, the sequence of price change during recessions appears to be slightly more consistent than the sequence of change during revivals. The average of the different coefficients given in each of the above tables dealing with recessions is slightly higher than the average of the corresponding measures relating to revival. A somewhat more accurate test of the relative consistency of price movements during recession and during revival may be made if we employ the measures of inconsistency for individual commodities which were explained in an earlier section. For any single commodity, it will be recalled, the measure of inconsistency relating to revival (or to recession) would be zero if its price moved with a constant lead or lag in reference to the wholesale price index. Hence, the lower the average of the measures of inconsistency for a given group of commodities, the less is the variation from cycle to cycle in sequence of price movements. When we combine the measures of inconsistency relating to the movements during revival and recession of the 84 most sensitive price series (i. e. those commodities which were not classed as exceptional and which passed through nine cycles or more during the period from 1890 to 1925), we secure the following figures.[1]

	Arithmetic mean	Standard deviation
Measures of inconsistency relating to revival	7.73	2.22
Measures of inconsistency relating to recession	6.85	2.14
Difference between means	.88	
Standard error of difference between means	.336	

The average of the recession measures is smaller than the average for revival, the difference between the two means being 2.61 times the standard error of the difference. As such a difference would arise because of sampling errors less than 1 time out of 100, there is evidence here that for this group of commodities the sequence

[1]The measures of inconsistency here employed are based upon entries for all periods. If the measures relating to recession be those from which the first period of post-war recession (period 16) was excluded, a mean of 6.65 is secured, instead of the value of 6.85 given in the text.

of price movements during recession has been more consistent than the sequence of price changes during revival.

The various coefficients presented in the preceding tables have shown that there are significant interrelations among the several measures relating to the timing, duration and amplitude of cyclical price movements. The individual measures have been derived, it will be recalled, by applying to more than two hundred price series a standardized procedure for measuring the changes in commodity prices which have accompanied cycles in general business. After the individual measures had been secured, tests of relationship were made. It is highly significant that these subsequent tests revealed the presence of a common pattern in these cyclical price movements. True regularities, which clearly reflect the influence of forces other than chance, are found in the cyclical movements of commodity prices.

V Relations Between Prices and Price-Determining Factors: Price Flexibility

In the four preceding sections certain general characteristics of commodity prices have been dealt with. In describing these attributes attention was concentrated on price changes, with no reference to specific factors which might have produced these changes. The present section is concerned with those movements in the prices of individual commodities which are related in some measurable way to specific economic factors. We are concerned, that is, with the general problem of price determination, though certain aspects only of this broad subject can be considered in the present study.

This section differs from those which have preceded it in that no compilation of measures relating to a number of commodities is attempted. A brief account is given of methods which have been developed elsewhere, and several examples are included as illustrations of procedure. So much is necessary in any complete account of measures of price behavior. A collection of measures of the type here described, suitable in quality and quantity for a study of group behavior, waits upon the future.

1. Measures Needed in Defining the Relationship Between Prices and Price-Determining Factors

In studying the factors affecting the price of any commodity we are working upon an old problem, that of defining the relation-