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CHAPTER 9

Role of Averages in the Analysis

THE SUCCESSIVE volumes in the Bureau's *Studies in Business Cycles* stress average cyclical behavior. In passing from one economic process to another, we note briefly the scope and representative character of the original data, describe any departures from the usual mode of analysis, and call attention to doubtful features of the results. Although the behavior of a series during individual cycles is frequently described, the chief purpose is to point out what features of cyclical behavior are broadly characteristic of the economic activities we treat, to compare and contrast the behavior of the series representing different activities, and to suggest problems that will be encountered in constructing a theory of business cycles. The reader who does not go back to the cycle-by-cycle measures must judge the results mainly from averages, average deviations, and the number of cycles covered. To develop the meaning of the averages and average deviations is the principal task of this and the succeeding chapters.

I Variability of Cyclical Behavior

Like all scientific inquiries, our study of business cycles presupposes the 'uniformity of nature'. Of course, to allow generalization this uniformity need not be perfect. Physiologists are not debarred from making general statements by the differences among human bodies; for certain purposes they can even disregard differences between men and guinea pigs. Statistical methods such as we use are peculiarly adapted to treating phenomena that have a considerable range of variation. Yet we must face the difficulty that results are apt to become less trustworthy as the range of variation becomes larger and the number of observations fewer. This difficulty is especially acute in handling temporal sequences subject to cumulative changes. Relatively few of our time series cover as many as fifteen cycles, most series show great variation from cycle to cycle, and

some appear to have experienced secular or cyclical changes in business-cycle behavior.

Table 139 shows how variable the durations of business cycles have been according to our reference dates. At the close of World War I we

TABLE 139

Average Duration of Business Cycles and Their Variability
Four Countries

Country and measure[a]	Reference dates used[b]	Period covered	No. of observations	Duration in months				Coefficient of variation[c]
				Average	Average deviation	Standard deviation	Range	
UNITED STATES								
Expansion..	M	1854–1929	20	25	8	9	9– 46	38
Contraction	M	1857–1933	20	22	10	14	8– 65	61
Full cycle								
T-T.....	M	1854–1933	20	47	13	18	29– 99	38
P-P.....	M	1857–1929	19	45	13	17	17–101	38
T-T.....	A	1834–1888	12	54	21	23	24– 96	43
P-P.....	A	1836–1890	12	54	17	22	24–108	40
T-T.....	A	1888–1932	13	41	9	11	24– 60	27
P-P.....	A	1890–1929	12	39	8	10	24– 60	25
T-T.....	A	1834–1932	25	47	15	19	24– 96	41
P-P.....	A	1836–1929	24	46	14	18	24–108	40
GREAT BRITAIN								
Expansion..	M	1854–1929	15	36	14	17	8– 64	47
Contraction	M	1857–1932	15	27	14	19	6– 81	72
Full cycle								
T-T.....	M	1854–1932	15	62	22	28	26–135	46
P-P.....	M	1857–1929	14	62	26	32	17–123	51
T-T.....	A	1793–1858	14	56	15	17	36– 84	31
P-P.....	A	1792–1857	14	56	17	21	36–108	38
T-T.....	A	1858–1932	14	63	23	28	24–132	45
P-P.....	A	1857–1929	14	62	26	30	24–120	49
T-T.....	A	1793–1932	28	60	18	24	24–132	40
P-P.....	A	1792–1929	28	59	22	26	24–120	44
FRANCE								
Expansion..	M	1865–1930	15	31	12	15	8– 62	48
Contraction	M	1867–1932	15	23	13	16	8– 68	72
Full cycle								
T-T.....	M	1865–1932	15	53	19	23	24– 95	43
P-P.....	M	1867–1930	14	53	20	26	24–110	49
T-T.....	A	1840–1932	19	58	21	25	24–108	43
P-P.....	A	1847–1930	18	55	19	24	24–120	44
GERMANY								
Expansion..	M	1879–1929	10	37	10	13	16– 61	37
Contraction	M	1882–1932	10	27	15	17	12– 61	63
Full cycle								
T-T.....	M	1879–1932	10	64	20	23	28–102	36
P-P.....	M	1882–1929	9	63	22	27	34–122	43
T-T.....	A	1866–1932	12	66	22	25	24– 96	37
P-P.....	A	1869–1929	11	65	27	31	36–120	47

[a] T-T means that the durations are measured from trough to trough; P-P means that they are measured from peak to peak.

[b] M stands for monthly reference dates, A for calendar-year reference dates. See Table 16.

[c] Standard deviation expressed as a percentage of the mean, each carried to one more place than shown in the table. In computing the standard deviation, we divided the sum of squared deviations from the mean by the number of observations, not the number of 'degrees of freedom'.

find one business cycle in the United States lasting 17 months when measured from peak to peak, and a roughly contemporaneous cycle of the same duration in Great Britain. At the other extreme is a British cycle in 1868–79 which lasted 135 months from trough to trough. Here is an eightfold difference in duration. Among our annual measures the extremes are 2 and 11 years.[1] Even the average duration of business cycles varies appreciably from country to country, and from period to period in the same country. The average ranges from 45 months in the United States to 64 months in Germany according to the monthly reference dates, from 46 to 66 months according to the annual reference dates. If we group the measures made from annual reference troughs into two equal parts, we find in the United States a decline from an average of 54 months in 1834–88 to an average of 41 months in 1888–1932, and in Great Britain an increase from 56 months in 1793–1858 to 63 months in 1858–1932. The coefficients of variation of full-cycle durations range in Table 139 from 25 to 51 per cent. In each country they are about the same for expansions as for full cycles, but they are much higher for contractions than for expansions.

In view of the irregular duration of business cycles, we should expect great variability in the cyclical behavior of most time series. The seven series in Chart 53 illustrate the variability characteristic of single branches of activity in the United States.[2] They cover a considerable stretch of time, from fifty-odd to nearly eighty years. Two represent the production of durable goods, two the money market, two the stock market, and one the volume of payments. More specifically, the series show the number of tons of pig iron produced by months since 1877 and the number of freight cars ordered by railroads of the United States each quarter since 1870; yields of high-grade railroad bonds and call money rates on the New York Stock Exchange by months since 1857; railroad stock prices by months since 1857 and the number of shares traded in round lots on the New York Stock Exchange by months since 1875; bank clearings outside New York City by months from 1875 through 1918, continued by bank debits after 1918, and 'deflated' throughout by Snyder's index of the 'general price level'.

Tables 140-143 and Chart 54 show cyclical measures for these series, from the time they start until about 1933.[3] Only two series, pig iron pro-

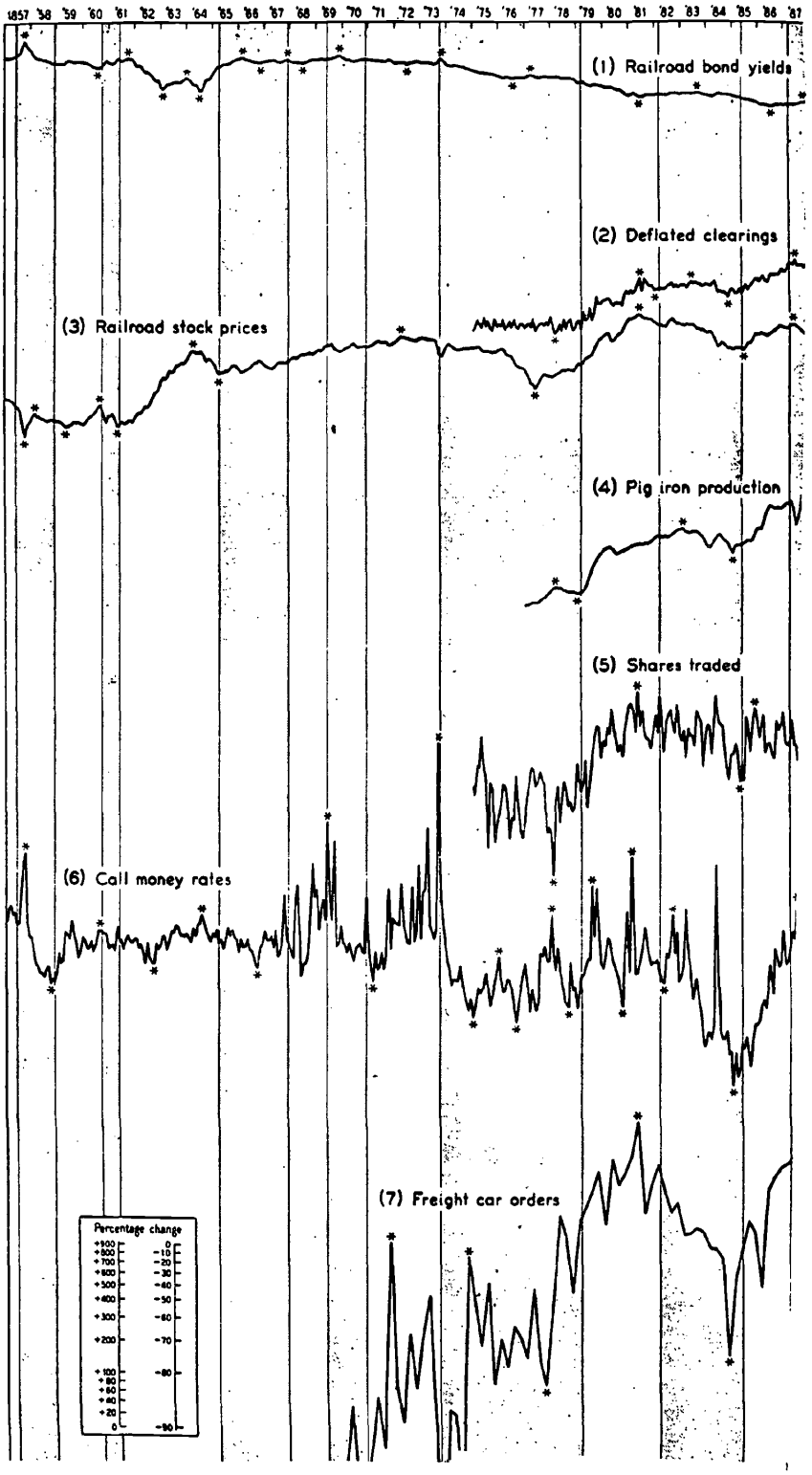
[1] See p. 113.

