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CHAPTER 7

Varieties of Reference-Cycle Amplitude

I RANGE AND DISTRIBUTION OF AMPLITUDES

Reference-cycle amplitudes are tied closely to our judgments about cyclical timing and the indexes of conformity. Having decided in what stages the reference-cycle pattern of a series typically reaches its trough and peak, we compute three amplitude measures from the average standings of the series in its typical peak and trough stages: (1) for the phase matched with reference expansion, (2) for the phase matched with reference contraction, and (3) for the two phases combined.[1] The last measure is the arithmetic sum of the phase movements when one is a rise and the other a fall. It is the difference between the phase movements when both are advances or both are declines; for, when a series either rises or falls during both expansions and contractions, the influence of business cycles upon its behavior is limited to accelerating the movement in one of the phases and retarding it in the other. A plus sign prefixed to the expansion or to the full-cycle amplitude indicates positive and a minus sign indicates inverted conformity; but a minus sign prefixed to the contraction amplitude indicates positive and a plus sign inverted conformity.

Table 10 and Chart 5, which summarize the amplitude measures, correspond to Table 6 and Chart 3, which summarize the indexes of conformity. While the numerical value of conformity indexes cannot fall below 0 or rise above 100, amplitudes have a lower but not an upper limit. How radically the two measures differ in their distribution is most readily seen by comparing the two charts. Over a third of the conformity indexes are concentrated at the extreme upper limit of their possible range; the heaviest concentration of amplitudes occurs near to the lower limit. More than two-thirds of the amplitudes

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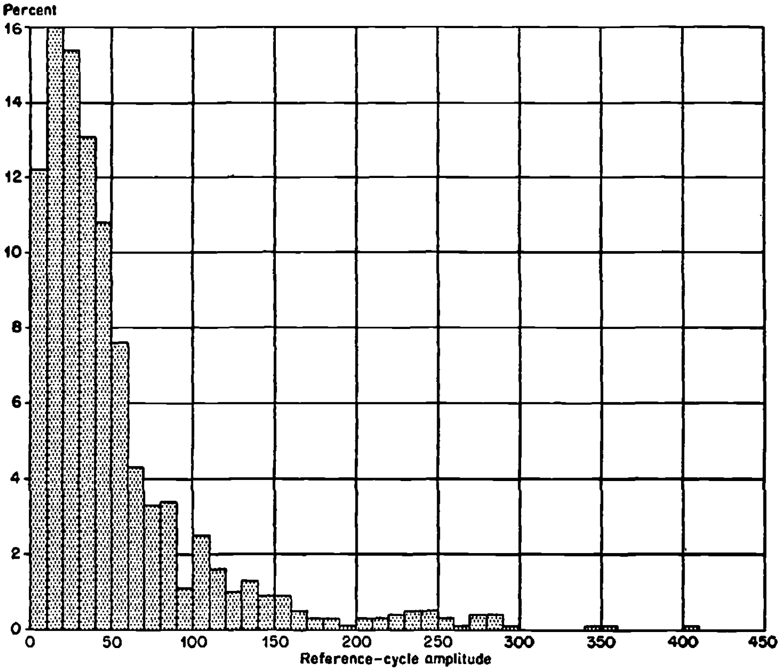
[1] In general, (3) = (1) − (2), all signs regarded.

fall in the range 0–49, and another fifth in 50–99. Yet the 13 percent of the amplitudes of 100 or more run to such high values that the arithmetic mean stands well above the median of the array, whereas the mean of the conformity indexes is lower than the median.

Chart 5

Percentage Distribution of 794 Series According to the Numerical Value of Their Average Reference-Cycle Amplitudes



See Table 10.

II The Problem of Bias

The number of cycles covered by a series has no such technical influence upon its amplitude as upon the numerical value of its conformity index. But the fact that so many of our series are confined to the years between the two world wars, or a part of that unsettled period, raises the question whether this small sample of cycles presents unusually violent or unusually mild fluctuations. We can answer with confidence that it presents both. For example, the contraction of 1926–27 was exceptionally mild, that of 1929–33 exceptionally severe; the expansion of 1921–23 was much more vigorous than that of 1927–29. All in all, the average amplitudes of the 5 reference cycles in 1919–38, and of the 4 in 1921–38, seem to exceed those of the

Table 10

SUMMARIES OF AVERAGE REFERENCE-CYCLE AMPLITUDES OF 794 MONTHLY OR QUARTERLY SERIES[a]

RANGE, DECILES, AND QUARTILES OF ARRAYS

	Average Reference-Cycle Amplitude			
	Expansion	*Contraction*	*Full cycle*	
	(signs regarded)	(signs regarded)	Signs regarded	Signs disregarded
Lowest (in contraction, highest)	−122.9	+126.1	−249.0	0.2
1st decile	−4.7	+8.6	−10.8	8.2
2nd "	+3.5	−0.3	+6.7	15.1
3rd "	+7.8	−5.6	+16.0	21.2
4th "	+11.7	−9.9	+22.9	27.4
Median	+16.7	−14.2	+30.4	34.3
6th decile	+22.0	−18.7	+39.2	42.4
7th "	+27.1	−24.0	+49.6	53.5
8th "	+35.1	−33.0	+67.6	71.2
9th "	+53.6	−54.7	+106.8	111.2
Highest (in contraction, lowest)	+187.6	−219.0	+400.3	400.3
Lower quartile	+5.4	−2.9	+11.8	17.6
Upper quartile	+30.2	−27.7	+54.7	59.7
Range: Lowest to highest	310.5	345.1	649.3	400.1
Central four-fifths	58.3	63.3	117.6	103.0
Central three-fifths	31.6	32.7	60.9	56.1
Central two-fifths	19.3	18.4	33.6	32.3
Central fifth	10.3	8.8	16.3	15.0
Interquartile	24.8	24.8	42.9	42.1

PERCENTAGE DISTRIBUTION OF AVERAGE FULL-CYCLE AMPLITUDES, SIGNS DISREGARDED

Amplitude	%	*Amplitude*	%	*Amplitude*	%	*Amplitude*	%
0– 9.9	12.2	100–109.9	2.5	200–209.9	0.3	300–309.9	...
10–19.9	16.0	110–119.9	1.6	210–219.9	0.3	310–319.9	...
20–29.9	15.4	120–129.9	1.0	220–229.9	0.4	320–329.9	...
30–39.9	13.1	130–139.9	1.3	230–239.9	0.5	330–339.9	...
40–49.9	10.8	140–149.9	0.9	240–249.9	0.5	340–349.9	0.1
50–59.9	7.6	150–159.9	0.9	250–259.9	0.3	350–359.9	0.1
60–69.9	4.3	160–169.9	0.5	260–269.9	0.1	360–369.9	...
70–79.9	3.3	170–179.9	0.3	270–279.9	0.4	370–379.9	...
80–89.9	3.4	180–189.9	0.3	280–289.9	0.4	380–389.9	...
90–99.9	1.1	190–199.9	0.1	290–299.9	0.1	390–399.9	...
						400–409.9	0.1
0–99.9	87.2	100–199.9	9.3	200–299.9	3.1	300–409.9	0.4

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[a] 'Signs disregarded' means that the sign is dropped *after* the average reference-cycle amplitude of a series is computed.

Table 10 (concl.)

MEANS AND MEDIANS OF AVERAGE FULL-CYCLE AMPLITUDES

	Median	*Arithmetic mean*
668 series with positive amplitudes	+36.8	+53.9
126 series with negative amplitudes	−17.2	−33.7
794 series without regard to sign	34.3	50.7
794 series with regard to sign	+30.4	+40.0

PERCENTAGE DISTRIBUTIONS OF FULL-CYCLE AMPLITUDE AND CONFORMITY COMPARED

Amplitude	%	%	*Conformity index*
0– 39.9	56.7	3.6	0– 9
40– 79.9	25.9	4.5	10– 19
80–119.9	8.7	4.3	20– 29
120–159.9	4.0	5.4	30– 39
160–199.9	1.1	5.0	40– 49
200–239.9	1.4	9.2	50– 59
240–279.9	1.3	8.1	60– 69
280–319.9	0.5	12.0	70– 79
320–359.9	0.3	8.8	80– 89
360–400.3	0.1	39.1	90–100
Total	100.0	100.0	*Total*

earlier cycles covered by our data.[2] If so, most of the amplitude averages of our present sample are higher than they would be

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[2] Our most definite evidence for this opinion comes from the relatively long series in our collection. Millard Hastay has selected 30 series covering 15 to 21 business cycles, plus 11 covering 10 to 14, and compared their average amplitudes in 1919–38 with those in earlier periods. Averages were taken both before and after extreme movements had been excluded—mainly the war and first postwar cycles in price and value series. Three-quarters of the comparisons showed a higher mean amplitude in 1919–38 than before 1919. The 10 exceptions to this rule were 3 open market interest rates, bank clearings in New York, outside clearings after 'deflation', Snyder's clearings index of business (also deflated), bonds (but not shares) traded on the New York Stock Exchange, Evans' record of business incorporations, liabilities (but not the number) of business failures, and the Bureau of Labor Statistics index of the prices of metals and metal products.

Hastay's sample includes 11 series that can be taken as indicators of 'general business activity', 3 that represent investment decisions, 3 that reflect industrial output or employment, 2 on foreign commerce, 9 on commodity prices, 9 on the money and security markets in New York, 2 on corporate earnings, and 2 on failures. Production is most inadequately represented; the single series on construction relates to Manhattan; there are no series on retail trade, personal incomes, inventories, or banking. Yet, pending a more thorough investigation, we incline to accept the conclusion toward which this sample, and much nonstatistical evidence, points.

if all our series could be carried back to 1900, or 1880, or 1850. By the same token, the averages are lower than they would be if we discarded all data earlier than 1919. Thus the measures in Table 10 and Chart 5 seem to be biased, but whether the bias is in an upward or downward direction depends upon the range of experience one wishes to cover. If one wants a long-range average, our measures are probably too high; if one wants to summarize the conditions with which the current generation has had to contend, our measures are probably too low. How grave either bias is cannot be determined with assurance from data now available.[3]

III AMPLITUDES IN VARIOUS SECTORS OF THE ECONOMY

Table 11 is similar in form to Table 8. In discussing measures of timing and conformity, I argued that indexes of a given value are as indicative of the impact of business cycles upon an activity when the timing is neutral or inverted as when the timing is positive. But I also had occasion to point out that some inversions—butter production, for example—make expansions less buoyant and contractions less drastic. When we think about the range and variety of activities swayed by business cycles, the first consideration must be stressed; when we think about the cyclical fluctuations of the whole economy, the second consideration becomes the more important. So we proceed as before, presenting amplitude measures with and without regard to sign, knowing that we shall have use for both sets.

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[3] Perhaps the least hazardous guess at the order of magnitude of the bias can be made by averaging the amplitudes of Hastay's 11 indicators of 'general business activity'. Measures which cover from 10 to 21 cycles yield averages of +22, —17, +39, while the averages of the cycles before 1919 come out +21, —12, +33, and the averages for 1919–38 are +24, —28, +52. (The successive entries show respectively the amplitude during stages matched with reference expansion, contraction, and full reference cycles.) Thus our standard average reference-cycle amplitude is 6 points higher than that for the earlier and 13 points lower than that for the recent group of cycles. It should be noted that the differences are wider in contraction (mainly because of the 'Great Depression') than in expansion. On the problem of secular change in amplitudes, see however *Measuring Business Cycles,* Ch. 10, especially pp. 406–12.

Minus amplitude signs do not always mean inversion, or plus signs positive timing. Of the 608 positive series[4] in our sample, 2 have average reference-cycle amplitudes of −0.2 and −0.6; of the 77 inverted series, 1 has an amplitude of +0.2; of the neutral series, 22 have plus and 2 minus amplitudes; finally, of the 85 irregular series, 39 are scattered through the array of plus and 46 through the array of minus amplitudes. Of course, only in groups where irregular series are relatively numerous, or where there is a mixture of inverted and positive series, are there appreciable differences between the average amplitudes computed with and without regard to sign.

Most basic of all the facts brought out by the table is the wide range of the amplitudes presented by different segments of our economy. When amplitudes are measured in percentages of the average standing of a series during a reference cycle, contracts for construction work let by private parties rise and fall in the course of a business cycle 13 times as much as bond yields and long-term interest rates. The five highest ranking groups represent aspects of investing; but so also do the interest rates yielded by bonds, which rank lowest. How can an economic system function when its interrelated parts have such widely different 'coefficients of expansion'? And how can we account for these differences?

The coefficient of rank correlation between the reference-cycle amplitudes and the business-cycle conformity indexes of Table 11 is only +.33. It is clear that conformity influences the average amplitudes; but it is equally clear that various other factors must be taken into account.

IV FACTORS THAT INFLUENCE AMPLITUDES

A RELATIONS BETWEEN SPECIFIC- AND REFERENCE-CYCLE AMPLITUDES

We may start with the formal proposition that the reference-cycle amplitudes of a series are determined jointly by its specific-cycle amplitudes, reference-cycle timing, and degree of conformity.

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[4] See Ch. 6, p. 94, note 7.

Table 11

GROUPS OF SERIES RANKED ACCORDING TO THEIR AVERAGE REFERENCE-CYCLE AMPLITUDES[a]

GROUP	NO. OF SERIES	AVERAGE REFERENCE-CYCLE Amplitude *Signs regarded*			RANK, SIGNS DISREGARDED	
		Amplitude *Signs regarded*	**Amplitude** *Signs disregarded*	Conformity, Signs Disregarded	Amplitude	Conformity[b]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bond yields & other long-term interest rates	12	+3.6	12.8	66	1	10
Production, foodstuffs	47	+8.3	15.3	42	2	3
Employment, perishable goods industries	8	+18.2	18.2	78	3	15
Hours of work per week	9	+20.4	20.4	100	4	28.5
Earnings per week, month, or year	10	+23.0	23.0	94	5	25
Prices, semidurables	18	+24.1	24.1	52	6	5
Prices, farm products & foods	51	+20.3	24.9	52	7	4
Prices, durables	45	+26.0	26.3	65	8	9
Employment, semidurable goods industries	13	+27.2	27.2	77	9	14
Retail sales	10	+27.6	27.8	82	10	19
Prices, perishables other than foods	22	+27.6	29.5	63	11	7
Payrolls, perishable goods industries	8	+31.2	31.2	76	12	12
Inventories, irregular timing	18	−23.6	33.6	24	13	1
Construction contracts, public	16	+42.5	42.5	32	14	2
Inventories, positive timing	18	+44.3	44.3	69	15	11
Bank clearings or debits	8	+45.8	45.8	83	16	21
Indexes of business activity	11	+46.3	46.3	99	17	27
Production, semidurables	29	+47.5	47.6	79	18	17
Wholesale sales	15	+48.1	48.1	87	19	24
Interest rates, short-term	11	+49.1	49.1	77	20	13
Production, perishables other than foods	29	+51.2	51.4	83	21	20
Payrolls, semidurable goods industries	13	+55.7	55.7	78	22	16
Employment, durable goods industries	9	+62.8	62.8	98	23	26
Inventories, inverted timing	24	−68.2	68.2	64	24	8
Payrolls, durable goods industries	6	+95.0	95.0	100	25	28.5
Production, durables	57	+99.6	100.8	82	26	18
Security issues, corporate	14	+122.8	124.9	55	27	6
New orders from manufacturers	17	+147.6	147.6	86	28	22
Construction contracts, private	26	+166.0	166.0	87	29	23
Summaries						
All series on						
Prices of commodities	147	+23.8	25.7	60	1	1
Employment	37	+35.3	35.3	87	2	5
Payrolls & other income payments	30	+57.6	57.6	84	3	4
Production	188	+55.5	57.7	74	4	3
Construction contracts or permits	58	+106.1	106.1	71	5	2

Table 11 (concl.)

		AVERAGE REFERENCE-CYCLE			RANK, SIGNS DISREGARDED	
		Amplitude		Conformity, Signs Disregarded	Amplitude	Conformity[e]
GROUP (1)	NO. OF SERIES (2)	*Signs regarded* (3)	*Signs disregarded* (4)	(5)	(6)	(7)
Summaries						
All series on						
Prices of commodities or services	168	+22.4	24.4	61	1	1
Financial activities	135	+27.3	46.6	73	2	2
General business activity	13	+46.9	46.9	98	3	4
Flow of commodities, services, or income	478	+49.5	61.1	74	4	3
All series in sample	794	+40.0	50.7	71	..	..

		AVERAGE REFERENCE-CYCLE		RANK[f] IN	
		Amplitude	Conformity	Amplitude	Conformity
		(*Signs regarded*)			
All series with					
Irregular timing	85[b]	+1.9	0	1	1
Neutral timing	24	+30.6	+75	2	3
Inverted timing	77[c]	−44.3	−68	3	2
Positive timing	608[d]	+56.3	+78	4	4
All series in sample	794	+40.0	+55	..	..

[a] See Table 8, note *a*.

[b] Includes one series analyzed in part as positive.

[c] Includes one series analyzed also as neutral.

[d] Includes two odd cases: rail orders (see Ch. 6, note 7) and one series analyzed also as neutral.

[e] Based on column (5), computed to an additional place.

[f] These ranks, like those above, are based on averages in the two preceding columns; but the signs of the averages are disregarded in the present ranking, whereas the signs of the individual series are disregarded in the averages on which the ranks of the 29 groups and of the first two summaries are based.

Most of our series are subject to fluctuations corresponding to business cycles in duration. We locate the peaks and troughs of these movements, convert the seasonally-adjusted data during each specific cycle into percentages of their average value, and strike 3-month averages of these percentages centered on the peak and trough dates, from which we compute the rise from trough to peak and the fall from peak to trough, or, in cases of inversion, the fall and the rise. Granted our methods, these measures represent the full amplitude of the cyclical movements peculiar to each series analyzed. It can be exceeded by the corresponding reference-cycle amplitude only when some bit of freakish behavior interferes, of which more in a moment.

How closely the reference-cycle amplitude of a series approaches the upper limit set by its specific-cycle amplitude depends upon the relationship over time between the two sets of cycles. If the specific-cycle peaks and troughs invariably coincide with our reference dates for business-cycle peaks and troughs, or if the specific cycles are inverted so that their peaks coincide with reference troughs and the troughs with reference peaks, the two amplitudes are equal. This condition is occasionally satisfied by monthly or quarterly, and more often by annual, series during one or more cycles; but I do not recall any monthly series covering several cycles that shows throughout perfect coincidence of its specific- and reference-cycle turns.

The timing varieties that tend to preserve specific-cycle amplitudes most fully are expansion in stages I–V or V–IX. All the other varieties listed in Table 4 put the specific-cycle peaks, or troughs, or both into reference stages that usually cover more than three months, which of course tends to lower peaks or raise troughs, or do both.

Whatever the timing type, any irregularity in the relations between the movements peculiar to a series and the general tides of business tends to widen the gap between the two amplitudes. For, in the specific-cycle analysis, all of the cyclical peaks of a series are added together and averaged, whereas irregular reference-cycle timing scatters these specific-cycle peaks among different reference stages, none of which has as high a total standing as the sum of specific-cycle peaks. So also, irregular timing makes the average reference-cycle trough higher than that of specific cycles. When the irregularity is extreme it may reduce a high specific-cycle amplitude to a very low reference-cycle amplitude. For example, contracts for building bridges underwent 5 specific cycles in 1919–38;

their average amplitude was +119, −120, +239; but the conformity was only +20, −20, −33, and this irregular timing reduced the average reference-cycle amplitude to +12, +1, +11.

Specific cycles cannot have zero amplitudes, for they are conceived to consist of alternating advances and declines. Though a few series have no specific cycles, there may be small differences between their average movements during reference expansions and contractions, which means low reference-cycle amplitudes. These cases are not exceptions to the rule that reference-cycle are lower than specific-cycle amplitudes;[5] for the absence of specific cycles is not equivalent to

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[5] The exceptional conditions under which reference-cycle exceed specific-cycle amplitudes are of two sorts.

In fixing specific-cycle turns we sometimes disregard isolated high or low points because they seem erratic rather than cyclical in character. If a disregarded high point happens to be in the reference-cycle stage that characteristically brings the culmination of expansions in the series, or a disregarded low point happens to be in the culminating stage of its contractions, the reference-cycle amplitude of this cycle may exceed its specific-cycle mate. If the series has highly regular cyclical timing, so that in other cycles the reference-cycle approximates the specific-cycle amplitude, the one cycle affected by the erratic high or low point may dominate the average of all cycles. Such a combination of contingencies is unlikely, and I cannot supply an example.

Not infrequently one specific cycle occurs within the period occupied by two business cycles, or one business cycle spans two specific cycles. When one specific cycle matches two business cycles, the tendency of specific-cycle to exceed reference-cycle amplitudes is reenforced; it may be weakened in the opposite case of two specific cycles within one business cycle. The one exceptional cycle may dominate the average relation between the two amplitudes, provided that regularity of timing makes the reference-cycle amplitudes of the other cycles nearly equal to their specific-cycle counterparts. Production of automobile trucks in 1914–38 affords an illustration. This series had two specific cycles during World War I; their mean amplitude was 120; that of the corresponding reference cycle was 158. The next 5 specific cycles were in one-to-one correspondence with reference cycles and exceeded them only a little in amplitude, so that the war episode decided the issue. The average amplitude of the 7 specific cycles is +92, −62, +154, that of the 6 reference cycles is +94, −65, +159. Another illustration, mentioned in *Measuring Business Cycles*, p. 175, is the inverted series showing stocks of slab zinc held in warehouses, which had 5 specific cycles in 1921–38, 2 of which matched one business cycle.

the presence of ghostly specific cycles without amplitudes. Finally, reference-cycle amplitudes can fall to zero. Several series come close to that limit and one reaches it in contraction.[6]

B RELATIONS BETWEEN SPECIFIC AND BUSINESS CYCLES

While helpful in organizing ideas, the preceding statements are patently incomplete, for we must ask: On what do specific cycles depend?

We conceive these cycles to be movements in specific activities corresponding in character and order of duration to business cycles. Conversely, we conceive business cycles to be congeries of specific cycles. There is nothing novel in this way of thinking; it comes from applying to our problem the familiar idea that, in a system of private enterprise, all economic activities are interdependent. The intricacies of the crisscrossing relationships among the elements of such an economy have been schematically indicated by the systems of simultaneous equations devised by Leon Walras and his successors. Fundamentally the same conception runs through Alfred Marshall's more concrete description of the interactions of demand, supply, and value in the operations of producing and distributing the national income. If we must recognize 'the one in many' and 'the many in the one' when dwelling upon problems of equilibrium, so must we recognize them when thinking about economic fluctuations.

How the concepts of specific and business cycles are re-

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[6] Some commodity prices, transportation charges, and official discount rates of central banks have been kept unchanged for years at a time. We have examples of such behavior during one or more reference cycles, but not during all the reference cycles covered by a series. Also a series might rise (or fall) by the same percentage of its base in both phases of every cycle, or on the average, which would give identical amplitudes in expansion and contraction but a zero reference-cycle amplitude. Again I can cite no example. Or the changes during successive reference expansions might neatly cancel one another, and so might the changes during successive contractions, which would produce amplitudes of 0, 0, 0. One of our short series achieves this feat in contraction—hourly earnings in northern cotton mills. The lowest expansion amplitude in our sample is —0.05 (wholesale price of sulphuric acid); the lowest reference-cycle amplitudes are +0.2 and —0.2, of which the former appears in one and the latter in three series.

lated is best indicated by recalling the way in which they evolved in the course of men's thinking about economic troubles. The notion of business cycles in hazy forms goes back more than a century to 'commercial crises', which were slumps occurring at about the same time in the markets for many commodities. Our predecessors had no difficulty in grasping both the particular and the general features of these episodes. As recurrences brought fuller opportunities for observation and analysis, the concept of crises broadened into that of cycles, and clearer distinctions were drawn between what happened in the economy as a whole and what happened in its component parts. The present effort to increase knowledge of cyclical movements takes over these familiar ideas. But it defines them somewhat more precisely, and tests their objective validity more systematically.

For the latter purpose, we have collected a diversified sample of time series, and examined each specimen to see whether it is subject to movements corresponding in character and duration to those postulated by our definition of business cycles. Finding 'specific cycles' (the name alone is new) in a great majority of series, we examined their relations to one another in time.[7] Covariation appeared to be the rule. To verify or disprove this impression, we tabulated the trough and the peak dates of specific cycles in the most representative samples of series that we could arrange in successive periods. These dates appeared mainly in clusters and the clusters usually came during periods in which nonstatistical observers had sensed reversals in the direction of business movements. By analyzing the clusters of specific-cycle turning dates in the light of what we were learning about the relations of individual activities to the national economy, we could tell the years, the quarters, and approximately the months when general expansions and contractions in business activity had culminated. These inferences of the general from the particular could be checked and often improved by supposing them to be correct. That is, we imposed the business-cycle chronology derived from specific-

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[7] See *Measuring Business Cycles*, p. 66 ff.

cycle turns upon the individual series, and shifted the business-cycle dates first chosen if they misrepresented the consensus of specific-cycle turns. The broad outcome of these operations to date has been presented in the two preceding chapters. Eight-ninths of our sample of monthly and quarterly series from the United States seem to have a definite timing relation to business-cycle expansions and contractions—a behavior pattern to which they adhere on the average with a regularity exceeding three cases out of four.

The prevalence of wavelike forms among the reference-cycle patterns of Chart 1 and their infinite differences of detail illustrate these findings graphically. Both the similarities and the differences are explicable on the assumption that economic activities are functionally related to one another in the numberless direct and indirect ways suggested in fancy by the equations of Walras and the analyses of Marshall. For explanations of the behavior of one series, an investigator turns as a matter of course to the behavior of other series that he believes on independent grounds to be functionally related to the first.[8] That is the course followed in Chapter 5 where departures from the dominant variety of timing are discussed. Probably few readers had methodological misgivings then.

In no case, however, can the cyclical behavior of an activity be explained wholly by what other activities do to it. Each activity has characteristics of its own that affect its behavior and the influence it exercises upon other components of the economy. For example, the inverted pattern of butter production in factories was traced in Chapter 5, not only to the positive patterns of income receipts and milk purchases by consumers, but also to the conditions that prevent dairymen from adjusting their supply promptly to fluctuations in demand. Cows are not precisely like any other equipment for producing goods in which businessmen invest; but the possession of

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[8] The prevailing similarity of reference-cycle patterns may suggest 'nonsense correlations' without number to the incautious. On purely statistical evidence one can explain the movements of any series that conforms perfectly to business cycles by that of any other perfect conformer.

idiosyncrasies is not an idiosyncrasy, on the contrary it is a characteristic common to all goods.

To generalize: the specific cycles of every economic activity are joint products of factors peculiar to the activity itself, and of movements in other activities that impinge upon it in numerous ways and with varying force. Among these impinging activities, if our observations are representative, a majority expand and contract in unison. Thus the specific cycles of each activity are partially shaped by those congeries of specific cycles in other activities which we call business cycles. If the specific cycles of a series are formed in this fashion, so also are its reference cycles; for they are merely specific cycles transferred to a new time schedule, which has itself been derived from the consensus of specific-cycle turning dates in supposedly representative samples of series.

In trying to account for the wide variety of reference-cycle amplitudes, then, we might take up one series after another, considering in each case the conditions under which the activity represented is conducted, the other activities by which it is most influenced, and their behavior as factors shaping the behavior of the activity on which we are focusing attention for the time being. That is the procedure to follow whenever one is concerned with the cyclical amplitudes of particular series; but it is ill adapted to a systematic survey because of its mountainous detail. For the present, we can get on faster by asking, not why steel production has large reference-cycle amplitudes and department store sales much smaller ones, but by asking what factors tend to produce large and what tend to produce small fluctuations.

Even this modest inquiry will be rather long. To keep the crisscrossing influences that must be considered from getting hopelessly tangled, I shall deal first with the factors that influence the amplitudes of consumers' purchases, then turn to producers' purchases, the employment of resources, and the broad behavior of prices and production in different sectors of the economy and the system at large.

C CYCLICAL FLUCTUATIONS IN CONSUMERS' PURCHASES

Though an individual has virtually no control over the business conditions that affect his money income, he has a considerable measure of freedom in deciding how to use whatever money he receives, and the larger his income after taxes the fuller this freedom becomes. Studies of family budgets in many lands since Ernst Engel formulated his 'law of consumption' in 1857 have demonstrated that the allocation of family income among different lines of expenditure changes notably as income increases. Our measures show corresponding differences in the cyclical behavior characteristic of aggregate expenditure for different types of goods. The factors chiefly responsible for differences in reference-cycle timing and amplitude seem to be the nature of the wants to be met and the characteristics of the goods bought.

The first factor recalls the time-honored but rather fuzzy distinction between necessities, conveniences, and luxuries—fuzzy in that it changes with living standards, and differs at any given time with the past income and the personal tastes of consumers. Every day everyone requires a minimum of food, clothing, and housing. In a country as well to do as the United States, no one is knowingly allowed to starve, to go naked, or to perish from exposure; public relief and private charity prevent aggregate consumption from falling so low in hard times as it would if there were not a large-scale sharing of goods by the more fortunate. However, the demand for food declines very rapidly in intensity as consumption increases. As suggested above, people do not eat much more in the United States during expansions than during contractions, though the kinds of food they buy shift appreciably. The demand for clothing, and still more the demand for additional housing, is subject to larger cyclical fluctuations than the demand for food, partly because the appetite for additional supplies of these goods does not fall so fast after biological needs have been met.

Demand for comforts and luxuries hardly appears until the means of subsistence have been obtained; thereafter it extends to an ever wider variety of goods. Of course, dainty viands, choice beverages, large wardrobes, and roomy dwellings are themselves luxuries. The purchasing of such goods may fall very low when consumers feel poor, and rise very rapidly when they feel rich. Because the United States comes nearest to being a land of abundance, the buying of staple foods has low cyclical amplitudes; for the same reason purchases of luxuries have high cyclical amplitudes; between these rather vague boundaries fall the amplitudes of outlays upon the growing variety of conveniences that make American standards of living what they are in successive decades.