[2] The series on freight car orders comes from John E. Partington, *Railroad Purchasing and the Business Cycle* (Brookings Institution. 1929), pp. 219-26 for 1870–1926; overlapped since 1924 by figures from the *Iron Trade Review*. Partington's series represents orders by domestic railroads; the *Iron Trade Review* data include also orders by foreign railroads and by noncarriers. In Chart 53 Partington's series is plotted through 1924, the *Iron Trade Review* data thereafter. The data are not adjusted for seasonal variations after 1930.

For the sources of the other series in Chart 53, see p. 210, note 7.

[3] The analysis is confined to periods starting and ending with a trough.

CHART 53


1857 '58 '59 '60 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70 '71 '72 '73 '74 '75 '76 '77 '78 '79 '80 '81 '82 '83 '84 '85 '86 '87
(1) Railroad bond yields
(2) Deflated clearings
(3) Railroad stock prices
(4) Pig iron production
(5) Shares traded
(6) Call money rates
(7) Freight car orders
Percentage change

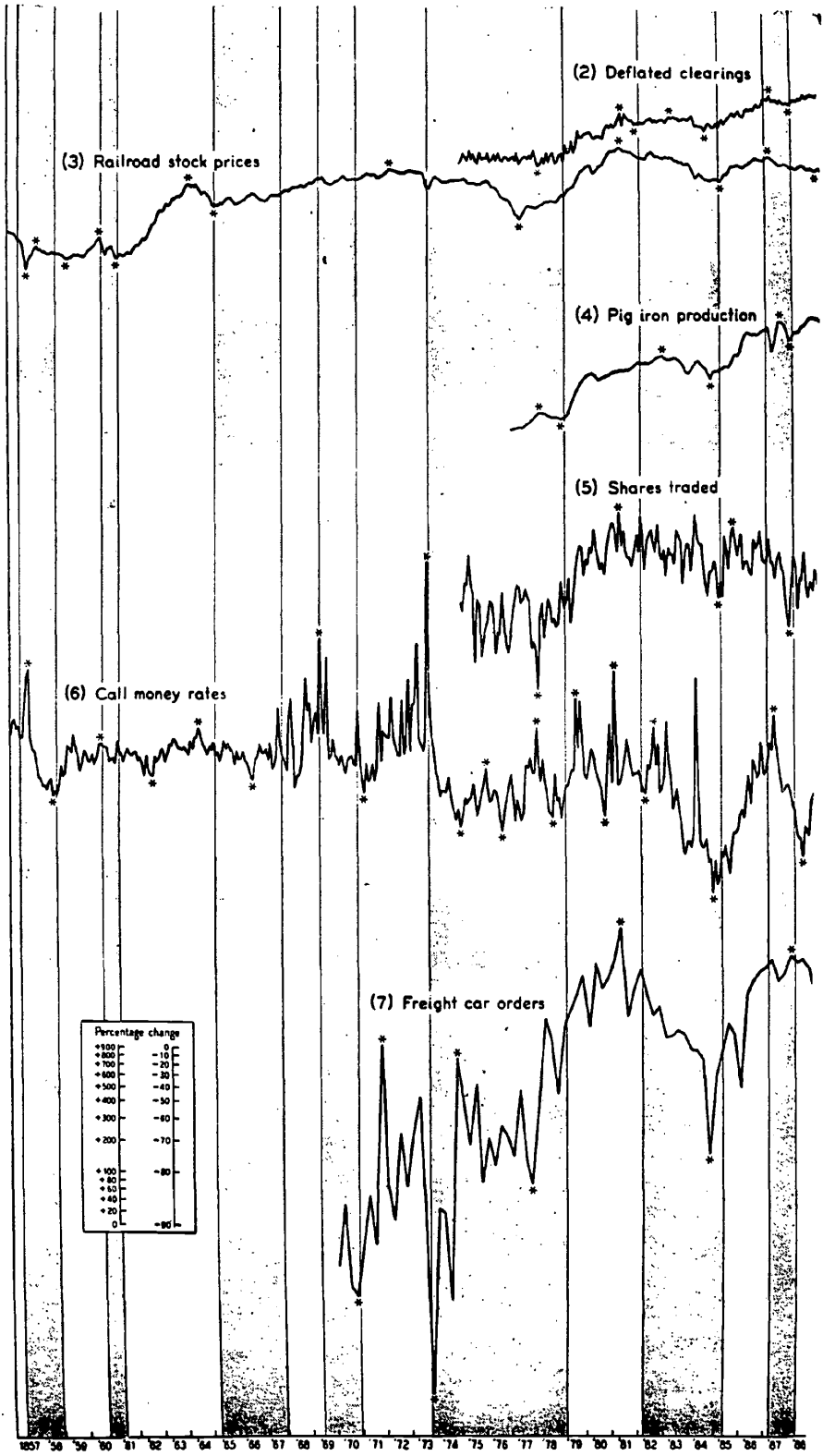
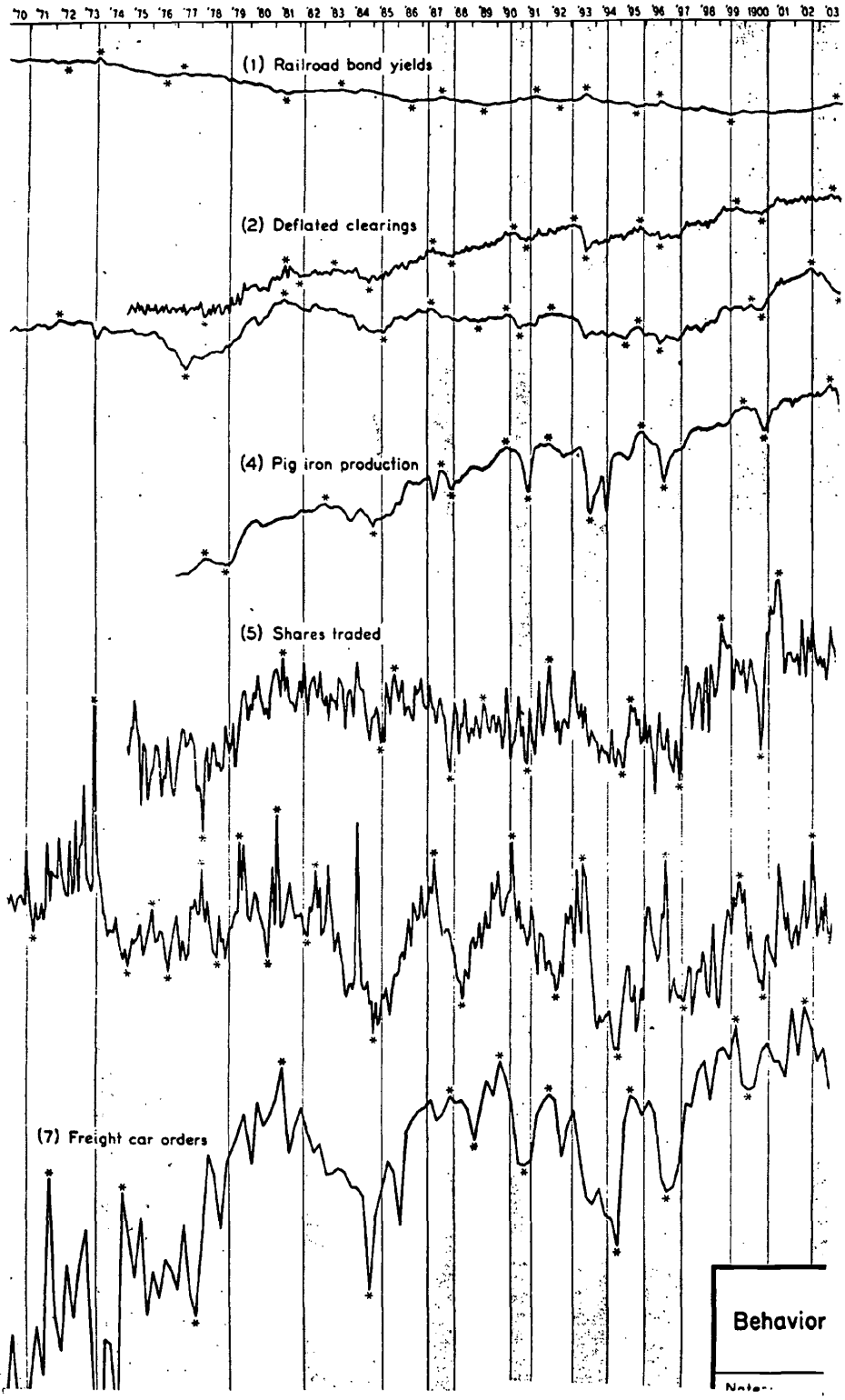
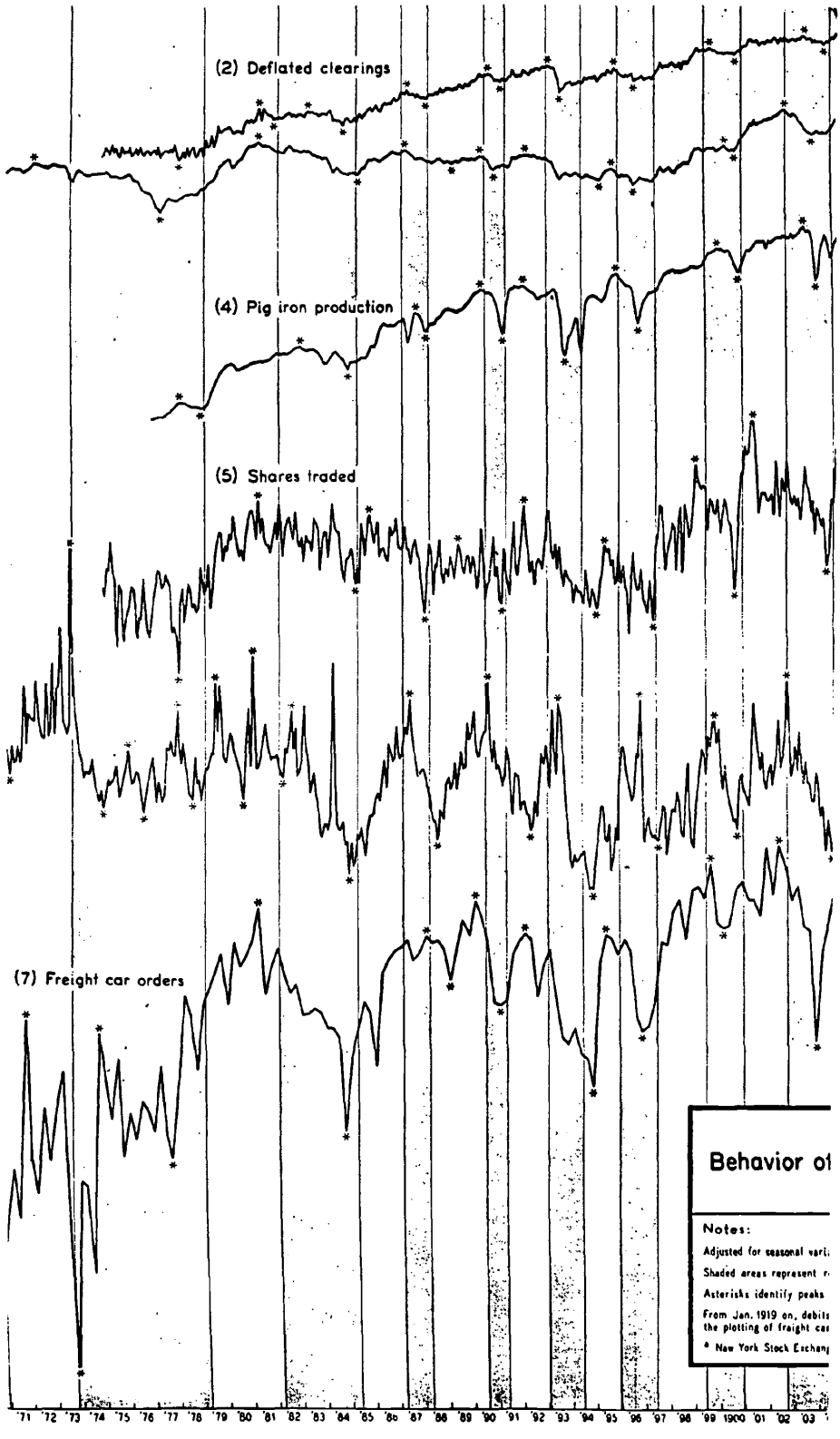