The characteristic of goods that seems to have most influence upon cyclical amplitudes is durability—a somewhat ambiguous term. A unit of electricity can be used only once, and it must be used, if at all, the minute it is generated. An egg can be eaten only once, but it can be kept in cold storage for months and still be salable. Some types of clothing have for most consumers a useful life limited by their physical properties; other types are discarded by the well-to-do when the fashion changes. A machine may have years of efficient service left in it, but be junked because a more efficient model has been put on the market.

The subtle mixtures of physical and economic considerations illustrated by these examples have to be drastically simplified in statistical classifications. There the prevailing distinction seems to be between perishables that can be used only once or for a short while, however long they may have been preserved; semidurables that are typically used, say, for six months to three years; and durables that are typically used for more than three years. All foods are treated as perishables—canned goods on the same basis as fresh fruit. Fuels and electricity are perishable—coke used in making steel, as well as gasoline for 'joy rides'. So too 'chemicals' and paper are put here, despite the repeated use of some industrial chemicals, and the indefinitely long life of many books and building papers. Semidurables comprise mainly articles of clothing, leather, and rubber goods; multiple but not indefinitely numerous uses are inferred from the physical character of the materials. Durables are in practice ores, which are really used only once, metals, metallic products, construction materials, buildings, and other man-made structures from roads to dams. As Table 11 shows, this classification brings out highly significant differences in the cyclical behavior of production and employment; but its crudity also hides certain differences.

For present purposes, the point of chief importance is that durability confers ability to control the timing of purchases for replacement. When a perishable is used, it must be replaced before another use can be enjoyed. We have already noticed that the practical effects of this truism depend upon whether the good is a necessity or not. If a single-use good is felt by its users to be as vital as coffee is to millions of Americans, perishability maintains a rather steady flow of purchases, which in this instance increase in contraction. An operatic performance is no less perishable than coffee; but to few Americans is grand opera a necessity; most people can adjust their indulgences to the state of their pocketbooks with less sacrifice than they feel in postponing the purchase of a new automobile. Thus, to understand many of the differences in cyclical amplitudes, we must cross our first classification upon the second.

Semidurables in the necessary class typically have amplitudes larger than basic perishables because consumers have more leeway in determining when to buy. But this leeway has time limits narrower than most business cycles. Shirts will not come back wearable after more than so many trips to the laundry. Shoes cannot be reheeled and resoled indefinitely. The specific cycles in our series on the production of textiles, shoes, and automobile tires conform rather closely to most business cycles, but when a contraction lasts more than 18 or 24 months, the output of these articles is apt to rise, which suggests that mass buying expands somewhat despite the continued shrinking of family incomes. If we could secure production records of fine attire, we might find continuous decreases even in long contractions.

Durables have limits of useful life so elastic that consumers are seldom forced to buy when very reluctant to do so. The recent war gave the whole nation a demonstration of how long motor cars can be kept running. Contracts for residential buildings, it is true, typically rise before contractions are over, but not because the old buildings have been used up like shirts and shoes. Durability cushions the shocks of cyclical fluctuations in that the longer goods last, the more leeway people have in deciding when to buy new units. Rather paradoxically, this cushioning of the shocks upon consumers induces a type of behavior that makes cyclical fluctuations more violent.

Of other factors that influence consumer purchasing, at least three should be mentioned. First is the ability to carry stocks of goods adequate to meet needs for considerable periods, which increases control over the timing of purchases. The close connection of this factor with differences in durability is obvious. Nations at war can restrict drastically the output of consumer durables for several years at a stretch without undermining civilian morale. So, too, a prosperous people entering a cyclical contraction with relatively well stocked wardrobes can restrict their purchases of wearing apparel for months without grave discomfort. Perishables present a different case. Many a farm family keeps in its cellar a winter's supply of potatoes, canned vegetables and fruits, smoked and pickled meats, and it may have also a shed filled with firewood. The age-old arts of preserving perishables have been enormously improved and extended by applications of scientific discoveries. But broader trends have tended to reduce the carrying of food and fuel stocks by families. An increasing percentage of people live in cities where few families have the space and equipment required for storing appreciable stocks. That task has been handed over to commercial enterprises, and will be discussed in connection with business inventories.

The second factor is the availability of 'consumer credit'. By emancipating people from the restrictions that current income or assets place upon their purchases, credit increases control over the timing of demand. Being based upon expectations of future ability to pay, credit gives imagination tinged with emotional coloring a larger role in determining action. But the freedom to buy conferred by the granting of credit is followed by a restriction: part of future income is committed to repayment and less is left to spend on the wants that will crop up in days to come. How much influence this factor has upon cyclical amplitudes we cannot say with assurance, for the availability of credit is merely a condition that gives other factors fuller sway over consumers' choices. Yet we can observe its effects here and there, because consumers resort to credit in financing certain kinds of goods with especial freedom.

We may set aside the large volume of 'charge account' credit that is used by shoppers merely as a convenience. For our purposes, it matters little whether goods are paid for at the time of purchase, at the end of the week, or on the first of next month. But when charge accounts are allowed to run for months at a time, and become a means of tiding needy families over serious emergencies, they must be counted among the influences that sustain the demand for basic consumer goods during contraction, and so mitigate somewhat the hardships it imposes. About these credit arrangements between retail stores and their customers we have little information, but collections doubtless become slower in hard times, and perhaps the unpaid balances mount despite the decline in sales.

Much more is known about sales of goods on instalment and the granting of short-term loans to consumers. The first type of transaction is largely confined to purchases of durable goods that can be 'repossessed' by the lender in case of default. A large proportion of short-term loans serves the same purpose as instalment sales, but a part is negotiated to meet emergencies of divers sorts. What chiefly concerns us about transactions of both types is that they enable consumers to increase their purchases of durables as soon as their *prospects* improve after a cyclical contraction and many months before they have saved enough money to pay in cash. Such transactions continue to increase as long as the prospects of more and more people keep improving, or until reluctance to assume further debts overbalances desires for further goods. Meeting the payments on purchases made during expansion contributes toward the drastic reduction in the buying of durables during contraction.

While it seems plain that instalment credit tends to heighten the amplitude of cyclical fluctuations, the relative importance of this factor has been much debated. Holthausen, Merriam, and Nugent have estimated that the total instalment credit granted by retailers of goods (including automobiles) and cash lending institutions exceeded 5 billion dollars in 1929, fell to 2 billion in 1932, and rose again to more than 5 billion in 1937. These are imposing sums, but in no year did they reach 11 percent of the annual incomes of consumers receiving $5,000 or less. More important is the fact that every year consumers were paying instalments on earlier contracts. That is, the change in purchasing power effected by instalment credit consisted, not of the volume of credit granted, but of that sum minus repayments. This 'net credit change' varied between an excess of repayments of 711 million dollars in 1932 and an excess of new credits of 773 million in 1936. In only one year did these balances reach 2 percent of consumer incomes up to $5,000. Similar results have been reached by Blanche Bernstein, who used a quite different source.[9] The Study of Consumer Purchases in 1935–36, a Works Progress Administration project that covered some 60,000 nonrelief families in all parts of the country, made it possible to determine the net change in purchasing power arising from all forms of consumer credit. Dr. Bernstein summed up her findings as follows:

> For the nonrelief population as a whole, the gross addition to purchasing power [in 1935–36] . . . from the use of consumer credit . . . came to less than 3 percent of the total income received, and after subtraction for repayments the net addition to income was less than 2 percent, or approximately $805,000,000. The entire class of families with

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[9] See Holthausen, Merriam, and Nugent, *The Volume of Consumer Instalment Credit, 1929–38* (National Bureau, 1940), especially pp. 99, 101; Bernstein, *The Pattern of Consumer Debt, 1935–36* (National Bureau, 1940), especially p. 10; Gottfried Haberler, *Consumer Instalment Credit and Economic Fluctuations* (National Bureau, 1942).

incomes under $500, however, added a net 10 percent to their immediate purchasing power through the use of consumer credit, and families with incomes of $500–2,000 added from 2 to 5 percent. On the other hand, for families receiving more than $2,000 consumer credit was relatively insignificant as a source of funds for additional spending.

A third factor that bears on the satisfaction of consumer wants, and which is probably more important than the highly fluctuating item of consumer credit, is the relatively stable provision for certain consumer needs supplied through government. Public schools, highways, public health offices, police and fire protection, not to mention the multiform services performed by departments of the federal government, make a substantial contribution to the American standard of living. Though the production of these goods is authorized indirectly by consumers as voters, and the costs are met from taxes they consent to have levied, the whole process of deciding what services to render and how to pay for them differs so radically from the business model that these operations are commonly disregarded in cyclical studies. While we have not yet investigated governmental activities systematically, we know that they conform less closely to the cyclical tides on the whole than do private activities organized in business enterprises, except when a great war expands governmental operations to a scale that dominates the economy. Yet even in peacetime, the governmental sector has become so considerable that lack of detailed data concerning its fluctuations is a serious deficiency in our sample.

D CYCLICAL FLUCTUATIONS IN PRODUCERS' PURCHASES

The common statement that the demands of business enterprises for goods depend directly or indirectly upon what consumers buy is substantially valid, though it requires the qualification that producers and distributors spend much energy in trying to influence consumer choices, and the reminder that how much consumers can buy depends primarily upon how much business enterprises pay out in wages, salaries, interest, rent, and dividends, plus what Simon Kuznets calls 'entrepreneurial withdrawals' from the incomes of small concerns operated by their owners.

Since retailers pass on consumers' demands to preceding links in chains of supply, the differences we have noted in the cyclical amplitudes of demand for various types of goods tend to be maintained in the dealings of business enterprises with one another. But the conditions under which enterprises of different sorts operate modify the timing and amplitudes of fluctuations in considerable degree.

One of the leading factors responsible for these alterations is the size of the inventories carried by business enterprises in relation to their sales. We have noted that the possession of stocks of goods gives consumers fuller control over the timing of purchases, and so tends to increase the amplitude of cyclical fluctuations in the quantities bought. The like is true of business houses. Dealers in fresh vegetables, fish, meats, milk, bakery goods, newspapers, and other ultraperishables try to buy every day what they think they can sell. That is, they pass along to wholesale houses, bakers, publishers, or other suppliers whatever changes occur in their daily sales. Dealers in perishables that deteriorate less rapidly, in semidurables, and in durables carry stocks varying from a few days' sales to the sales of several months—in some trades, a year or more. Carrying stocks becomes a competitive necessity where it is physically and financially feasible; for customers can satisfy their tastes best in a shop that offers a considerable assortment of qualities, sizes, styles, and prices. The successful retailer learns from experience approximately how large a stock in proportion to sales it is profitable to carry. The prevailing stock-sales ratios, or 'turnover rates', differ not only from one branch of trade to another, but also within a given branch from one shop to another according to the class of customers catered to.

Now the larger a retailer's stock in proportion to daily sales, the less is he forced to buy his merchandise on a hand-to-mouth basis, and so to pass on unmodified the variations in consumer demand. Much work can be saved, and better terms can be had by ordering the bulk of his requirements in rather large lots and at considerable intervals, with the expectation of placing 'fill-in' orders if sales exceed estimates. This clustering of orders tends to produce wider fluctuations, both seasonal and cyclical, in the purchases of goods by retailers than in their sales to consumers. Furthermore, good times tempt the retail merchant to 'speculate in inventories'. Even the man who consciously resists this dangerous practice, and not all merchants do resist all the time, may think it safe to base his expectation of future sales on changes occurring in current sales.

Say, for example, that experience has taught some merchant to maintain a monthly stock-sales ratio of 3:1, and that he places his bulk orders at monthly intervals. Say also that monthly sales have gone up 5 percent, and that the larger volume seems likely to be maintained. To obey his rule of thumb, the retailer must increase his purchases more than his sales have risen; for his inventory has been depleted by the 5 percent increase in sales, and he must not only make up this deficiency but also raise his inventory from 3 × 100 to 3 × 105; that is, his increase in purchases must be 20 percent. If the merchant takes a chance that sales will continue to increase 5 percent a month, similar reasoning will lead him to increase monthly purchases about 35 percent. If, on the contrary, sales decline, purchases will be reduced more than sales have fallen off, and the more pessimistic are expectations regarding the volume of future sales, the more will the reduction in purchases exceed the reduction in sales.

Not only is the amplitude of purchases likely to be larger than that of sales, but the cyclical timing may be different. An unexpected decline in the *rate* at which sales rise in late expansion may leave our merchant with awkwardly large stocks, and lead him to reduce his purchases before sales turn downward. Seemingly more common is an upturn of purchasing by merchants in late contraction, while their sales are still shrinking, though more slowly than before, to replenish inventories that have fallen below standard.

Needless to say, my numerical example is fanciful. But it suggests how the carrying of stocks tends to amplify the modest fluctuations characteristic of much consumer purchasing as orders are passed back by retailers who carry appreciable stocks instead of buying hand to mouth. The higher the stock-sales ratio, the greater the amplification. In Table 11 the mean reference-cycle amplitude of our 10 series on retail sales is 28 points, of our 15 series on wholesale sales 48 points. Unfortunately, the available series of sales at wholesale do not match at all well the series of retail sales. Neither the comparison of the group averages nor any comparison of individual series in our sample affords a convincing test of the reasoning.

A further increase in amplitudes is probable when the wholesaler who carries stocks buys consumer goods from the manufacturer. Our 17 series on new orders have average reference-cycle amplitudes of 148. But all of these orders call for durable goods, whereas our wholesale series relate mainly to sales of perishables and semidurables, and again no satisfactory comparisons can be arranged between individual series in the two groups.

In turn, manufacturers who carry stocks of the materials they use may group their purchases in large lots, and pass on demands that fluctuate even more violently than the orders they receive. But the opposite may often be true. For when merchants place large orders, they seldom wish the goods delivered all in one shipment. Our series on the physical volume of merchandise received by department stores has reference-cycle amplitudes only a trifle larger than those of the series on the physical volume of department store sales (+16, −13, +29 as compared with +16, −10, +26). The task of supplying consumers can be carried on most efficiently by maintaining as steady a flow of goods as technological and economic conditions allow from the producers of raw materials to factories, thence to distributors, and finally to individual purchasers. For the steadier this flow, the better can production be organized, the more fully can industrial equipment be utilized, and the smaller will be the capital investment per unit of output.

Our best bit of evidence about what actually happens comes from Ruth P. Mack, who has managed to assemble fairly comparable data upon successive links in the shoe-leather-hide chain of supply. Table 12 presents certain of her findings concerning the physical and the dollar volume of sales and output. The reference-cycle amplitudes increase modestly from retail to wholesale sales of shoes, increase again from wholesaling to manufacturing, and increase a third time (now more sharply) from making up shoes to tanning leather. At the raw material stage, however, the succession of increases is reversed in the physical volume records, and—in spite of the high cyclical variability of hide prices—in two of the three dollar comparisons. 'Movement of hides into sight' is dominated by the inspected slaughter of cattle, although the power of increased demand to attract hides from country areas and abroad imparts some additional flexibility to their supply. The reference-cycle amplitudes of federally inspected slaughter in 1908–38 averaged +13, −10, +23, well inside the range of Dr. Mack's briefer averages for the movement of hides. In this country, of course, cattle are slaughtered primarily for beef, and the cyclical behavior of the series is characteristic of the food group. Hides are a not very consequential byproduct, of which the price fluctuates much more than the output. If all leather were produced domestically and made from some synthetic substance turned out for that one use in readily controllable volume, the production of the raw material would probably have cyclical amplitudes equaling or exceeding those of leather, while its price would fluctuate less than the price of hides and probably less than its output.

One feature of the table may arouse misgivings: the fluctuations of employment in shoe factories are much smaller than the fluctuations in pairs produced, and a minor fraction of the fluctuations in payrolls. 'Employment' means here the number of names on payrolls, not manhours of work performed. A shrinkage in the buying of shoes is met only in part by reducing the number of employees; for the rest, it is met by sharing what work is to be had in smaller lots among those who remain on the factory rolls. In the shoe industry, wages are paid mainly

Table 12

AVERAGE REFERENCE-CYCLE AMPLITUDES AT SUCCESSIVE LINKS IN THE SHOE-LEATHER-HIDE CHAIN OF SUPPLY

	SERIES[a]	EXPANSION STAGES	AVERAGE REFERENCE-CYCLE AMPLITUDE								
			2 Cycles, 1927–38			3 Cycles, 1924–38			4 Cycles, 1921–38		
			Expansion	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*
	Physical Volume										
1	Pairs of shoes sold at retail	I–V	+17.2	−13.6	+30.8	...	...	...	...	...	...
2	Index of wholesale sales of shoes, deflated	VIII–V	+10.0	−25.4	+35.4	+9.6	−18.0	+27.6	+11.4	−18.2	+29.6
3	Total shoe production	VIII–V	+20.6	−19.6	+40.2	+16.7	−12.0	+28.7	...	...	...
4	Index of factory employment, boots & shoes	I–V	+11.5	−11.4	+22.9	+9.5	−9.1	+18.6	+10.8	−10.9	+21.7
5	Cattle hide & kip leather production	VIII–V	+19.3	−31.7	+51.0	+12.9	−23.6	+36.5	+18.6	−22.6	+41.2
6	Cattle hides, total movement into sight	VIII–V	+4.4	−23.4	+27.8	+3.4	−14.8	+18.2	+13.8	−17.8	+31.6
	Value										
7	Retail sales of shoes	I–V	+26.4	−37.6	+64.0	...	...	...	...	...	...
8	Index of wholesale sales of shoes	I–V	+15.8	−49.6	+65.4	+14.6	−32.8	+47.4	+13.0	−30.3	+43.3
9	Value of total shoe production at factories	I–V	+31.4	−46.4	+77.8	+25.4	−29.0	+54.4	+23.7[b]	−27.7	+51.4[b]
10	Index of factory payrolls, boots & shoes	I–V	+29.4	−43.2	+72.6	+22.8	−31.4	+54.2	+21.8	−29.2	+51.0
11	Value of cattle hide & kip leather production	I–V	+34.2	−77.1	+111.3	+23.3	−41.5	+64.8	+23.8	−40.6	+64.4
12	Value of cattle hides moving into sight	VIII–IV	+11.2	−74.4	+85.6	+11.2	−32.0	+43.2	+30.0	−40.6	+70.6

[a] See Appendix B for sources of data.

[b] Initial expansion covers only stages II–V.

on a piecework basis, and changes in total payrolls are a better indicator of fluctuations in the amount of work done than is the number of people to whom some wages are paid. The table indicates that the cyclical amplitudes of payrolls differ little from those of value produced.

We should note also that the increase of cyclical amplitudes as we pass from retailing shoes to tanning leather is accompanied by a shift toward earlier timing. On the average of the few cycles covered, the shoe industry has somehow managed toward the end of contraction to begin increasing the wholesale distribution of shoes, their manufacture, and the production of the basic material one stage earlier than consumers have begun increasing their purchases. That such differences are economically feasible is suggested by what was said above about changes in the sales and in the purchases of merchants in branches of trade where the monthly stock-sales ratio is moderately high. Nor is the failure of the employment series to rise as soon as the output of shoes suspicious in the light of what was said in the preceding paragraph. Finally, the failure of all except one of the dollar series to rise in stage VIII–IX may mean merely that commodity prices and wage rates lag behind production at revival.[10]

Of course we cannot assume that the shoe-leather-hide chain represents accurately what happens in other industries producing semidurable consumer goods, not to speak of perishables on the one side or durables on the other. Not until what Dr. Mack has done with much difficulty and various reservations for one industry during a brief period can be supplemented by numerous similar researches shall we have a clear view of the relations between consumer purchasing and cyclical fluctuations in antecedent links of the chains that run back to the production of raw materials, and that disburse much of the income wherewith consumers buy. Meanwhile we seem warranted in proceeding on the assumption that cy-

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[10] For a much more thorough analysis and a demonstration of 'subcycles' in this group of series, see the forthcoming monograph, "Consumption and Business Cycles, A Case Study: Shoes", by Ruth P. Mack.

clical amplitudes tend to grow larger, and that cyclical turns tend to occur earlier (at least at troughs) as we pass from retailing to wholesaling, to manufacturing, and sometimes as we go on to the production of raw materials. On the one hand, these tendencies are deducible from what we know about the influences exerted by the carrying of inventories upon the relations between the sales and the purchases of business enterprises. On the other hand, such rough comparisons as we can make among the series of our sample indicate that the tendencies in question commonly manifest themselves in practice. Indeed, I think that our statistical evidence for the groups of Table 11 exaggerates the increase in amplitudes, because the data available for the earlier industrial stages more often than not represent processes that are highly sensitive to business cycles for reasons besides their remoteness from retail distribution to consumers.

The preceding analysis applies most definitely to industrial chains in which a finished product can be traced link by link from specialty shops or 'departments' through factories that turn out one type of goods, to a chief raw material for which the product in question provides the main market. The transmission of cyclical impulses becomes much more complicated when several materials are combined on a somewhat similar scale in a single product, and when a single material or other good is put to many uses. The latter condition and its consequences for cyclical behavior are illustrated by fuel, electric current, transportation, communications, paper, and lubricating oil, which are bought by virtually all business enterprises and, except for lubricating oil, by all or by most families. Purchases and output of these goods, after due allowance is made for differences in intracycle trends, fluctuate cyclically much as do indexes of business activity. Yet even among them we can trace the amplification of amplitudes characteristic of the passage from retailing to manufacturing, whenever it is possible to distinguish roughly between consumer and producer goods. Compare, for example, the reference-cycle amplitudes of the following pairs of goods related in origin and mode of production but used primarily by families in one case, by business enterprises in the other—a brief list eked out by two index numbers.

PRIMARILY CONSUMER GOODS	AV. REFERENCE-CYCLE AMPLITUDE		PRIMARILY PRODUCER GOODS
Anthracite coal production	+17.5	+56.0	Bituminous coal production
Gasoline production	+27.7	+41.5	Lubricants production
R.R. passenger miles	+29.6	+52.9	R.R. freight ton miles
Newsprint paper consumption	+31.1	+55.2	Wrapping paper production
Passenger automobiles, production	+104.8	+158.5	Automobile trucks, production
Index of production, consumer goods (Fed. Res. Bank of N.Y.)	+33.9	+68.6	Index of production, producer goods (Fed. Res. Bank of N.Y.)

E CYCLICAL FLUCTUATIONS IN EMPLOYMENT OF RESOURCES

The next problem is whether amplification of amplitudes continues as we pass on to demands for the 'factors of production', which we may group under their time-honored captions, land, labor, and capital.

1 Land

In one sense, farm land approaches the ideal of full employment more closely than any other resource. When times are hard, most producers can cut their losses by letting their facilities for production stand idle part of the time. A farmer may do the like if he depends upon hired labor to put in his crops, or is subject to other heavy costs that vary directly with the scale on which he operates. But even the large-scale farmer usually thinks it better to grow a crop, if he can, than to let his land lie fallow, while the typical American farmer can get a return for his own labor and that of his children only by working his land. Indeed, if the financial outlook is unpromising when crops are put in, the farmer is tempted to *increase* the acreage he plants in an effort to offset the drop in prices. For the little an individual can add to the year's supply will not have any appreciable influence upon the selling price per unit; but each unit an individual can add to his sales at any price above out-of-pocket expenditures will make an appreciable, perhaps a crucial, addition to family income. In practice, the total area used as crop land, meadow, and pasture varies little, year by year.

About cyclical variations in land purchases we have little direct evidence and not much to say. The demand for farm lands, and their prices, fluctuates with current expectations concerning the profits of agriculture, and concerning the future of land prices themselves. It is affected by the cyclical tides, and reacts upon them. Indeed, few factors have played so spectacular a role as land speculation in the history of American business. But land booms and depressions have suffered a secular decline in relative importance as other industries have come to surpass farming in number of workers and contribution to gross national product. Within most of the period covered by our investigation, the demand for farm lands, like farm output, seems to have had only a loose connection with business cycles. In studies of differences among individual cycles, this topic retains importance down to the present moment; but in a preliminary effort to ascertain what typically happens in the course of these cycles we seem justified in classifying it as an irregular element of secondary consequence concerning which we have no satisfactory statistical record.

About the market for mineral and timber lands our information is even more vague. Here we may assume a somewhat closer and more regular relation to business cycles, apart from the discoveries of new ore deposits and oil fields—an important exception in some cases. Concerning the amplitude of fluctuations we have no systematic evidence.

We are somewhat better off in dealing with land wanted primarily for its location. Every construction project requires a site, and the parcels used, whether previously owned or newly acquired, must fluctuate with the volume of construction. Hence to this type of demand for land we may attribute the large cyclical amplitudes characteristic of our series on construction, of which the most comprehensive is the F. W. Dodge Corporation's record of value of total contracts, first in 27, later in 36 and 37 states. Our analysis covers the 7 reference cycles of 1912–38, is based on expansion stages VIII–IV, and yields conformity indexes of +71, +50, +86. The mean amplitude is +43, −30, +74. More direct, though more restricted, evidence is afforded by annual records running back to the 1830's of the 'number of acres subdivided' in Chicago, and the net increase of building lots in the Detroit and Pittsburgh 'areas'. The reference-cycle timing, conformity, and amplitudes of these three series are as follows:

				INDEX OF CONFORMITY TO			AV. REFERENCE-CYCLE AMPLITUDE		
	PERIOD COVERED	NO. OF REF. CYCLES	EXPANSION STAGES	Expansion	Contraction	Business cycles	Expansion	Contraction	Full cycle
Chicago	1834–1932	25	I–V	+56	+36	+47	+48	−42	+90
Detroit area	1834–1924	23	I–V	+65	+30	+38	+75	−44	+119
Pittsburgh area	1834–1932	25	I–V	+16	+4	+12	+14	−9	+23

Why the conformity and reference-cycle amplitude should be so much lower in the big steel center than in the other two cities I do not know. The Chicago and Detroit amplitudes are large for annual data, and confirm the inference from the Dodge record of contracts. Despite the mysterious warning from Pittsburgh, I think the demand for land as building sites must conform tolerably well on the average to business cycles, and must undergo the large reference-cycle fluctuations characteristic of durable goods.

2 Labor

Mankind's hope of some day attaining a genuine 'economy of abundance' rests on the possibility of making the goods it wants with ever less labor. But under the conditions imposed by pecuniary organization, the chief agents to whom society entrusts the utilization of its labor, its science, and other resources must give precedence to making money over making goods. Only as far as it enhances profit, is technological efficiency valued in the world of business. Production itself must stop if making goods threatens heavier losses than remaining idle will impose. There is little of the personal or the arbitrary about decisions to reduce output, and with it employment. For business managers are not free agents. They are under obligation to protect as best they can the property entrusted to them, and in times of poor markets must choose the course that promises to keep losses light and to maintain solvency. The basic difficulty lies in our economic organization, or rather in our inability to keep this organization in good working order all the time. Industrial 'know how' will not bring a satisfactory life to a nation until that nation gains also the economic 'know how' to use its resources at tolerably full capacity year in and year out. If anyone thinks the United States has the practical economic knowledge it needs, the cyclical patterns of Chart 1 should disabuse him.

Of course the worst sufferers in seasons when it does not pay to make goods are those who live by selling labor. While labor is an ultraperishable, laborers are durables—durables in need of constant upkeep. The nation has—for present purposes, we may say the nation is—a huge inventory of producer durables in various stages of maturing and decaying. As with other durables, the changes in the total stock are slight within brief periods. Indeed, the rate of increase in the potential supply of labor is not reduced by a cyclical contraction; and the current market supply may be augmented, for when the chief breadwinner of a family is looking for work in vain, he may be joined in the search by young people and women who in better times would go to school or keep house.[11]

Since labor is an ultraperishable, no inventory can be piled up by an employer for future use. At most, the employer can arrange for a flow of services varying with his requirements by entering into contracts with individuals or trade unions and by trying in less formal ways to hold his working force together even when he cannot offer regular work. Consequently, within

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[11] The logic of pecuniary organization implies that wage earners should consume less than they receive in good times so that they may save enough to tide over periods of slack employment. As far as that rule is practiced, it tends to keep down the reference-cycle amplitudes of demand for staple consumer goods. Though many families cannot and others will not save in good times, these amplitudes remain modest because families that have exhausted their savings and their credit can turn to relatives, private charity, or public relief for at least the bare essentials of livelihood.

the relatively short periods of cyclical phases, employment is dominated by the volume of production. For example, we find that in the 5 business cycles of 1919–38 records of factory employment compiled by the Bureau of Labor Statistics have mean amplitudes of +12 in flour mills, +31 in cotton mills, and +63 in steel mills—differences that correspond roughly to those in the output of the perishable, semidurable, and durable commodities in question.

However, the bond between production and employment is not rigid. Even within business cycles, we can often observe a rising trend in manhour output and its effects upon the number of employees. Immediately, this increasing efficiency must be credited mainly to employers, though fundamentally it is a cultural product of which alert businessmen make use as they do of other resources. The most active agent in developing the industrial 'know how' responsible for the great achievements and the dazzling or horrible promises of our day has been scientific research. But to utilize this fastest growing of resources requires command over capital, business organization, and commercial skills such as few scientists possess. So the task of applying discoveries to daily work falls to businessmen. They perform it by employing scientifically trained experts to plan the technical features of production processes, and also with increasing frequency by investing in scientific research itself, usually of an applied type. When manhour efficiency increases, employment rises less than output in cyclical expansions, and falls more rapidly than output in contractions. Such differences are shown by our measures, as will presently appear.

Around the generally rising trend of manhour efficiency are twined two sets of cyclical fluctuations, one positively, the other inversely, related to production. The positive cyclical movements arise from the fact that modern plants attain their highest technological efficiency when operated steadily at the capacity for which they are designed. An irregular flow of work, substandard in volume, causes expensive stoppages, and makes it harder to integrate smoothly the numerous processes that contribute to the final product. Hence unit costs tend to rise in contraction, and to fall at least during the earlier stages of expansion—a result to which other factors to be noted later also contribute, often in larger degree. In the later stages of expansion, however, the volume of work sometimes exceeds the optimum, and unit costs turn upward. It may be necessary to use substandard equipment; similarly, a shortage of well trained workers may lead to the hiring of less desirable recruits. Under such conditions, the maintenance of shop discipline becomes difficult—the penalty of discharge is less dreaded when new jobs are easy to get. These conditions are reversed in contraction, and the efficiency of personnel tends to increase again, while the reduced flow of work is tending to raise unit costs.[12]

The preceding considerations help to clarify the reference-cycle movements of our comprehensive series on employment, payrolls, and closely associated factors, which are assembled in Table 13. To secure such uniformity as is possible, longer series are cut to the time coverage of the shortest—the 4 reference cycles of 1921–38. Several features of the table merit comment.