(2) Deflated clearings
(3) Railroad stock prices
(4) Pig iron production
(5) Shares traded
(6) Call money rates
(7) Freight car orders
Percentage change
+900
+800
+700
+600
+500
+400
+300
+200
+100
+90
+80
+70
+60
+50
+40
+30
+20
+10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1857 '58 '59 '60 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70 '71 '72 '73 '74 '75 '76 '77 '78 '79 '80 '81 '82 '83 '84 '85 '86 '87 '88

CHART 53


'70 '71 '72 '73 '74 '75 '76 '77 '78 '79 '80 '81 '82 '83 '84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94 '95 '96 '97 '98 '99 1900 '01 '02 '03
(1) Railroad bond yields
(2) Deflated clearings
(4) Pig iron production
(5) Shares traded
(7) Freight car orders
Behavior


(2) Deflated clearings
(4) Pig iron production
(5) Shares traded
(7) Freight car orders
'71 '72 '73 '74 '75 '76 '77 '78 '79 '80 '81 '82 '83 '84 '85 '86 '87 '88 '89 '90 '91 '92 '93 '94 '95 '96 '97 '98 '99 1900 '01 '02 '03
Behavior of
Notes:
Adjusted for seasonal vari
Shaded areas represent r
Asterisks identify peaks
From Jan. 1919 on, debits
the plotting of freight car
* New York Stock Exchan