Fluctuations in employment as reported by the Bureau of Labor Statistics are usually slighter than the corresponding fluctuations in production.[13] As noted in the discussion of Dr. Mack's shoe-leather-hide sequence, 'employment' means the number of names on payrolls, and takes no account of hours worked per week. Unfortunately, data on the length of the working week, compiled by the National Industrial Conference Board, are not classified in the same fashion as the BLS data on employment, so that we cannot readily estimate total hours of work per month in individual industries. But we may

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[12] For one industry, railroads, these relations have been studied with care. See Thor Hultgren, *op. cit.*, especially Ch. 7 and 9.

[13] The exceptions seem to be confined to food processing industries. They may be due to differences of coverage in the employment and production data, or to differences between the relative labor requirements of the industrial processes combined in an employment index and the formal weights assigned to the corresponding products in an index of production, or to technological factors of which I am unaware.

Table 13

REFERENCE-CYCLE TIMING, CONFORMITY, AND AMPLITUDE OF 'COMPREHENSIVE' SERIES ON EMPLOYMENT AND RELATED FACTORS IN FOUR BUSINESS CYCLES, 1921–1938

Series	Expansion Stages	Conformity to Business Cycles	Av. Reference-Cycle Amplitude		
			Expansion	*Contraction*	*Full cycle*
1 Employment, all mfg. (BLS index)	I–V	+100	+24	−23	+48
2 Av. hours worked per week, mfg. wage earners (NICB)	I–V	+100	+8	−16	+25
3 Manhours per week, estimated from 2 preceding series	I–V	+100	+33	−40	+73
4 Industrial production, manufactures (FRB index)	I–V	+100	+41	−35	+76
5 Composite wages (FRB N.Y. index)	I–VI	+71	+10	−5	+15
6 Av. hourly earnings, 25 mfg. industries (NICB)	I–VI	+71	+14	−5	+19
7 Av. weekly earnings, representative factories, N.Y. State	I–VI	+100	+12	−10	+22
8 Factory payrolls, total (BLS index)	I–V	+100	+39	−39	+78
9 Production of consumer goods (FRB N.Y. index)	VIII–IV	+100	+14	−17	+31
10 Cost of living (BLS index)	I–VI	+71	+3	−8	+11

BLS: Bureau of Labor Statistics
FRB: Federal Reserve Board
FRB N.Y.: Federal Reserve Bank of New York
NICB: National Industrial Conference Board

For fuller identification of sources, see Appendix B.

hazard a rough estimate for all manufactures by multiplying together the mean reference-cycle relatives of the BLS index of total factory employment and the NICB index of hours worked. In the interwar period the secular decline in the length of the working week proceeded apace, while the trend in the number of factory employees was nearly horizontal. Hence their product rises in expansion decidedly less than it falls in contraction. The opposite is true of the FRB index of manufacturing production. Though the average of the 4 cycles covered is heavily influenced by the 'Great Depression', the production index rises 41 points in expansion and falls 35 points in contraction. The difference between the expansion rise of 41 points in output and 33 points in manhours, together with the difference between the contraction decline of 35 points in output and 40 points in manhours, is a rough measure of the increasing technical efficiency with which factory labor was used. That the total cyclical amplitudes of manhours and output round off to nearly the same figure is a statistical accident—not a proof that our manhour estimate is precise or that the cyclical amplitude of output per manhour is slight.[14] The above-mentioned fluctuations in efficiency will be treated later, when we enter upon the stage-by-stage analysis of a typical cycle.

Wage rates are of crucial importance to the employer because, in conjunction with manhour efficiency, they bear directly upon unit costs of production. Their interest to the worker is obvious; indeed, it sometimes seems that trade-union officials and members, likewise government officials, overstress the importance of rates and give insufficient attention to the reaction of high prices for labor upon employment and upon the prices of consumer staples. As is well known, American wages have had a rising secular trend, at least since the resumption of specie payments in 1879—a trend that has become steeper with the progress of organized labor. To measure this broad secular movement is exceedingly difficult, and the best series we have found are none too trustworthy. Formally, at least, the FRB N.Y. index of composite wages is our 'purest' measure of changes in the monthly prices paid for supposedly

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[14] For fuller evidence and analysis of changes in output per manhour, see Solomon Fabricant, *Employment in Manufacturing, 1899-1939: An Analysis of Its Relation to the Volume of Production* (National Bureau, 1942). The leading results for all industries are summarized on pp. 16–22; individual industries are treated in Ch. 4. Fabricant's data are mostly in annual form and come chiefly from other sources than do the monthly series of our sample.

That similar, though usually less striking, increases of manhour output have occurred in other sectors of the economy is shown by other National Bureau studies of employment and productivity. See especially, Harold Barger and H. H. Landsberg, *American Agriculture, 1899-1939* (1942); Barger and S. H. Schurr, *The Mining Industries, 1899-1939* (1944); and J. M. Gould, *Output and Productivity in the Electric and Gas Utilities, 1899-1942* (1946). Similar investigations are in progress relating to the service industries. For some partial results, see the Bureau's *Occasional Papers*, No. 24, 29, and 33. A summary of these related studies to date is provided by George J. Stigler, *Trends in Output and Employment* (National Bureau, 1947).

comparable units of work. Average hourly earnings in 25 manufacturing industries approximate wage rates, but must be influenced also in some degree by changes in the composition of the working forces. However, the two series behave much alike and show what other information leads one to expect: the rising secular trend has been attained not so much by great gains in expansion, as by stubborn resistance to rate reductions in contraction. The advances in expansion have been moderate, though more than three times as fast as the rise in living costs during the brief period covered by Table 13, if we may trust our indexes. Of the moderate gains in expansion, only half on the average is lost in the succeeding contractions, so that the gains in the next expansion typically start from a higher level than in the preceding cycle.[15]

Average weekly earnings per employee should have larger cyclical amplitudes than hourly earnings, or wage rates proper, because they are influenced by number of hours worked. Our table shows such a difference, but it is smaller than is to be expected. There seems no reason why changes in the composition of working forces should affect this series more than they affect average hourly earnings. A more plausible explanation of the slightness of the difference in amplitude is that the industrial distribution of 'representative factories' in New York State gives greater weight to perishable and semidurable products than do the series on composite wages or hourly earnings.

Payrolls equal number of employees, times hours worked, times wages per hour; or number of employees times average weekly earnings. Since the factor series are positively correlated (except in stage V–VI, when wage rates, hourly earnings, and average weekly earnings rise a little), payrolls have relatively large cyclical amplitudes. They exceed the amplitudes of aggregate manhours per week, as they should because of the modest cyclical movements in wage rates, and exceed also the amplitudes of industrial production because a price factor enters into payrolls but not into physical output. Payrolls have more than twice the amplitude of consumer goods output according to the FRB N.Y. index. Of course the pro-

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[15] See Creamer, *op. cit.*

duction index records changes in physical units. But it would have required cyclical fluctuations in the retail prices of consumer goods very much larger than those recorded by the Bureau of Labor Statistics in 1921–38 to prevent wage earners' purchases from keeping up with the rise of output in expansion —provided families did not alter radically their distribution of income between current expenditure and saving as conditions improved; provided also the cyclical amplitudes of aggregate payrolls matched the amplitudes of payrolls in manufacturing. Here we are getting merely our first glimpse of an intricate problem that is one of the foci of current debate among business-cycle theorists—a problem with which we must deal faithfully later on.

3 Capital

Our most realistic view of the demand for and supply of capital as the businessman thinks of it is afforded by the accounting analysis concerned with the uses and sources of funds. Concerning the magnitude of these funds in American corporations since 1916 much can be learned from the balance sheets and income statements compiled by the Treasury from annual income tax returns. However, frequent changes in tax laws, administrative rulings, and the classification of corporations impede the use of these data. Moreover, the official summaries are totals for groups large enough to conceal the conditions of individual enterprises. To ascertain differences hidden by this necessary practice, the National Bureau's Financial Research Program has compiled from state tax records and financial handbooks several samples of balance sheets and income statements for individual corporations. I shall borrow freely from the Bureau's *Studies in Business Financing*, identifying the books referred to by the names of the authors.[16]

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[16] The authors and titles of the reports most pertinent to this section are: Charles L. Merwin, *Financing Small Corporations in Five Manufacturing Industries, 1926–36* (1942); Albert R. Koch, *The Financing of Large Corporations, 1920–39* (1943); Walter A. Chudson, *The Pattern of Corporate Financial Structure: A Cross-Section View of Manufacturing, Mining, Trade, and Construction, 1937* (1945); Friedrich A. Lutz, *Corporate Cash Balances, 1914–43, Manufacturing and Trade* (1945); and Neil H. Jacoby and R. J. Saulnier, *Business Finance and Banking* (1947).

Financial Structure of Business Enterprises

Useful basing points for the coming analysis are provided by Table 14, which summarizes Chudson's cross section of corporate balance sheets and income accounts as reported in 1937 to the Bureau of Internal Revenue by enterprises engaged in 61 branches of mining, manufacturing, construction work, and trade. The table stresses the varieties of financial pattern; but one who studies Chudson's charts finds that the distribution of the 61 'minor industrial divisions' around the central tendencies of their arrays is such as to give the medians of Table 14 considerable significance.

Of chief interest for present purposes are the following observations: (1) Three-quarters of total assets belong to the stockholders on the average. This ratio varies within the moderate limits of 43 and 85 percent. (2) The heaviest investment is usually in fixed capital assets; but here the range of variation is very wide. Technological requirements are the chief determinants of this ratio, which runs highest in public utilities (not included in the table), and declines progressively as we pass to mining, manufacturing, retailing, and wholesale trade. (3) Working capital runs in Chudson's whole sample about as high as fixed capital assets plus long-term investments. More detailed figures show wide industrial differences in the percentage of current to total assets—trade 63 percent, manufacturing 39, electric light and power 6, telephone 6, railroads 4.[17] (4) Long-term debt is smaller than short-term on the average. In 1937, sums due to commercial houses exceeded sums due to banks. (5) In more than half of the groups covered, annual sales exceeded total assets.

Fixed Capital

Outside the realm of finance, the bulk of an enterprise's 'fixed capital' is usually invested in durable goods. The demand for these 'producer durables' is subject to cyclical fluctuations even more violent than those we have seen to be characteristic

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[17] See Koch, *op. cit.*, p. 42.

Table 14

RANGE OF VARIATION OF BALANCE-SHEET RATIOS AMONG MINOR INDUSTRIAL DIVISIONS, 1937[a]

	Range		Median	Index of Relative Variation[b]
	Low	*High*		
PERCENTAGE OF TOTAL ASSETS				
Fixed capital assets	4.9	74.4	34.6	47.4
Other investments	5.3	25.6	12.6	72.2
Cash	1.4	13.0	6.2	35.5
Government securities	0.1	4.9	1.8	61.1
Receivables	5.5	37.9	13.7	58.4
Inventory	0.5	47.5	22.7	62.6
Notes payable	1.2	16.6	5.2	69.2
Accounts payable	4.4	29.4	7.6	43.4
Long-term debt	1.2	35.9	6.9	78.3
Capital stock	27.5	66.1	47.7	16.1
Surplus	6.1	51.7	25.2	32.1
Net worth	42.7	84.9	75.4	18.7
PERCENTAGE OF SALES				
Total assets	30.6	239.2	94.7	48.6
Fixed capital assets	3.8	186.3	30.6	84.6
Cash plus government securities	1.7	19.6	7.7	53.2
Receivables	4.9	28.0	12.7	59.8
Inventory	4.7	38.5	18.2	57.7
Notes payable	0.8	20.5	4.8	37.5
Accounts payable	2.5	23.4	7.7	59.7
Other liabilities	1.0	14.7	3.9	94.9
OTHER RATIOS				
Current assets to current liabilities	0.6	5.1	2.5	40.0
Invested capital to capital assets	1.1	10.8	2.2	45.5
Net income as percent of net worth	−7.7	14.5	5.8	70.5

[a] Adapted from Chudson, *op. cit.*, Table 2. Based upon 61 'minor industrial divisions' of the Bureau of Internal Revenue classification, which are grouped as follows: mining and quarrying (6), manufacturing (47), construction (2), shipbuilding (1), trade (5).

[b] Interquartile range expressed as a percentage of the median.

of consumer durables. Buyers have as wide a leeway in deciding when to make replacements in or additions to their stock; they have also keener incentives to purchase at certain stages of a business cycle than at others. It is not clear that the owner of an old passenger automobile feels a stronger desire for a new car after revival than he felt before; but it is clear that a trucking company with the poorest of its vehicles laid up during contraction has a stronger motive to get new trucks after all of its fleet come into use. Whatever differences appear between cyclical movements in the prices charged for producer and for consumer durables may be traceable to these underlying differences between the attitudes of the two sets of buyers. Anticipating correctly the cyclical swings in the requirements for industrial equipment, being financially ready to meet their cost, and placing orders betimes are matters of much moment in many industries, especially when the investment in durable goods is relatively heavy and the goods take months to produce.

As the stock of fixed capital increases, maintenance expenditures usually mount. But maintenance expenditures are not nearly so stable as are the stocks of fixed capital, nor so volatile as are orders or construction of new plant and equipment.[18] The current upkeep of physical structures, including repairs and replacements of minor parts, is usually treated as a current expense on a par with the cost of raw materials. In a few instances virtually no other charge is made. American railroads, for example, charge almost all of their outlays on maintaining 'way and structures' to 'operating costs'.[19] But not many physical properties can be kept efficient indefinitely by piecemeal repairs. No matter how faithfully maintenance work is done, the article, be it a huge building or a single machine, declines in value. If the enterprise is to remain in business, provision must be made for replacing old properties when they shall have fallen below the required standard of efficiency. Meanwhile the proprietors and creditors must know whether the enterprise is covering all its costs.[20]

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[18] *Ibid.*, p. 132, note 7, and Solomon Fabricant, *Capital Consumption and Adjustment* (National Bureau, 1938), Table 5.

[19] Cf. Fabricant, *ibid.*, p. 44.

[20] Needless to say, I am skipping numberless problems of detail. For more adequate discussions of the distinction between maintenance and depreciation, and of the numerous ways in which durable properties depreciate, see George O. May's three chapters on depreciation in his *Financial Accounting, A Distillation of Experience* (Macmillan, 1943), and Fabricant, *Capital Consumption and Adjustment.*

To the latter end, the accountant accepts a (necessarily rough) estimate of the depreciation suffered during the year by the durable properties of an enterprise, and deducts this sum from current receipts when computing its profit or loss on the year's operations. Besides retaining from operations funds to offset depreciation, a successful enterprise usually retains part of its net earnings. These retained earnings may be used like depreciation reserves for whatever purpose the management thinks important—to increase any asset or diminish any liability. While depreciation reserves supposedly prevent the gradual decline in the value of an enterprise's fixed property from producing a decline in its net worth, the retention of earnings supposedly increases net worth. Within brief periods, the gross savings of business enterprises include both reserves to offset depreciation and undistributed profits; net savings include only the latter. But these internal sources of funds are not always sufficient to cover fixed capital requirements; in that event the enterprise may turn to other devices—chiefly borrowing or selling additional shares to stockholders, old or new.

The relative costs of acquiring and maintaining fixed property vary considerably, and so too does the importance of various sources of funds for financing the acquisition of fixed capital. Though the basic data leave much to be desired, a few broad conclusions can be drawn. (1) Maintenance charges exceed depreciation accruals several fold in American railroad practice, and to a less degree in some other utilities; but it appears that in most other nonfinancial types of business annual depreciation exceeds maintenance.[21] (2) In manufacturing, according to our sample of large corporation accounts covering the 19 years 1921–39, depreciation reserves (plus property revaluations) were much larger than the sum of undistributed earnings plus net funds obtained from security issues. Among trading companies, however, undistributed earnings exceed the sum of depreciation and new funds from the security

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[21] See Fabricant, *ibid.*, pp. 44–8, and Table 29.

markets.[22] (3) According to the Kuznets-Fabricant estimates, of which more presently, nearly two-thirds of the capital 'formed' in the United States from 1921 to 1938 was required to offset the capital 'consumed' in those years. Presumably, in the economy as a whole, over a period of this length, depreciation charges roughly equal capital 'replacements'; whereas the increase in capital is provided mainly by retained profits and net increase of investments by stock and bond holders.

In cyclical behavior the several ways of financing durable properties differ widely. Unlike maintenance expenditures, depreciation charges are linked more closely to the book value of fixed physical assets at the beginning of successive years than to sales within years. Only in long contractions are the aggregate book values of the property held by all enterprises in an economy likely to decline. Thus the average fall in depreciation during reference-cycle contractions is relatively smaller than the average fall in maintenance. Of course, the absence of decline in a contraction tends to moderate the rise during the subsequent expansion. Fabricant's final summary of accounting measures of depreciation and of repairs and maintenance yields the following mean reference-cycle amplitudes in the four cycles of 1921–38:

	Expansion	*Contraction*	*Full cycle*
Depreciation (all business capital)	+8.2	−0.5	+8.7
Repairs & maintenance (public utilities only)	+12.6	−22.0	+34.6

These figures understate the differences in amplitude between depreciation and maintenance, because the maintenance figures

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[22] The figures compiled from Koch's (*op. cit.*) samples (see his Tables 4, 12, 13, and 14), which seem to be broadly though not strictly comparable, are as follows:

	ANNUAL AVERAGE, $ MILLION, 1921–39	
	Manufacturing	Trade
Depreciation & property revaluations	592	21
Undistributed earnings	177	35
New funds from issues & retirements of securities	128	9

are restricted to types of business well above average in cyclical stability.[23]

Retained proceeds have exceedingly large reference-cycle amplitudes, in contrast to depreciation charges. Profits themselves fluctuate violently. Dividends are usually kept more stable than profits. When dividends are subtracted from profits, the remainder is even more variable than the minuend. According to Kuznets' estimates, the net dissavings of American business corporations in 1930–38 exceeded their net savings in 1919–29, and we therefore cannot measure the enormous amplitude of their retained proceeds in our standard fashion.[24]

Concerning the issuing of securities we have monthly records that, with all their deficiencies, are convincing on one point: the amount of capital secured in this fashion is subject to very large cyclical swings. Among the 29 groups of series ranked in order of their average reference-cycle amplitudes in Table 11, corporate security issues are third from the top.

To sum up: retained profits have exceedingly large reference-cycle amplitudes, net sales of securities have large amplitudes, and depreciation accruals fluctuate little. Of these sources of funds, the one with the smallest amplitudes seems to be the most important for the purchasing of industrial equipment when we consider the whole economy and considerable periods. Not only does it yield larger funds; it gives business managements the fullest discretion as to when they shall buy, and thus allows very large amplitudes in the demand for equipment. There is no close connection between the time when depreciation accrues, and the time when depreciation reserves are expended for fresh equipment—indeed, the reserves may never be put to that use. But the possession of these reserves enables enterprises to increase their purchases of industrial equipment when managements think best, even though

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[23] Professor Fabricant kindly extended his original estimates (*Capital Consumption and Adjustment*, Table 29) through 1938 for my benefit.

[24] See Simon Kuznets, *National Income and Its Composition, 1919–1938* (National Bureau, 1941), Table 39; and the comments on Table 15 below.

profits are nearing their lowest ebb, new security issues are inadvisable, and maintenance work is being deferred in many quarters. However, depreciation reserves cannot be used to obtain industrial equipment unless they have been kept in cash or assets readily convertible into cash. The next section will show how this condition is often met when times are hardest by certain developments in working capital.

Meanwhile we should note that investments in industrial equipment are not dominated by the *concomitant* volume of saving; they depend far more upon decisions by management as to the time when it is wise to use in this way certain funds retained from past operations. Also we should be clear regarding the strain we are putting upon the word 'saving' if we apply it to reserves for depreciation. Such a reserve does not represent an increase in the net worth of an enterprise. It is merely an estimate of the property used up in the conduct of business—property that has not yet been replaced, but the funds for replacing which are represented either in the increase of some asset or the decrease of some liability.

Working Capital

Among the components of working capital in the 61 branches of business represented in Table 14, much the largest as a rule is inventories. In his 1921–39 sample of large corporations, Koch shows that inventories constituted about 60 percent of the working capital in trading and about 50 percent in manufacturing companies. Abramovitz finds that manufacturing and trading concerns carry some three-quarters or four-fifths of all inventories, and that half of the remainder is held by farmers.[25]

In our sample of monthly and quarterly series for the United States we have direct evidence concerning the reference-cycle amplitudes of inventories. But these 62 series on stocks of commodities tell little about the volume of capital needed to carry

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[25] See Koch, *op. cit.*, Chart 4; Abramovitz, *op. cit.*, Table 3, and context. Manufacturers' inventories are somewhat larger than traders' in this table—a conclusion not inconsistent with Koch's finding that inventories form a larger proportion of traders' than of manufacturers' working capital, which in turn is a larger proportion of traders' than of manufacturers' total assets.

inventories. First, all of our monthly series (except department store stocks) are expressed in physical units, and, as a factor in business, inventories vary with prices as well as quantities. Second, our series on stocks of commodities are badly split among the four types of cyclical timing we recognize: 18 of the 62 have positive timing, 2 neutral, 24 inverted, and 18 irregular. If we compute the reference-cycle amplitudes of the whole group without regard to sign, we get a mean rise and fall, or fall and rise of 50 points—nearly the same as the similarly computed average of all the 794 series in our sample (see Table 10). Of course a businessman would not compute the fluctuations in his inventory in this way. Instead, he would cast up the value of the stocks of all commodities he carries, and note the fluctuations in these totals. If, as often happens, some of his stocks have positive, others inverted, and still others irregular timing, there will be more or less offsetting among their cyclical movements.[26] So, when we work with sample balance sheets, we expect to find rather moderate amplitudes in inventories because of their mixed timing as well as because the data are usually reported only once a year. Koch's samples of 80 large manufacturing and of 26 large trading corporations give mean amplitudes for inventories in the 4 reference cycles of 1921–38 of +12, −3, +15 and +27, −1, +28, respectively. The nationwide estimates of inventories in current prices used in making Simon Kuznets' tables of gross national product have intermediate amplitudes in these cycles: namely, +11, −10, +21.

These modest amplitudes of total inventories accord with rational expectations. For the total business inventories of any given date are that portion of a nation's production which is

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[26] If we respect signs in computing the mean reference-cycle amplitude of our 62 monthly series on stocks of commodities, the average comes out −19 points; for it happens that we have more inverted than positive series in our sample, and that the irregular series yield negative averages. The weighting of our samples of inventories is not representative. Perhaps the reason is that, in this field as in many others, men have recorded factors that cause them trouble (inverted inventories) more fully than factors that are easy to manage.

then passing through the hands of producers, fabricators, and distributors on its way to final consumers. The goods that make up the inventories of any reference-cycle stage will, in altered assortments, become the bulk of the gross product of that or some later stage, so that the reference-cycle amplitudes of total inventories do not differ drastically from the moderate amplitudes of gross product itself. This relation between total inventories and gross product explains also why positive prevails over inverted timing in all comprehensive series on inventories.

Perhaps the reader has noticed that I am implicitly measuring the amplitudes of inventories on a basis different from that which I stressed in considering the amplitudes of fixed capital. If I treated stocks of industrial equipment on the same basis as stocks of raw materials held by a factory or merchandise held by a retailer, I would get extremely low reference-cycle amplitudes, instead of the high amplitudes suggested by the preceding section. For the changes that occur during a reference cycle in the total fixed capital, or the aggregate industrial equipment, of an industry make small percentages of the whole capital or equipment that has accumulated over decades. But, on the average, these same changes make large percentages of the fixed capital or industrial equipment that is added to existing stocks during a business cycle. Both methods of treating amplitudes are valid; both are important, and in the sequel I shall employ both.[27]

Receivables have a median in Table 14 two-thirds that of inventory. Their amplitudes seem to be controlled by the amplitudes of sales; but their ratio to sales differs widely from one branch of business to another. It is not easy to rationalize all the long established differences in prevailing terms of sales, or

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[27] In dealing with the cyclical aspects of employment, for example, it is not very pertinent to say that additions to the supply of industrial equipment rise and fall in the course of a business cycle less than 10 percent of the existing stock. Yet this method of measuring is appropriate when we deal with quantities that are turned over several times a year. Koch (*op. cit.*, p. 52) finds that in 1921-39 large manufacturing companies had average annual stock-sales ratios of about 1:3.9, and large trading companies of about 1:7.6.

in the proportions of receivables rediscounted with banks or sold to finance companies. According to our sample of large corporations, the collection period averages 41 days in manufacturing and 12 days in trade; but the range runs from 19 days in the motor car industry to 105 in machine building, and from 1 day in chain variety stores to 58 days in department stores.[28]

Cash holdings, the third item of working capital in average magnitude, behave in a fashion that is puzzling at first sight. In our sample of large corporations, cash increases in 3 out of 4 expansions; then increases further in all 4 contractions. The cyclical timing is irregular, and the mean amplitude is low (+9, +16, −7). But Friedrich A. Lutz has wrung an interesting story from these data by breaking the total holdings into two components—'transaction cash' and 'free cash'. Finding that the ratio of cash to payments was remarkably stable in 1922–29, when large corporations could lend any temporary surplus of funds on the active stock market, Lutz assumes that the average ratio shown by each corporation in his sample during this period measures its 'normal' requirements of 'transaction cash'. By applying this ratio to payments in each year from 1915–43, he determines when each company was embarrassed by a shortage of cash for transacting business, and when it had more cash than it needed. If we accept the two series into which Lutz thus decomposes the original record of year-end cash balances, and analyze them in our standard fashion, we find that transaction cash and free cash have precisely opposite cyclical timing (expansion in I–V and in V–IX), almost perfect positive and perfect inverted conformity, and substantial amplitudes.

What happens during expansion is that the need for transaction cash swells with the dollar volume of payments to be made. This increase presently brings into use any surplus balances enterprises had been holding, and then calls for additional cash, which may come from current sales or from borrowings. If the expansion is long and intense, a shortage of cash

[28] *Ibid.*, pp. 54, 55.

is likely to feature its closing stage. But during contraction, the shrinking physical volume of business and falling prices reduce the need for transaction cash; cash balances go on increasing, often faster than they had grown in expansion. This increase comes mainly from the 'liquidation' of receivables and inventories. The surplus balances piling up from the decreasing need for and increasing supply of cash are presumably used as far as feasible to pay off debts to banks and commercial houses, perhaps to maintain dividends, perhaps to buy marketable securities from which some income may be expected. But, after all such opportunities have been grasped, the corporations of our sample held their largest cash balances at cyclical troughs, and these balances enhanced the ability of business managements to increase their purchases of industrial equipment at this lowest stage of business cycles.[29]

[29] Our analyses of Lutz' estimates for large manufacturing companies (much the best of his samples) are summarized below. Our standard method of measuring reference-cycle amplitudes cannot be applied to series in which both plus and minus items are numerous, as they are in the estimates of 'free' cash. (Cf. *Measuring Business Cycles*, pp. 166, 167.) In such cases, we measure amplitudes as deviations from the cycle bases, expressed in whatever units are used—here millions of dollars. Our standard method can be applied to 3 of the series presented here, and the measurement in millions of dollars to all 5. The measures are averages of 4 reference cycles, 1921–38. For the annual data used, see Lutz, *op. cit.*, Appendix D-2, sample B. As far as they go, Lutz' other samples seem to yield similar results. What holds true of year-end cash balances and free cash is broadly true also of marketable securities and 'free liquid funds'—that is, the cash plus marketable securities not required for transactions.

SERIES & EXPANSION STAGES	REFERENCE-CYCLE BASE ($ mil.)	INDEX OF CONFORMITY TO			AV. REFERENCE-CYCLE AMPLITUDE					
					In Millions of Dollars			In Reference-Cycle Relatives		
		Expansion	Contraction	Business cycles	*Expansion*	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*
Cash balances at year end (irreg.)	638	+50	−100	−43	+52	+111	−59	+9	+16	−7
Transaction cash (I–V)	530	+100	+50	+100	+197	−152	+349	+38	−27	+65
Free cash (V–IX)	103	−100	−100	−100	−157	+231	−388	...	...	...
Marketable securities, year end (I–V)	481	0	+100	+71	+84	−116	+200	+13	−20	+33
Free liquid funds (V–IX)	93	−100	−100	−100	−338	+336	−674	...	...	...

Failure of reference-cycle bases for 'transaction cash' and 'free cash' to add up to that for total cash is due to the fact that total cash was analyzed in its year-end version, whereas the components are estimated from a two-year moving average of total cash. Concerning the arithmetical relations of 'free cash' and 'free liquid funds', see Lutz, Ch. 4. It may also be noted that, according to Lutz' Preface, A. Kisselgoff developed the measures of 'free cash'.

In going concerns, most of the working capital is derived immediately from operations. The funds paid out for materials, merchandise, labor, and the like are supposedly recovered with a profit from sales. Most enterprises, however, supplement these internal sources by drawing upon outside funds. Almost all of them buy at least part of the goods they need on credit. Table 14 indicates that in 1937 accounts payable (supposedly to commercial houses) typically exceeded notes (supposedly owed to banks). However, the margin between the two forms of short-term debt is not wide, and the excess of payables may be a recent development. Our samples of corporation accounts indicate that, at least between the two world wars, short-term debt both to banks and to commercial houses declined in relation to total liabilities, but bank debt fell faster.[30] Mercantile enterprises use relatively more short-term credit than manufacturing enterprises. In both groups the volume rises and falls with the cyclical tides.[31]

Ultimate Sources of Funds

Enlightening as the preceding analysis may be, it is superficial in the sense of staying strictly within the limits of business enterprise. Proper as this limitation may be for the accountant's purposes, an economist must ask: Whence come the funds that business obtains from 'external sources'? For that matter, funds obtained from 'internal sources'—that is, from the operations of business enterprises—have not really been accounted for until we know whence come the funds wherewith outsiders buy what business has to sell. Thus accounting, like economic theory, raises the fundamental problem of interrelationships among the processes with which it deals. Each fresh encounter with this problem has its special lesson to teach, or may repeat an old lesson to our advantage.