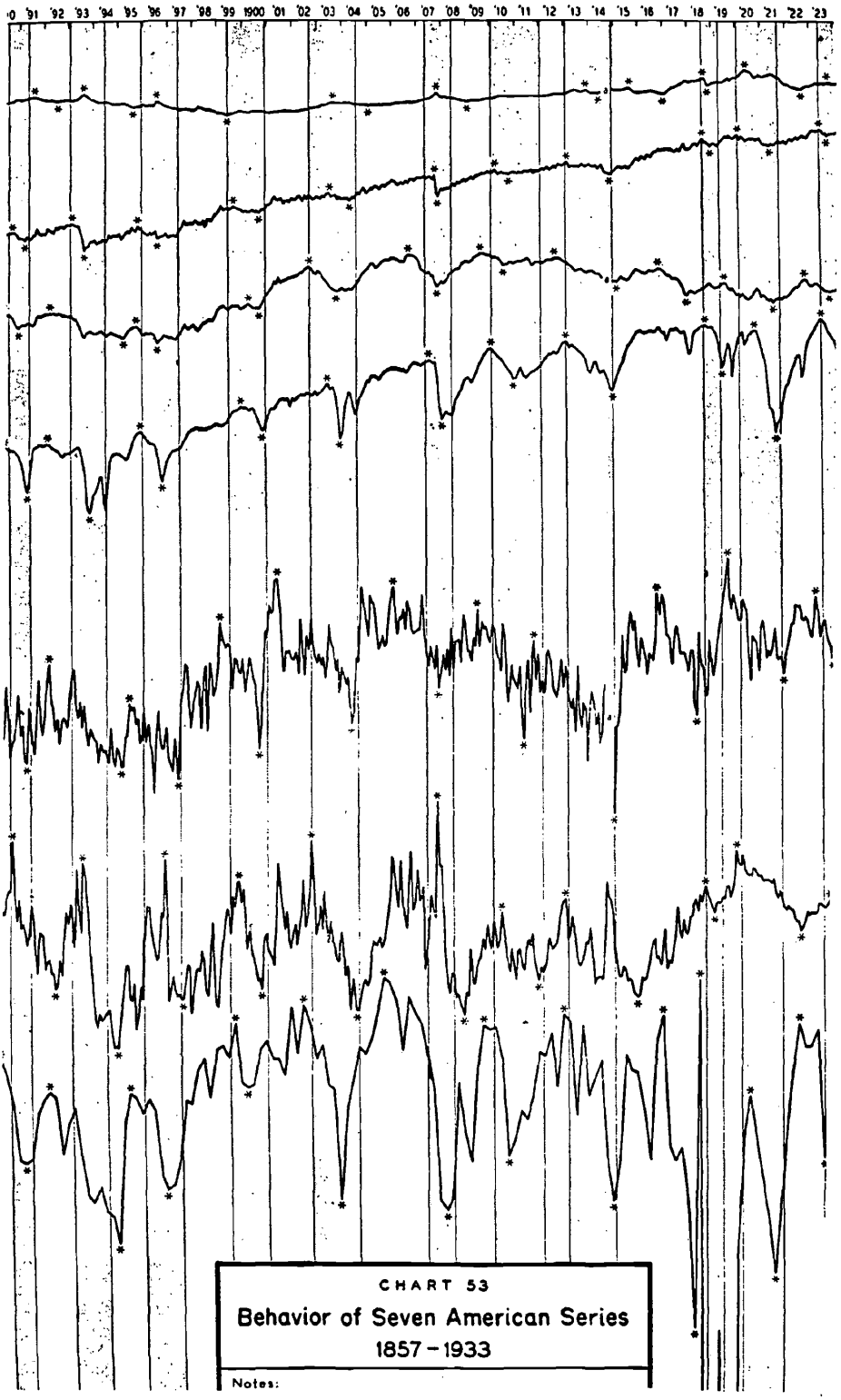


CHART 53

Behavior of Seven American Series
1857 – 1933

Notes:

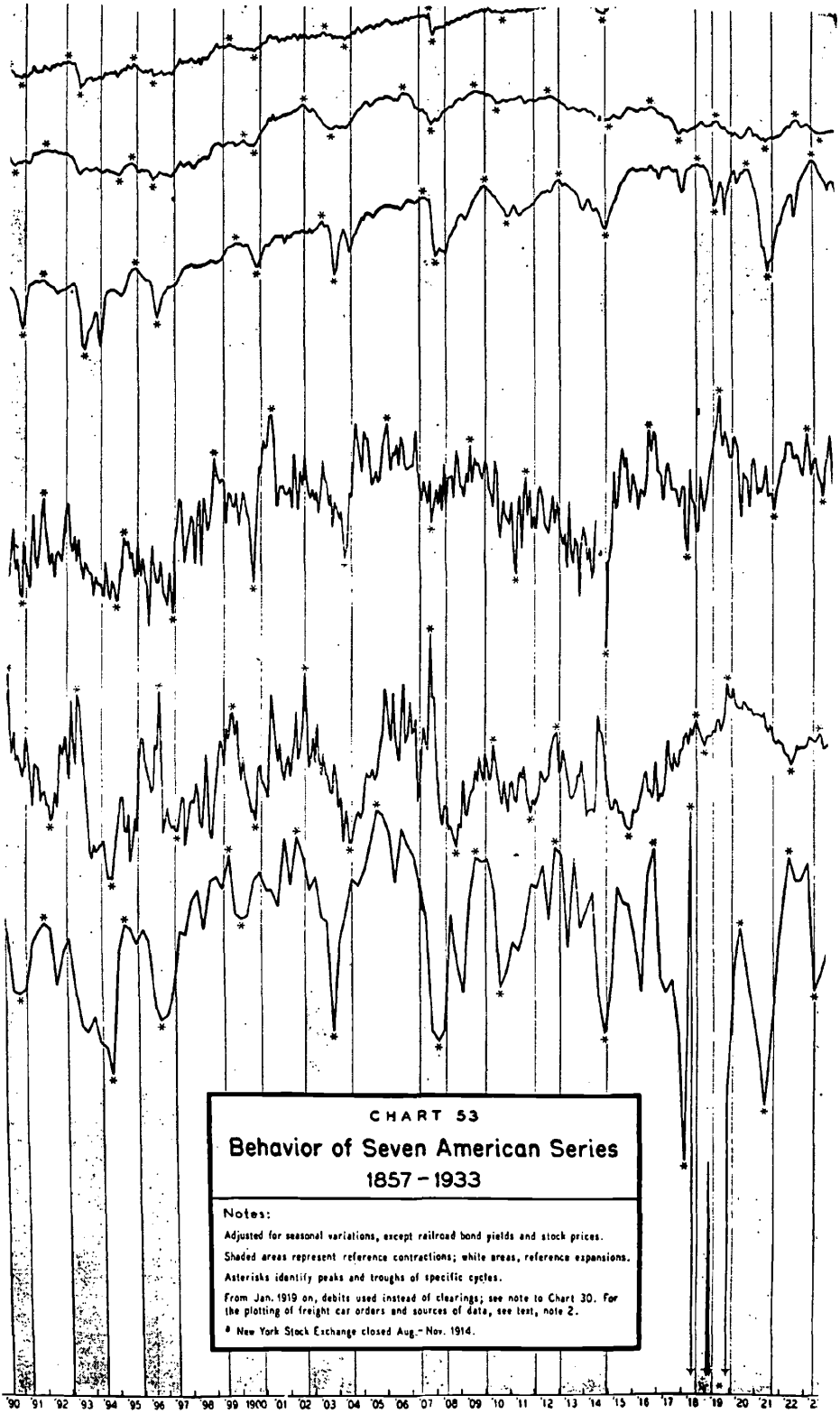


CHART 53

Behavior of Seven American Series 1857 – 1933

Notes:

Adjusted for seasonal variations, except railroad bond yields and stock prices.

Shaded areas represent reference contractions; white areas, reference expansions.

Asterisks identify peaks and troughs of specific cycles.

From Jan. 1919 on, debits used instead of clearings; see note to Chart 30. For the plotting of freight car orders and sources of data, see text, note 2.

* New York Stock Exchange closed Aug.–Nov. 1914.