To say that business enterprises get most of their funds, whether fixed or working capital, from internal sources is to recognize that their operations depend primarily upon dollar sales, which in turn depend primarily upon antecedent income

[30] Jacoby and Saulnier, *op. cit.*, pp. 91, 92.

[31] Koch, *op. cit.*, pp. 65–73.

disbursements by business enterprises to consumers, which in turn depend primarily upon antecedent purchases by consumers from business enterprises. To say that business enterprises get part of their funds from external sources is to recognize that this circular flow of funds from the realm of business to the realm of consumers and back to business is accompanied and complicated by eddies within the realm of business, and by whatever changes occur in the proportions of their current incomes consumers spend for consumer goods. The business eddies of moment here are connected with commercial credit, banking, and dealings in securities.

For the economy as a whole, including households as well as firms, the total credits received through 'accounts payable' are offset by the total credits extended through 'accounts receivable'. This equality does not appear in any of our samples, for they are compiled from the accounts of corporations, in which receivables usually exceed payables by substantial margins. As Koch explains, business enterprises are net trade creditors of consumers, corporations are net trade creditors of unincorporated enterprises, and large corporations are net trade creditors of small ones.[32] But though payables in the aggregate are offset by receivables, the institution of commercial credit has consequences of great moment for business cycles; it alters the cyclical timing of activities into which it enters on a large scale, and it creates a vast interlocking system of short-term debts, the paying of which has often presented a major problem at cyclical recessions.

Banks, however, make a net addition to the funds of an economy. The funds they provide consist in Anglo-Saxon countries chiefly of deposit credits, checks against which the lending banks must be ready to pay, for the most part on demand. The total volume of loans or investments a bank is able to make exceeds its capital, surplus, and undivided profits, and in this excess lies the net addition that banks make to the nation's funds. More than a century ago, American state governments began imposing limits upon the volume of credit banks might extend,

[32] *Ibid.*, p. 56.

usually by requiring them to hold reserves of lawful money equal to at least certain specified percentages of their demand liabilities. We shall have occasion to observe how alterations in these legal requirements concerning bank reserves have influenced business cycles in this country.

Meanwhile we may note that the above-mentioned 'decline in the commercial loan' between the two world wars has not meant a corresponding decline in the volume of credit supplied by banks to other business enterprises. For decades American banks have been investing an increasing part of their funds in the securities of corporations. When a bank buys a bond, the seller usually accepts a deposit credit, just as a borrower accepts a deposit credit when a bank discounts his note. The rules about minimum reserves apply to deposits originating in one way as in the other. By the end of the interwar years, member banks of the Federal Reserve System reported substantial investments in corporate securities and still larger investments in government securities.[33]

The contribution that banks make to business funds paves the way for a contribution by government. The minimum reserve provisions that are supposed to limit the volume of bank credit were designed to accompany monetary systems in which the volume of money was controlled by economic

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[33] The following figures show how different have been the rates of growth in bank loans and investments since the 1880's.

	REFERENCE-CYCLE BASE ($ MIL.)		
REFERENCE CYCLE	Loans	Investments, excl. U.S. securities	INVESTMENTS AS % OF LOANS
All national banks			
Mar. 1879–May 1885	1,145	59	5.2
Jan. 1912–Dec. 1914	6,174	1,030	16.7
Reporting member banks			
Apr. 1919–Sept. 1921	12,450	1,909	15.3
Mar. 1933–May 1938	8,700	3,085	35.5

The greatest growth has been in the holdings of U. S. government securities. Total investments, including 'governments', of reporting member banks were 29.4 percent of loans in the 1919–21 cycle and 132.6 percent in the 1933–38 cycle.

forces other than the exigencies of public finance. Let the metallic standard be replaced by a standard of irredeemable paper money, and the economic safeguards against an indefinite increase of bank credit are radically altered and often swept aside. Our economic organization can adapt itself to the conditions created by huge issues of irredeemable paper money, but the business cycles that run their course under these conditions constitute a special variety of their species.

There remains as an outside source of funds the investing public made up of individuals, other business enterprises, and at times governments. Our definite information about this source concerns chiefly the organized markets for securities, to which noncorporate enterprises and small corporations have virtually no access. How large manufacturing corporations use the securities markets is illustrated by Koch's tables.[34] Every year from 1921 to 1939 they sold their own securities in amounts that varied between $1,256 million in 1929 and $46 million in 1933. Also in every year they retired securities in amounts varying between $680 million in 1929 and $76 million in 1938. Sales exceeded retirements by $576 million in 1929; retirements exceeded sales by $164 million in 1935. On the average, sales were $341 million, retirements $213 million, new funds obtained $128 million. Only in 1921 did new funds from security sales exceed total funds retained from operations; on the average, retentions exceeded net funds drawn from outside investors by more than 7 to 1. But even in the depressed decade 1930–39, when assertions that the United States had reached 'economic maturity' became common, our 'large' manufacturing corporations were obtaining an average of $43 million a year net from the investing public toward their fixed capital expenditures of $736 million.

Where the investing public gets its funds is the next question. For an answer we had best turn to the overall view of economic operations in the United States provided by Simon Kuznets' estimates of gross national product and national income.

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[34] Koch, *op. cit.*, Tables 12–13.

Estimates of Capital Formation and of Saving

Table 15 presents these estimates in the form best adapted to present needs—that is, on a reference-cycle basis. Current rather than constant prices are used, for it is in current prices that businessmen confront their problems. As usual when treating price and value series, we exclude the first cycle after World War I, though that decision leaves only four cycles to average—a thin sample at best, and doubtfully representative of earlier experience. The thoughtful reader will be tempted to dwell upon various features of this table that do not concern us at the moment, for it would be hard to find elsewhere so instructive or, to the instructed, so fascinating an exhibit of how our economy works. Often in coming chapters we shall turn back to this table for basing points, but for the moment let us stick to capital formation and saving.

On the average of reference-cycle bases, 'capital goods' form less than 18 percent of gross national product, while more than 82 percent is devoted to meeting our wants as consumers (col. 3 of the table). Consequently, the cyclical fluctuations in output taken at current prices are larger in consumer than in capital goods. Rounded off to the nearest billion dollars, the mean amplitudes for consumer goods are +9, −7, +16; for capital goods, +6, −6, +12 (col. 8–10). But in relation to their own average volume, the cyclical fluctuations in the production of capital goods are four times as violent as those in consumer goods: +55, −49, +105 compared with +15, −10, +25 (col. 14–16). This sharp contrast suggests still a third way of measuring the amplitudes—reducing the cyclical rise and fall in the output of both consumer and capital goods to percentages of the cyclical rise and fall in the output of all goods (col. 11–13). On this basis, the amplitudes are +60, −52, +56 in consumer goods and +40, −48, +44 in capital goods. Though capital goods form less than 18 percent of gross national product, their output is subject to such violent alternations of good and ill fortune that this minor segment of the economy contributes 44 percent of the total cyclical fluctuations in output, and nearly half of the cyclical declines.

Table 15

REFERENCE-CYCLE BASES, TIMING, CONFORMITY, AND AMPLITUDE OF KUZNETS' ESTIMATES OF CAPITAL FORMATION, SAVINGS, AND RELATED MAGNITUDES, AT CURRENT PRICES, FOUR BUSINESS CYCLES, 1921–1938[a]

	AVERAGE REFERENCE-CYCLE BASE			INDEX OF CONFORMITY TO			AVERAGE REFERENCE-CYCLE AMPLITUDE IN								
							Millions of Dollars			% of Changes in *GROSS PRODUCT*			% of Reference-Cycle Bases		
	Millions of Dollars Per Year	% of *GROSS PRODUCT*	EXPANSION STAGES	Expansion	Contraction	Business cycles	*Expansion*	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Gross National Product	77,057	100.0	I–V	+100	+50	+100	+15,140	−13,214	+28,354	+100.0	−100.0	+100.0	+21.2	−16.4	+37.6
Components of Product															
Consumer goods															
Perishable commodities	23,750	30.8	I–V	+100	+50	+71	+3,816	−2,828	+6,644	+25.2	−21.4	+23.4	+16.4	−11.4	+27.8
Semidurable commodities[b]	9,919	12.9	I–V	+100	+50	+100	+1,275	−1,555	+2,830	+8.4	−11.8	+10.0	+13.8	−15.1	+28.9
Durable commodities[b]	6,489	8.4	I–V	+100	+50	+100	+1,810	−1,748	+3,558	+12.0	−13.2	+12.5	+31.0	−27.0	+58.0
Services[a]	23,282	30.2	III–VII	+100	0	+43	+3,173	−1,758	+4,931	+21.0	−13.3	+17.4	+14.4	−6.4	+20.8
TOTAL	63,440	82.3	I–V	+100	+50	+57	+9,016	−6,862	+15,878	+59.6	−51.9	+56.0	+15.0	−9.9	+24.9
Gross capital formation															
Durable producer commodities[b]	5,061	6.6	I–V	+100	+100	+100	+2,078	−1,982	+4,060	+13.7	−15.0	+14.3	+46.0	−39.4	+85.4
Construction, residential	2,988	3.9	I–V	+50	0	+43	+658	−665	+1,323	+4.3	−5.0	+4.7	+33.9	−22.0	+55.9
Construction, other private	2,679	3.5	I–V	+100	0	+71	+631	−852	+1,483	+4.2	−6.4	+5.2	+30.6	−32.9	+63.5
Construction, public[b]	1,987	2.6	V–IX	+100	−50	−29	+148	−12	+160	+1.0	−0.1	+0.6	+7.7	+1.4	+6.3
Construction, total[b]	7,654	9.9	I–V	+50	0	+43	+1,438	−1,530	+2,968	+9.5	−11.6	+10.5	+24.0	−18.6	+42.6
Net change in inventories	556	0.7	I–V	+100	+100	+100	+3,063	−3,169	+6,232	+20.2	−24.0	+22.0			
Net change in international claims	344	0.4	V–IX	−100	−50	−43	−452	+328	−780	−3.0	+2.5	−2.8	−131.2[c]	+95.2[c]	−226.4[c]
TOTAL	13,617	17.7	I–V	+100	+100	+100	+6,124	−6,352	+12,476	+40.4	−48.1	+44.0	+55.4	−49.3	+104.7
Capital Consumption	8,772	11.4	I–V	+100	+50	+100	+1,036	−623	+1,659	+6.8	−4.7	+5.9	+12.0	−6.6	+18.6
Net Capital Formation	4,844	6.3	I–V	+100	+100	+100	+5,088	−5,729	+10,817	+33.6	−43.4	+38.1	...	...	...
National Income	68,284	88.6	I–V	+100	+50	+100	+14,104	−12,592	+26,696	+93.2	−95.3	+94.2	+22.5	−17.6	+40.1

[a] All series summarized in this table come from worksheets for Kuznets' *National Product since 1869* (National Bureau, 1946) or from worksheets for his *National Income and Its Composition* after revision to accord with published results in *National Product since 1869*. In most cases the figures used were carried to an additional place beyond those published.

[b] Derived from original data expressed in ten millions of dollars per year.

[c] Amplitude in millions of dollars per year expressed as a percentage of the average reference-cycle base for the four cycles of 1921–38.

Table 15 (concl.)

	AVERAGE REFERENCE-CYCLE BASE			INDEX OF CONFORMITY TO			AVERAGE REFERENCE-CYCLE AMPLITUDE IN								
							Millions of Dollars			% of Changes in *NATIONAL INCOME*			% of Reference-Cycle Bases		
	Millions of Dollars Per Year	% of *NATIONAL INCOME*	EXPANSION STAGES	Expansion	Contraction	Business cycles	*Expansion*	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
National Income	68,284	100.0	I–V	+100	+50	+100	+14,104	−12,592	+26,696	+100.0	−100.0	+100.0	+22.5	−17.6	+40.1
Income of individuals															
Employees' compensation[d]	42,685	62.5	I–V	+100	+50	+100	+8,026	−5,822	+13,848	+56.9	−46.2	+51.9	+19.8	−13.0	+32.8
Entrepreneurial withdrawals	11,419	16.7	I–V	+100	0	+43	+957	−760	+1,717	+6.8	−6.0	+6.4	+8.7	−6.1	+14.8
Net rents	4,178	6.1	I–V	0	+50	−14	+133	−607	+740	+0.9	−4.8	+2.8	+5.7	−15.1	+20.8
Dividends	4,240	6.2	I–V	+100	+50	+100	+1,242	−1,112	+2,354	+8.8	−8.8	+8.8	+30.3	−23.7	+54.0
Interest[g]	4,766	7.0	III–V	+50	0	+43	+154	−1	+155	+1.1	[f]	+0.6	+3.2	+1.0	+2.2
TOTAL[e]	67,289	98.5	I–V	+100	0	+100	+10,482	−8,245	+18,727	+74.3	−65.5	+70.1	+16.4	−11.6	+28.0
Total consumers' outlay	63,440	92.9	I–V	+100	+50	+57	+9,016	−6,862	+15,878	+63.9	−54.5	+59.5	+15.0	−9.9	+24.9
Savings															
Individual	3,849	5.6	I–V	+100	+50	+43	+1,468	−1,383	+2,851	+10.4	−11.0	+10.7	+40.1	−39.2	+79.3
Entrepreneurial	344	0.5	I–V	+50	+100	+100	+1,404	−1,495	+2,899	+10.0	−11.9	+10.9	...	...	...
Corporate	−315	−0.5	I–V	+100	+50	+71	+1,612	−1,963	+3,575	+11.4	−15.6	+13.4	...	...	...
Governmental[g]	967	1.4	III–V	+100	+50	+100	+819	−1,076	+1,895	+5.8	−8.5	+7.1	...	...	...
TOTAL	4,844	7.1	I–V	+100	+100	+100	+5,088	−5,729	+10,817	+36.1	−45.5	+40.5	...	...	...

[d] Includes 'other payments to employees', i.e., social security contributions of employers, pensions, etc. Our series 'wages and salaries' excluding such other payments is presented in note g.

[e] The sum of the preceding five items. Our series 'income payments' comprises this total plus entrepreneurial savings minus imputed rent; it is presented in note g.

[f] Less than 0.05 percent.

[g] Averages for the two series referred to in notes *d* and *e* and averages on a I–V basis for the three series with expansion stages III–V or III–VII are:

	AVERAGE REFERENCE-CYCLE BASE			INDEX OF CONFORMITY TO			AVERAGE REFERENCE-CYCLE AMPLITUDE IN								
							Millions of Dollars			% of Changes in Gross Product or National Income			% of Reference-Cycle Bases		
	Millions of Dollars Per Year	% of Gross Prod. or Nat. Inc.	EXPANSION STAGES	Expansion	Contraction	Business cycles	*Expansion*	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*	*Expansion*	*Contraction*	*Full cycle*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Wages and salaries	41,426	60.7	I–V	+100	+50	+100	+7,250	−6,060	+13,310	+51.4	−48.1	+49.9	+18.6	−14.0	+32.6
Income payments	65,415	95.8	I–V	+100	0	+100	+12,270	−9,763	+22,033	+87.0	−77.5	+82.5	+19.8	−14.3	+34.1
Services	23,282	30.2	I–V	+100	−50	−14	+2,116	−733	+2,849	+14.0	−5.5	+10.0	+9.6	−1.5	+11.1
Interest	4,766	7.0	I–V	+50	0	−29	+125	+55	+70	+0.9	+0.4	+0.3	+2.5	+1.4	+1.1
Governmental savings	967	1.4	I–V	+50	0	+71	+606	−889	+1,495	+4.3	−7.1	+5.6	...	...	...