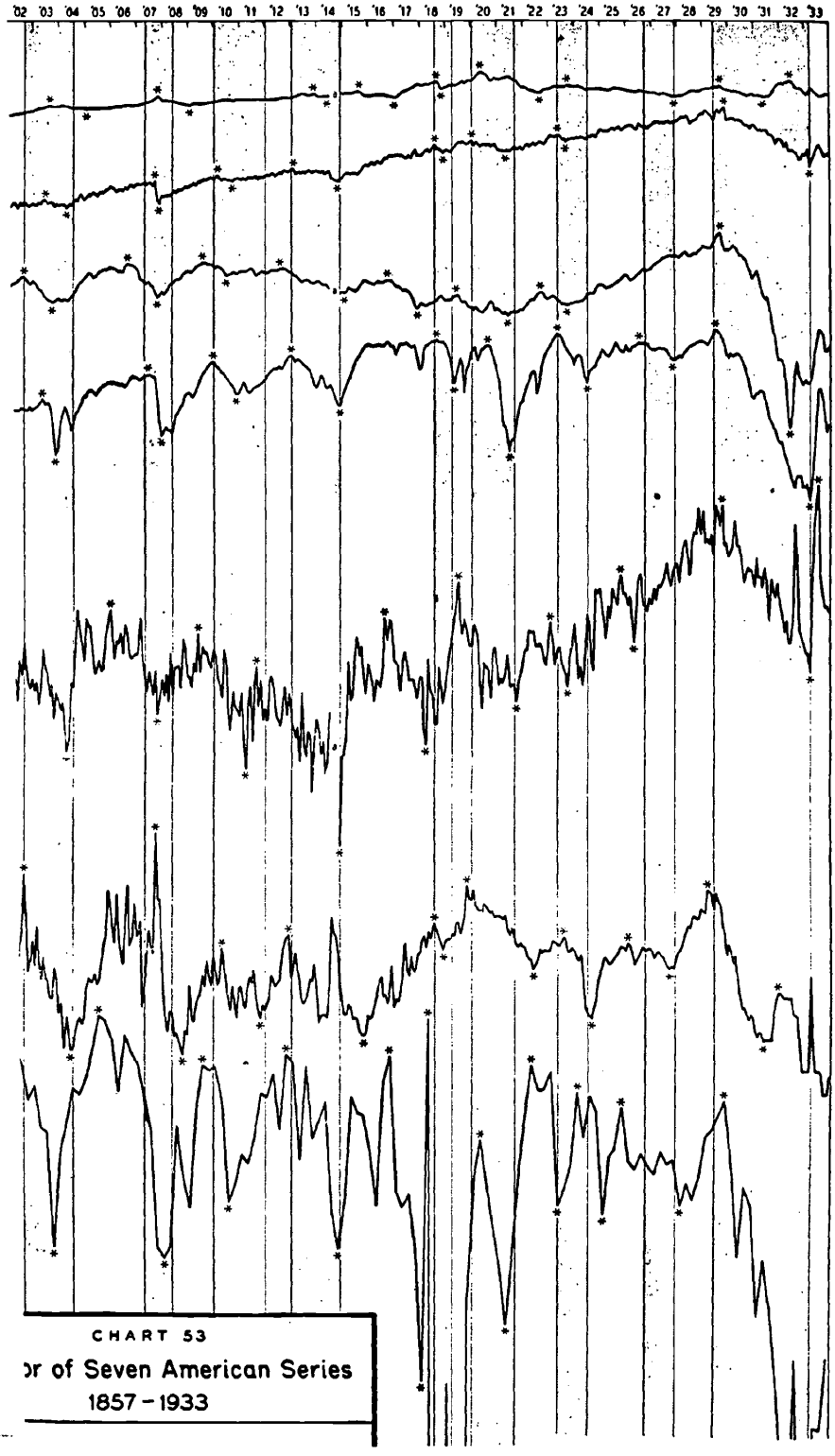


CHART 53

or of Seven American Series

1857 – 1933

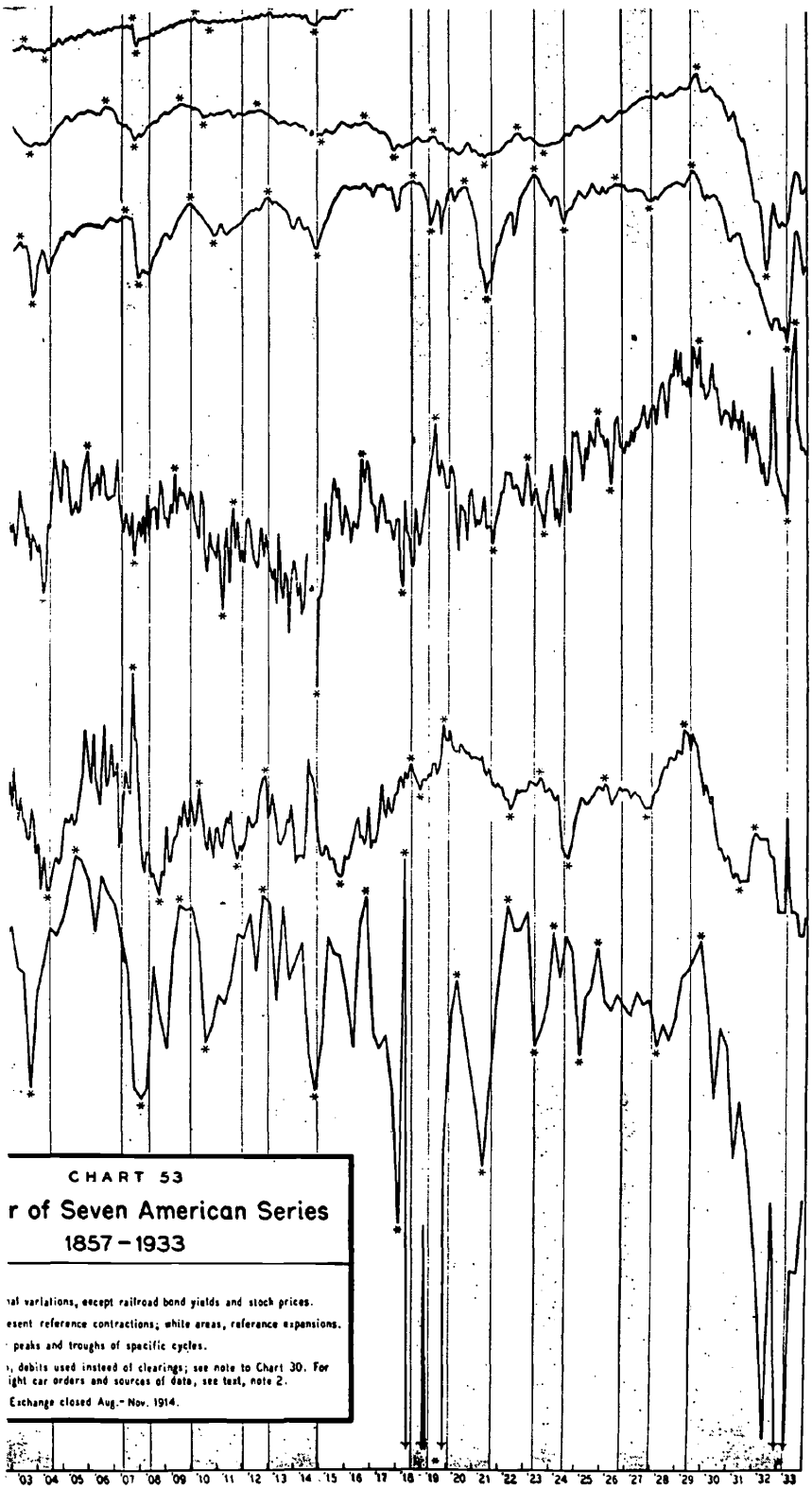


CHART 53

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1857 – 1933

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esent reference contractions; white areas, reference expansions.

· peaks and troughs of specific cycles.

ı, debits used instead of clearings; see note to Chart 30. For ight car orders and sources of data, see text, note 2.

Exchange closed Aug.– Nov. 1914.

TABLE 140

Averages and Ranges of Selected Cyclical Measures of Seven American Series

Measure	Deflated clearings	Pig iron production	Freight car orders	Railroad stock prices	Shares traded	Call money rates	Railroad bond yields
PERIOD COVERED							
Specific cycles	Mar. 78 – Mar. 33	Jan. 79 – Mar. 33	4Q 70 – 1Q 33	Oct. 57 – June 32	Feb. 78 – Mar. 33	Oct. 58 – May 31	Aug. 60 – May 31
Reference cycles	Mar. 79 – Mar. 33	Mar. 79 – Mar. 33	4Q 70 – 1Q 33	Dec. 58 – Mar. 33[h]	Mar. 79 – Mar. 33	Dec. 58 – Mar. 33[h]	Dec. 58 – Mar. 33[h]
NUMBER OF CYCLES							
Specific	15	15	19	18	15	23	20
Reference	15	15	16	19	15	19	19
DURATION OF SPECIFIC CYCLES[a]							
Expansion	33(13, 74)	29(10,49)	18 (3,42)	29 (5, 84)	18 (4,41)	20 (4,39)	21 (8,58)
Contraction	11 (2, 40)	15 (5,44)	21 (6,42)	21 (5, 62)	26 (6,47)	18 (4,35)	21 (2,50)
Full cycle	44(28,114)	43(26,72)	39(18,84)	50(17,146)	44(24,86)	38(19,53)	42(17,68)
AMPLITUDE OF SPECIFIC CYCLES[b]							
Rise	27 (6,60)	62(36,108)	213(106, 585)	36 (6, 90)	98(45,182)	116(33,316)	11(2,36)
Fall	13 (3,55)	55(19,149)	212 (67, 591)	32 (5,142)	92(38,176)	116(27,337)	13(2,33)
Rise & fall	40(18,91)	117(55,199)	425(209,1176)	67(23,232)	190(89,359)	232(83,653)	23(6,44)
Rise per month[c]	0.8(0.4, 1.5)	2.4(1.3, 4.9)	22.6(3.6,195.0)	1.4(0.3,3.6)	7.6(2.4,20.3)	6.9(2.0,24.5)	0.6(0.2,1.8)
Fall per month[c]	1.9(0.5,12.5)	4.7(1.1,10.4)	11.7(5.0, 39.4)	1.7(0.7,4.3)	4.1(1.3, 9.6)	7.6(1.3,21.1)	0.9(0.2,4.1)
Rise & fall per month[c]	0.9(0.5, 1.5)	2.9(1.2, 5.1)	13.2(4.1, 65.3)	1.4(0.6,2.5)	4.6(1.9, 8.0)	6.3(1.7,14.2)	0.6(0.2,1.5)
SECULAR MOVEMENTS							
% change from cycle to cycle							
Total[d]	+15(−6,+26)	+14(−30,+39)	+9(−59,+136)	+10(−21,+49)	+14(−51,+77)	0(−83,+55)	−2(−20,+21)
Per month[c]	+0.37(−0.18,+0.66)	+0.35(−0.58,+0.96)	+0.23(−3.03,+4.80)	+0.21(−0.55,+1.35)	+0.34(−1.20,+2.30)	0.00(−2.52,+1.39)	−0.04(−0.85,+0.93)
CONFORMITY							
Expansion stages[f]	VIII-V	I-V	VIII-IV	VIII-IV	VIII-IV	I-V	III-VI
Change per month during reference[g]							
Expansions	+0.8(+0.4,+1.1)	+2.3(+1.4,+5.0)	+3.8(+0.4,+9.3)	+0.8(−0.6,+1.9)	+2.0(−0.6,+4.8)	+3.6(−0.6,+11.9)	+0.2(−0.3,+1.1)
Contractions	−0.5(−1.5,+0.7)	−2.3(−4.4,−0.3)	−3.9(−8.0,+1.4)	−0.6(−2.9,+1.6)	−1.7(−3.9,+2.2)	−3.6(−8.7,− 0.2)	−0.2(−0.8,+0.2)
Index of conformity to reference							
Expansions	+100	+100	+100	+79	+87	+68	+47
Contractions	+73	+100	+62	+60	+73	+100	+30
Cycles	+86	+100	+100	+74	+93	+100	+68

The ranges are shown in parentheses; the lowest figure is to the left of the comma, the highest figure to the right. Averages are outside the parentheses. For several measures in this table, cycle-by-cycle figures are given in Appendix Table B1.

[a] In months.

[b] In specific-cycle relatives.

[c] Unweighted average.

[d] Corresponds to col. 9 of our Table S3; see sample in Table 33.

[c] Weighted average. Corresponds to col. 10 of our Table S3; see sample in Table 33.

[f] Matched in every series with reference expansion.

[g] That is, average change per month in reference-cycle relatives during stages matched with reference expansion and contraction.

[h] The index of conformity to reference contractions and full cycles covers an extra phase at the beginning; that is, the period covered is June 1857–March 1933.

TABLE 141

Average Timing of Specific-cycle Turns and Their Variability
Seven American Series

Series	Number of cycles		Lead (−) or lag (+) in months			Number of specific-cycle turns that			
	Specific	Reference	Average	Average deviation	Range	Lead	Lag	Coincide	Lead or lag 3 mos. or less
					Timing at reference peaks				
Deflated clearings...	15	15	+3.2	3.2	−2 to +15	1	10	3	10
Pig iron production..	15	15	+1.9	4.2	−11 to +11	4	8	3	9
Freight car orders...	19	16	−5.8	6.8	−23 to +11	12	4	0	3
Railroad stock prices.	18	19	−5.6	5.8	−22 to +10	13	3	1	6
Shares traded.....	15	15	−10.4	5.2	−23 to +4	14	1	0	1
Call money rates....	23	19	−0.1	3.8	−13 to +10	8	8	3	11
Railroad bond yields.	20	19	+7.8	3.8	+1 to +18	0	16	0	3
					Timing at reference troughs				
Deflated clearings...	15	15	−5.8	3.8	−15 to 0	14	0	1	6
Pig iron production..	15	15	−3.4	3.2	−13 to +1	12	1	3	10
Freight car orders...	19	16	−3.0	5.8	−17 to +10	12	5	0	5
Railroad stock prices.	18	19	−7.4	8.0	−32 to +12	14	4	0	5
Shares traded.....	15	15	−4.6	5.2	−19 to +7	12	2	2	8
Call money rates....	23	19	+1.5	5.6	−14 to +16	9	10	0	8
Railroad bond yields.	20	19	+11.8	7.6	−6 to +27	2	13	1	1

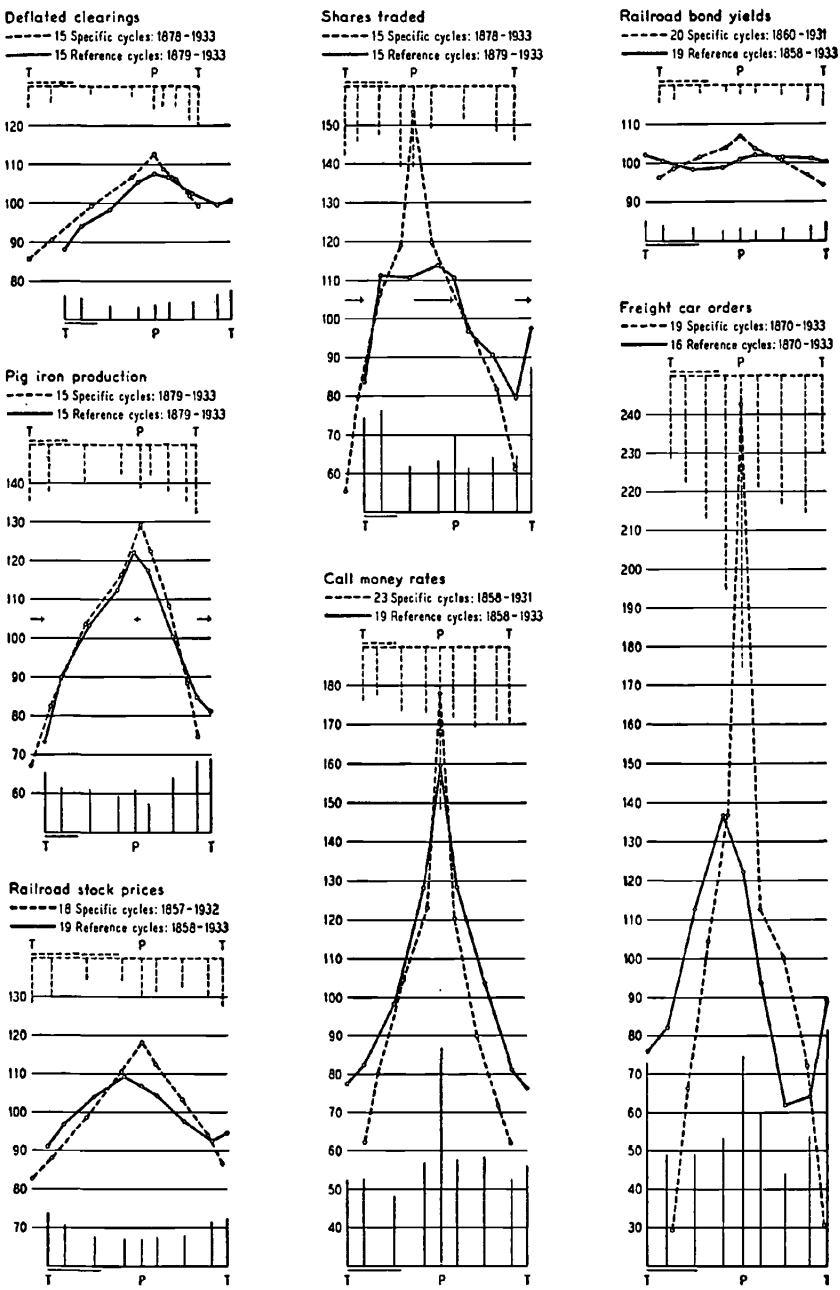
See Table 140 for the periods covered, and Appendix Table B3 for the timing of the individual specific-cycle turns at corresponding reference turns.

duction and share trading, have specific cycles that bear a one-to-one correspondence to business cycles.[4] None of the seven series leads or lags consistently at reference troughs. Railroad bond yields lag at every reference peak to which a specific-cycle peak corresponds, but we lack observations on the timing of this series at several peaks. The timing of the specific-cycle turns at reference troughs ranges from −13 to +1 months in iron production and from −32 to +12 months in railroad stock prices; the range at peaks runs from +1 to +18 months in railroad bond yields, from −2 to +15 in deflated clearings, from −23 to +11 in freight car orders. Iron production, deflated clearings, and freight car orders rose in every cycle during the stages matched with reference expansion; the other series show at least one decline during these stages. Iron production and call money rates declined invariably during the stages matched with reference contraction; every other series exhibits two or more lapses from conformity. In the peak stage of one reference cycle there were no freight car orders, in another they ran 133 per cent above the average for the cycle. At one reference-cycle peak call money rates were 35 per cent below the cycle average, at another 425 per cent above. One expansion in stock prices lasted 84 months, another only 5 months. The shortest contraction in bond yields is 2 months, the longest 50 months. The range of the full

[4] Even iron production is an exception if the record is pushed back of 1879, as is evident from the 'extra' contraction from March 1878 to Jan. 1879.

CHART 54

Average Cyclical Patterns of Seven American Series



Horizontal scale, in months 0 12 24 36 48 60

In series whose specific-cycle turns bear one-to-one correspondence to reference turns, → indicates lead at reference peaks, or troughs; and ← indicates lag at reference peaks.

For sources of data, see text, note 2; for explanation of chart, Ch. 5, Sec. VIII; for average patterns, Tables 142 and 143.

TABLE 142

Average Specific-cycle Patterns and Their Variability
Seven American Series

Series and measure	Standing in specific-cycle relatives at stage								
	I	II	III	IV	V	VI	VII	VIII	IX
	Initial trough (3 mos.)	Expansion			Peak (3 mos.)	Contraction			Terminal trough (3 mos.)
		First third	Middle third	Last third		First third	Middle third	Last third	
DEFLATED CLEARINGS (15)									
Average	85.7	90.5	99.2	106.7	112.6	108.7	106.0	101.9	99.2
Lowest value	72.2	78.2	95.5	101.3	104.3	96.8	90.0	74.8	68.4
Highest value	98.0	97.0	103.8	116.2	131.7	126.9	130.2	124.6	121.5
Range	25.8	18.8	8.3	14.9	27.4	30.1	40.2	49.8	53.1
Average deviation	5.5	4.2	2.0	2.8	5.9	5.2	6.6	8.8	10.6
PIG IRON PRODUCTION (15)									
Average	67.3	82.5	103.7	116.5	129.3	122.6	108.2	88.4	74.6
Lowest value	38.9	54.6	84.9	103.8	110.0	106.0	71.1	31.0	24.4
Highest value	123.3	129.2	147.6	154.7	173.3	137.9	125.1	109.1	106.3
Range	84.4	74.6	62.7	50.9	63.3	31.9	54.0	78.1	81.9
Average deviation	14.6	12.1	9.5	7.5	11.2	7.9	11.9	14.6	17.8
FREIGHT CAR ORDERS (19)									
Average	29.5	66.3	104.5	136.8	242.5	112.6	100.2	72.2	30.9
Lowest value	0.0	19.3	37.4	11.7	141.0	0.0	3.0	0.0	0.0
Highest value	91.3	152.3	298.6	444.8	591.0	180.2	185.6	166.0	86.9
Range	91.3	133.0	261.2	433.1	450.0	180.2	182.6	166.0	86.9
Average deviation	21.5	27.7	37.0	55.3	75.3	28.9	33.4	35.8	20.3
RAILROAD STOCK PRICES (18)									
Average	82.8	88.0	98.8	110.8	118.3	112.4	103.2	94.0	86.6
Lowest value	56.1	60.6	82.8	101.3	104.8	101.0	91.9	41.8	16.0
Highest value	101.9	104.5	106.3	132.2	157.8	140.4	129.4	120.9	115.9
Range	45.8	43.9	23.5	30.9	53.0	39.4	37.5	79.1	99.9
Average deviation	11.6	9.6	5.3	5.4	9.5	8.4	7.3	9.4	12.3
SHARES TRADED (15)									
Average	55.4	79.7	106.5	119.0	153.4	119.7	100.4	81.6	61.0
Lowest value	23.3	51.4	70.8	89.1	120.4	100.3	80.9	57.9	30.2
Highest value	81.5	112.7	145.6	181.9	217.7	142.3	117.2	112.0	95.6
Range	58.2	61.3	74.8	92.8	97.3	42.0	36.3	54.1	65.4
Average deviation	17.7	14.2	12.6	20.8	20.8	10.9	8.3	11.6	14.0
CALL MONEY RATES (23)									
Average	62.1	80.3	104.7	123.2	178.0	120.4	89.9	71.8	61.9
Lowest value	31.6	43.2	68.5	73.0	116.2	87.4	39.2	33.5	30.1
Highest value	105.5	132.3	154.5	162.1	369.6	163.3	146.3	132.9	132.8
Range	73.9	89.1	86.0	89.1	253.4	75.9	107.1	99.4	102.7
Average deviation	13.7	12.3	16.3	16.8	41.8	18.1	20.7	18.9	19.5
RAILROAD BOND YIELDS (20)									
Average	96.1	98.4	101.5	104.0	106.9	103.7	100.6	96.9	94.3
Lowest value	75.3	83.8	96.1	100.3	101.4	99.2	95.2	84.5	76.9
Highest value	106.1	107.3	106.7	108.4	111.7	109.6	106.7	105.0	104.7
Range	30.8	23.5	10.6	8.1	10.3	10.4	11.5	20.5	27.8
Average deviation	4.6	3.8	2.1	1.7	2.4	2.1	2.6	4.0	5.2

The number of cycles covered is shown in parentheses after the title of the series. See Table 140 for the periods covered, and Appendix Table B1 for the cycle-by-cycle patterns.

TABLE 143

Average Reference-cycle Patterns and Their Variability
Seven American Series

Series and measure	Standing in reference-cycle relatives at stage								
	I	II	III	IV	V	VI	VII	VIII	IX
	Initial trough (3 mos.)	Expansion			Peak (3 mos.)	Contraction			Terminal trough (3 mos.)
		First third	Middle third	Last third		First third	Middle third	Last third	
DEFLATED CLEARINGS (15)									
Average	88.1	94.0	98.4	105.2	107.5	106.7	102.3	99.5	100.6
Lowest value	71.1	82.5	90.8	100.8	99.5	100.5	87.0	75.5	67.5
Highest value	107.6	112.4	109.6	118.4	115.5	113.7	110.6	110.6	112.2
Range	36.5	29.9	18.8	17.6	16.0	13.2	23.6	35.1	44.7
Average deviation	6.6	5.7	3.7	3.2	4.0	4.5	4.8	6.6	7.6
PIG IRON PRODUCTION (15)									
Average	73.3	90.0	103.5	112.5	122.2	117.6	100.4	84.8	81.1
Lowest value	41.1	61.5	85.1	96.6	106.1	101.5	66.3	32.1	24.5
Highest value	124.6	132.2	148.4	153.1	169.3	139.8	123.5	108.7	106.1
Range	83.5	70.7	63.3	56.5	63.2	38.3	57.2	76.6	81.6
Average deviation	15.5	11.4	10.9	9.4	10.7	7.3	13.9	18.2	19.0
FREIGHT CAR ORDERS (16)									
Average	76.0	82.1	112.9	136.8	122.3	93.8	62.0	64.1	89.2
Lowest value	0.0	0.0	17.4	59.8	0.0	0.0	2.4	3.9	0.0
Highest value	292.4	142.9	164.2	200.3	232.8	229.5	117.8	173.0	350.5
Range	292.4	142.9	146.8	140.5	232.8	229.5	115.4	169.1	350.5
Average deviation	53.0	29.0	29.1	33.3	54.6	40.2	24.1	33.8	61.6
RAILROAD STOCK PRICES (19)									
Average	91.0	96.9	104.0	109.4	106.9	104.3	97.7	92.5	94.7
Lowest value	52.8	60.1	87.0	89.5	88.6	91.5	80.9	27.8	27.3
Highest value	129.4	131.4	133.4	143.8	153.0	144.2	118.3	125.4	126.1
Range	76.6	71.3	46.4	54.3	64.4	52.7	37.4	97.6	98.8
Average deviation	13.8	10.7	7.7	7.0	7.0	7.4	7.9	11.5	12.2
SHARES TRADED (15)									
Average	83.8	111.2	110.9	114.0	110.6	96.8	90.5	79.5	97.5
Lowest value	24.0	78.0	84.3	89.5	61.9	67.0	63.7	54.9	44.0
Highest value	137.9	180.1	139.6	141.9	161.0	133.3	115.6	133.0	194.6
Range	113.9	102.1	55.3	52.4	99.1	66.3	51.9	78.1	150.6
Average deviation	24.7	26.5	11.9	13.2	20.0	11.4	14.2	14.6	37.7
CALL MONEY RATES (19)									
Average	77.5	82.4	98.4	128.2	159.5	128.5	103.9	81.1	76.2
Lowest value	29.8	40.0	66.1	61.4	65.0	64.8	43.8	36.6	32.6
Highest value	130.7	135.6	167.3	268.5	524.9	195.2	212.3	151.0	157.2
Range	100.9	95.6	101.2	207.1	459.9	130.4	168.5	114.4	124.6
Average deviation	22.3	22.8	18.2	26.9	56.9	27.6	28.3	22.4	26.0
RAILROAD BOND YIELDS (19)									
Average	102.0	100.5	98.3	98.9	101.0	102.0	101.5	101.1	100.2
Lowest value	92.4	92.4	84.4	87.6	96.0	97.8	92.0	89.8	85.3
Highest value	113.4	111.7	109.0	108.6	112.4	110.5	111.2	111.0	111.9
Range	21.0	19.3	24.6	21.0	16.4	12.7	19.2	21.2	26.6
Average deviation	5.1	4.0	3.3	2.6	3.1	2.5	3.2	3.8	4.7

The number of cycles covered is shown in parentheses after the title of the series. See Table 140 for the periods covered, and Appendix Table B3 for the cycle-by-cycle patterns.

amplitudes of the 125 specific cycles in the seven series runs from 6 to 1,176 points. In pig iron production the most violent cycle has three to four times the amplitude of the mildest cycle. In railroad stock prices the most violent cycle has ten times the amplitude of the mildest. In one specific cycle the standing of freight car orders at the peak was about 40 per cent above the cycle average, in another almost 500 per cent above.[5] Even the percentage change from the level of one specific cycle to the next is unsteady within each series. In deflated clearings the percentage change from cycle to cycle varies from −6 to +26, in call money rates from −83 to +55, in freight car orders from −59 to +136.[6]

II Function of Averages and Average Deviations

To extract order from such highly variable observations on the specific and reference cycles of economic activities, we use devices that vary from one group of series to another according to the problems we encounter. But one device is common to our analysis as a whole and distinguishes it from the techniques usually employed by business-cycle statisticians: for virtually every series we strike averages that include all or most of its specific and reference cycles. In this way we attempt to expose the typical characteristics of the cyclical behavior of different activities and of business as a whole, and to establish a base from which the wide variations in cyclical behavior observable in actual life may be readily explored.

The averages of our sample series suggest that stock prices, share trading and freight car orders tend to lead in business-cycle revivals and recessions, that bond yields tend to lag, that call money rates tend to move coincidently, while deflated clearings and iron production tend to lead in revivals and lag in recessions. The amplitudes of the specific cycles of pig iron production are enormous in comparison with bond yields, but seem moderate in comparison with freight car orders. Expansions average three times as long as contractions in deflated clearings but only two-thirds as long in share trading. Contraction is a briefer and more violent phase than expansion in most series; in freight car orders and share trading expansion is briefer and more violent. The specific cycles of call money rates and freight car orders have sharply pointed, narrow tops; the cyclical top of stock prices seems rounded by comparison. Railroad stock prices conform better to business cycles than railroad bond yields, call

[5] The average deviations of the specific-cycle patterns tend to be at a maximum in stages I, V and IX, and at a minimum at or near stages III and VII. In large part this is a technical result of the use of the average standing during a cycle as the base for the relatives. A contributory factor is the brevity of stages I, V and IX, in comparison with the other stages. The latter factor leaves its impress also on the average deviations of the reference-cycle patterns, and it is reinforced by the first factor if the timing of a series matches fairly closely the reference dates.

[6] These percentage changes are computed on the base of the average value of the two cycles being compared. If the preceding cycle is used as the base, the range is still wider; in freight car orders it becomes −46 to +426.

money rates conform better than share trading, and iron production conforms better than freight car orders. Observations of this character for numerous series and several countries enable us to judge what cyclical behavior is characteristic of different activities, and lay the groundwork for a simple and systematic description of business cycles.

When averages are struck for groups of cycles, features peculiar to single cycles tend to fade away, while features common to most cycles tend to stand out clearly. The larger the number of cycles the greater the confidence we usually feel in the representative value of an average. At times, however, the representative quality of an average is improved by reducing the number of cycles. When we find secular changes in cyclical behavior, our usual practice is to break the series into segments that are roughly homogeneous and to compute separate averages for the cycles in each segment. More often we exclude from the averages such cycles as we believe are dominated by random influences. Most exclusions are cycles in price and value series affected by violent changes in monetary conditions. Occasionally, cycles in physical quantity series are excluded; for example, the cycles in vessel construction during World War I, and several cycles in anthracite coal mining distorted by strikes. Sometimes we exclude a cycle in averaging certain measures but include it in averaging others. Thus in price series the final stage of the reference cycle ending in 1914 is often seriously distorted by the outbreak of war; hence this stage is excluded in computing the average reference-cycle pattern but other stages of the cycle are included. All exclusions from our averages, and the reasons for them, will be noted in the succeeding monographs. The averages are as a rule unweighted arithmetic means, though we supplement them by weighted means in some of our measures, and occasionally use medians or other averages.[7]

To keep the varying character of the arrays from which the averages are drawn clearly in mind, we compute also a simple measure of dispersion—the average deviation from the arithmetic mean. Sometimes we find it desirable to use standard deviations, variances, or coefficients of variation; but for most of our work the average deviations seem sufficient. The average deviations are more than safeguards. They have a positive value, for they bring out what we consider one of the most important aspects of cyclical behavior. Some economic processes are fairly uniform in their movements from cycle to cycle, and so have relatively small average deviations; most factors show wide diversity of movement, and so have large average deviations. To know what processes can be counted upon with some assurance to behave in a standard fashion, and what processes vary in an unpredictable fashion from one cycle to the next, is important both theoretically and practically.

[7] To reduce the influence of extreme 'per month' figures, which usually occur during brief phases, we present weighted as well as unweighted averages in our standard Tables S2, S5 and R2. See pp. 134, 330, 342.

III Problems Raised by Averages

But are we justified in assuming that averages of cyclical movements are proper starting points for theoretical inquiries? An average covering a dozen cycles in a series takes no account of the historical sequence in which they occurred. Given a set of measures for individual cycles, the average will be the same whether the cycles show a progressive rise or a progressive decline in amplitude, whether the amplitudes vary haphazardly or depend upon the position of the cycles within 'long waves'. If secular, discontinuous, or cyclical changes of formidable scope occur in specific or business cycles, the repetition that justifies the use of averages becomes a repetition in name only. Under such conditions averages that cover decades hide significant traits of cyclical behavior; their historical value may be slight and their value as bases of future expectations slighter still.

The conclusions reached by some earlier investigators warn us not to dismiss this possibility lightly. Certain economists have held that 'commercial crises' tend to become progressively more severe; others have held the diametrically opposite view. Best known among suggestions of this character is Karl Marx's thesis that the commercial crises characteristic of capitalism tend to become increasingly severe. A generation or two later, Thorstein Veblen argued that the alternation of lively expansions and contractions is giving place to a chronic state of mild depression, from which business revives only when stimulated by favorable random factors.[8] Many American observers in the 1920's were persuaded that business cycles were being 'ironed out'. At the same time many of their foreign contemporaries believed that a structural change had taken place in world economy, and that business cycles shifted as a consequence from the characteristic pattern of pre-War times to a pattern marked by persistent underemployment and intensified fluctuations. Similar remarks have been echoed and re-echoed the world over since the crash of 1929–30.

Besides these contentions that there are secular and discontinuous changes in cyclical behavior, we must note the hypothesis that business cycles are minor subdivisions of 'major' or 'long' cycles. Several investigators have found long cycles by analyzing statistical records. Thus Kondratieff finds 'long waves' lasting about 50 to 60 years; Kuznets finds 'secondary secular movements' averaging 22 years in production and 23 years in price series; Burns finds 'trend cycles' of about 15 to 20 years in production and other business activities; Wardwell finds 'major cycles' that average about 15 years in the United States and 9.5 in Germany; Kitchin finds 'major cycles' lasting usually about 7 years, sometimes 10

[8] For fuller statements of the views of Marx and Veblen and references, see Mitchell, *Business Cycles: The Problem and Its Setting*, pp. 8-9, 42-4, 232, 255.

years.[9] If business cycles really succeed one another in cyclical fashion, then the position that an individual business cycle occupies in a 'long cycle' determines whether it is a mild movement of slight consequence or a convulsive fluctuation, whether the revival with which it begins is vigorous or mild, whether its expansion develops into a 'boom', whether its recession becomes a 'crisis', and whether its contraction turns into a drastic 'depression'.

The hypotheses we have noted are of the greatest importance. If any one of them is valid, we should be missing our opportunities if we did not take full account of it. As stated in Chapter 1, our aim is to determine as thoroughly as we can what business cycles are, which means that we must try to determine whether the variations of successive business and specific cycles are haphazard or follow some regular pattern. This objective is always before us in later monographs, where we prepare materials as well as we can in advance for a systematic attack in the theoretical volume. But we believe that an intelligible notion of what business cycles are can best be reached from available statistical records by a process of successive approximations. The primary objective of our monographs on cyclical behavior is to describe in a preliminary way the typical features of business cycles. Whether our averages yield a useful first approximation to a description of cyclical behavior turns on the question whether such secular, discontinuous, or cyclical changes as may have occurred in business and specific cycles may for a time be slighted, not on the question whether such changes have actually occurred.

All we need to determine at this stage, therefore, is whether secular, discontinuous, or cyclical changes in cyclical behavior have been so pronounced that they discredit the use of averages. For this purpose sample studies should suffice. In Chapter 10 we investigate secular and discontinuous changes in relation to our averages of cyclical behavior; in Chapter 11 we investigate cyclical changes. Finally, in Chapter 12 we consider whether 'random' differences among business cycles are so great as to make averages futile constructions. These studies put us in a fair position to judge to what extent averages of the sort used in our standard tables are open to serious criticism. At the same time they give us an opportunity to explain more fully the flexible features of our technique; in particular, how we modify our procedures when the materials at hand seem to require it.

[9] The different periods found by these investigators are not necessarily contradictory since several cycles may coexist. Schumpeter, for example, works with a three-cycle schema. See the references cited in Ch. 11.