While gross capital formation averaged nearly $14 billion per annum, nearly $9 billion of that output were required to offset capital consumption, leaving less than $5 billion a year as 'net capital formation', or saving (col. 2). In other words, almost two-thirds of the capital goods produced was needed to offset capital used up, and little more than one-third remained as an addition to the country's stock. Capital consumption, which corresponds roughly to depreciation and its congeners, has relatively narrow amplitudes (+12, −7, +19) when measured in our standard fashion (col. 14–16). When this relatively stable series is subtracted from the much more variable series on gross capital formation (average amplitudes +55, −49, +105), the remainder, net capital formation, alternates between plus and minus values so often that we cannot measure its amplitude in the usual fashion. In other words, saving in the economy as a whole is a process especially sensitive to the cyclical tides.

Gross national product minus capital consumption equals national income (col. 2). Net capital formation, which makes up 6 percent of gross product, becomes 'total savings' in the second part of the table, where it forms 7 percent of national income. Kuznets ascertained from published accounts approximately how much American governments and corporations have saved annually since 1919, and he made rougher approximations for unincorporated businesses from the Department of Agriculture's studies of farm income and similar sources. When these types of savings are subtracted from 'net capital formation', whatever remains is taken to be the savings of individuals. Kuznets is emphatic that his estimates are "subject to fairly wide margins of error", and that what constitutes 'net capital formation' in his studies of gross product differs radically from what enterprises and individuals commonly reckon as savings. For example, his estimates exclude all gains and losses on sales of capital assets. On the other hand, they include accruals to individuals as depositors in savings institutions and as holders of life insurance policies. As Kuznets sums up:

> . . . while the estimates . . . differ significantly from what enterprises and individuals conceive their savings to be; while they cannot

be used to gauge the propensity of enterprises and individuals to save, they do reflect approximately the shares of net capital formation, i.e., of real investment financed from the current income of different groups of enterprises and individuals. In that sense they measure the contribution of various types of savings from current income to additions to the stock of the nation's capital goods.[35]

Kuznets' year-by-year figures indicate that outgo exceeded income among corporations in 1930–38, among unincorporated enterprises in 1922 and 1930–34, and among governments (federal, state, and local) in 1919, 1932–36, and 1938. Individuals were the only group to put by money every year. They were also the largest savers in every year covered by the estimates except 1919 and 1921. On the average (Table 15, col. 2) individual thrift contributed nearly four-fifths of total savings. This I take to be a larger fraction than would appear if the estimates could be carried backward several decades or brought down to date; for it is very doubtful that on the average of any other stretch of 18 years corporate savings were a minus quantity. But even if we confined our average to 'the prosperous' 1920's—which would err on the opposite side—the share of individuals in the national total of savings would be one-half and the share of corporations less than a seventh.

We cannot measure the reference-cycle amplitudes of corporate, entrepreneurial, or governmental savings in our standard fashion because of the intermixture of minus and plus items. Individual savings alone can be measured this way. They have amplitudes that are rather large for annual data: +40, −39, +79 (col. 14–16). These are nearly triple the amplitudes of the income of individuals (+16, −12, +28). People spend 94 percent of their incomes on consumer goods, and these expenditures rise and fall during business cycles nearly as much (+15, −10, +25) as incomes themselves. So the small fraction of individual income that is saved (6 percent in the average year, if we accept Kuznets' concepts and estimates) constitutes a flow of funds into the investment market more than three times as variable as the aggregate flow into the markets for consumer goods.

Much more variable still are the savings of other groups.

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[35] *National Income and Its Composition*, Vol. I, p. 278.

Though they contribute on the average minor fractions of national savings, they are responsible for about three-quarters of the cyclical rise and fall in saving measured in millions of dollars (col. 8–10 of the table, and note *g* for governmental savings). Corporations contribute most to these fluctuations in savings, which is of course a sound reason for attending closely to them in studies of business cycles.

Summary and Supplement

So prominent is the role played by investing in the business-cycle drama that I commend to the reader's thoughtful study the following summary of the reference-cycle timing, conformity, and amplitudes of series representing this process from different viewpoints and at different stages.

Section A of Table 16 on stocks of industrial equipment in existence shows how little influence a typical business cycle has upon the numbers or the theoretical 'capacity' of the nation's mines, processing plants, transportation lines, and machines. The last few entries demonstrate that the use of monthly data would raise the amplitudes somewhat, but the most variable of these monthly series rises and falls only 6 percent. It is noteworthy, also, that not one of these series conforms perfectly to expansions, contractions, and full cycles, and not one has I–V timing. Indeed, the prevailing timing types are neutral, inverted, or irregular. None of these findings seems surprising when we recall how many years most of this equipment will last, how many months much of it takes to build, and at what stages of a business cycle the production of new equipment reaches the largest volumes.

Section B of the table deals with formal commitments to invest. Here the amplitudes run high, usually above 100, and the conformity is strikingly regular. Positive timing prevails with leads at one turn or both. The exceptions to these rules are few and (aside from the medium amplitudes of orders for Southern pine lumber) are confined to governmental construction.

Section C moves forward to the stage of production or ship-

Table 16

REFERENCE-CYCLE TIMING, CONFORMITY, AND AMPLITUDE OF SELECTED SERIES RELATING TO INVESTMENT

Series[a]	Period Covered[b]	No. of Reference Cycles	Expansion Stages	Index of Conformity to			Av. Reference-Cycle Amplitude		
				Expansion	*Contraction*	*Business cycles*	*Expansion*	*Contraction*	*Full cycle*[c]
A STOCKS OF INDUSTRIAL EQUIPMENT IN PLACE									
BY YEARS									
Coal and coke industries									
1 Anthracite coal mines, capacity	1891–1938	13	V–III	−38	−14	−38	−1.3	+2.3	−3.6
2 Bituminous coal mines, capacity	1891–1938	13	Irreg.	+69	−57	−8	+8.3	+2.5	+5.8
3 Bituminous coal, undercutting machines in use, no.	1897–1939	11	III–VII	+55	−9	+52	+12.2	+6.0	+6.2
4 Coke ovens, total, no.	1885–1939	15	V–IX	+7	−12	−33	+1.9	−0.8	+2.7
4 Coke ovens, total, no.	1885–1919	10	V–IX	+60	−64	−40	+9.0	+6.9	+2.1
4 Coke ovens, total, no.	1919–1939	5	V–IX	−100	+100	−33	−12.3	−16.2	+3.9
5 Beehive coke ovens, no.	1885–1919	10	V–IX	+60	−64	−50	+8.2	+6.6	+1.6
5 Beehive coke ovens, no.	1919–1939	5	V–IX	−100	+100	−33	−19.3	−23.3	+4.0
6 Byproduct coke ovens, no.	1894–1939	12	Irreg.	+83	−67	+22	+34.3	+20.0	+14.3
7 Byproduct coke ovens, capacity	1919–1939	5	Irreg.	+20	−67	−40	+5.6	+6.3	−0.7
Metal industries									
8 Pig iron capacity	1915–1939	6	III–VII	+57	+14	+69	+2.0	−0.2	+2.2
9 Steel ingot capacity	1915–1939	6	Irreg.	+67	−100	−33	+4.9	+4.4	+0.5
10 Copper refineries, capacity	1908–1939	8	III–VII	+56	−56	+29	+8.9	+4.8	+4.1
Cotton industry									
11 Spindles in place, total, no.	1908–1938	8	Irreg.	+25	−33	−31	−0.7	−0.02	−0.7
12 Spindles, cotton-growing states, no.	1914–1938	6	Irreg.	+67	−71	−33	+4.0	+2.2	+1.8
13 Spindles, noncotton-growing states, no.	1914–1938	6	Irreg.	0	+14	−33	−10.1	−5.5	−4.6

Table 16 (cont.)

	Series[a]	Period Covered[b]	No. of Reference Cycles	Expansion Stages	Index of Conformity to			Av. Reference-Cycle Amplitude		
					Expansion	*Contraction*	*Business cycles*	*Expansion*	*Contraction*	*Full cycle*[h]
	Railroads & other transport industries									
14	Locomotives, steam, available, no.	1891–1939	13	III–IX	+23	−57	−69	+0.2	+2.4	−2.2
15	Locomotives, steam, available, tractive power	1904–1939	9	III–VII	+60	−40	+47	+4.9	+2.3	+2.6
16	Locomotives, freight & passenger service, no.	1922–1939	4	Irreg.	−50	+100	−38	−6.6	−4.9	−1.7
17	Freight cars owned, no.	1922–1939	4	Irreg.	−50	+60	−50	−5.4	−2.6	−2.8
18	Freight cars on line, total, no.	1922–1939	4	III–VII	−50	+20	+12	−2.0	−3.8	+1.8
19	Freight cars on line, serviceable, no.	1922–1939	4	III–VII	0	+60	+75	+0.4	−6.3	+6.7
20	R.R., total track mileage	1891–1939	13	V–IX	+85	−79	−58	+3.0	+2.2	+0.8
21	Auto. registrations, truck, total	1908–1939	8	Irreg.	+100	−100	+65	+44.0	+40.7	+3.3
22	Auto. registrations, passenger car, total[f]	1897–1939	11	Irreg.	+100	−83	+27	+54.8	+50.8	+4.0
23	Merchant marine, total tonnage	1843–1938	24	Irreg.	+21	−42	−11	+4.6	+3.6	+1.0
	Communications industry									
24	Western Union, wire mileage	1867–1939[d]	17	III–VII	+100	−88	+19	+10.8	+8.9	+1.9
24	Western Union, wire mileage	1867–1914	12	III–VII	+100	−100	+35	+13.9	+11.4	+2.5
24	Western Union, wire mileage	1919–1939	5	Irreg.	+100	−100	−11	+3.4	+3.1	+0.3
	BY MONTHS									
	Railroad industry									
25	Locomotives, frt. & pass. service, no.	1921–1938	4	VI–IX	−100	+50	−71	−8.2	−2.2	−6.0
26	Freight cars owned, no.	1921–1938	4	Irreg.	−50	+60	−25	−5.6	−2.1	−3.5
27	Freight cars on line, total, no.	1921–1938	4	IV–VII	0	+60	0	−5.2	−0.4	−4.8
28	Freight cars on line, serviceable, no.	1921–1938	4	II–VI	0	+60	+100	+0.9	−5.5	+6.4

Table 16 (cont.)

B CONTRACTS AND ORDERS FOR INVESTMENT GOODS

Contracts for construction work									
29 Total, value	1912–1938	7	VIII–IV	+71	+50	+86	+43	−30	+74
30 Residential buildings, value	1919–1938	5	VII–IV	+60	+67	+80	+37	−37	+74
31 Commercial buildings, value	1919–1938	5	VIII–V	+100	+60	+100	+58	−55	+112
32 Industrial buildings, value	1919–1938	5	VIII–V	+100	+100	+100	+116	−114	+230
33 Public & institutional buildings, value	1919–1938	5	VIII–V	+60	−20	+11	+30	−9	+38
34 Public utilities, value	1919–1938	5	I–VI	+100	+100	+100	+117	−109	+225
35 Public works, value	1919–1938	5	Irreg.	+100	−20	+78	+35	−15	+50
New orders for industrial equipment									
36 Machine tools & forging machinery, index	1919–1938	5	I–V	+100	+100	+100	+116	−121	+237
37 R.R. locomotives, no.	1870–1938	17	VIII–IV	+100	+100	+100	+93	−92	+185
38 R.R. freight cars, no.	1870–1938	17	VIII–IV	+100	+65	+100	+90	−82	+172
39 R.R. passenger cars, no.	1870–1938	17	VIII–IV	+76	+88	+94	+60	−59	+120
40 Rails	1870–1927	15	VI–III[e]	+87	+60	+72	+69	−52	+121
New orders for basic materials									
41 Merchant pig iron	1919–1924	2	VIII–IV	+100	+100	+100	+141	−121	+262
42 Fabricated structural steel	1912–1938	7	VIII–V	+71	+25	+57	+51	−59	+110
43 Steel sheets	1919–1933	4	VIII–III	+100	+100	+100	+60	−60	+121
44 Southern pine lumber	1919–1938	5	VII–IV	+20	+100	+100	+21	−30	+51
45 Oak flooring	1914–1938	6	VII–III	+67	+43	+83	+45	−38	+82
Unfilled orders									
46 U.S. Steel Corporation	1904–1933	8	I–V	+100	+100	+100	+44	−51	+95

Table 16 (cont.)

Series[a]	Period Covered[b]	No. of Reference Cycles	Expansion Stages	Index of Conformity to			Av. Reference-Cycle Amplitude		
				Expansion	*Contraction*	*Business cycles*	*Expansion*	*Contraction*	*Full cycle*[h]
C PRODUCTION OF INVESTMENT GOODS									
Production indexes									
47 Producer durables	1919–1938	5	I–V	+100	+100	+100	+44	−57	+101
48 Consumer durables	1919–1938	5	I–IV	+100	+100	+100	+48	−57	+105
49 Producer nondurables[f]	1919–1938	5	I–V	+100	+100	+100	+18	−22	+40
50 Consumer nondurables[f]	1919–1938	5	I–V	+100	+100	+100	+7	−11	+18
Industrial equipment, etc.									
51 Machine-tool shipments, index	1927–1933	1	Uncertain	+100	+100	+100	+93	−187	+280
52 Woodworking mach., shipments, value	1919–1938	5	I–V	+100	+100	+100	+68	−80	+148
53 Industrial pumps, shipments, value	1919–1933	4	I–V	+100	+100	+100	+44	−60	+104
54 R.R. locomotives, shipments, no.	1919–1933	4	III–VI	+60	+60	+78	+58	−94	+152
55 R.R. freight cars, shipments, no.	1919–1938	5	I–V	+60	+100	+78	+95	−115	+210
56 R.R. passenger cars, shipments, no.	1919–1938	5	I–V	+20	+60	+33	+20	−20	+39
57 Auto. trucks, production	1914–1938	6	I–V	+100	+71	+100	+94	−65	+158
58 Auto. passenger cars, production	1914–1938	6	I–V	+100	+67	+82	+60	−45	+105
Production of basic materials									
59 Pig iron at merchant furnaces	1904–1938	9	I–V	+100	+100	+100	+59	−67	+126
60 Steel ingots	1900–1938	10	I–V	+100	+100	+100	+59	−55	+114
61 Steel sheets	1919–1938	5	VIII–V[c]	+100	+100	+100	+70	−70	+139
62 Southern pine lumber	1919–1938	5	I–IV	+60	+100	+80	+16	−29	+45
63 Oak flooring	1914–1938	6	VII–IV	+67	+43	+83	+40	−30	+71
64 Portland cement	1912–1938	7	I–V	+43	+14	+69	+20	−14	+33
65 Polished plate glass	1924–1938	3	I–V	+100	+100	+100	+69	−77	+146

Table 16 (cont.)

D Employment and Wages in Investment Goods Industries

	Employment indexes									
66	Factory, total	1914–1938	6	I–V	+100	+100	+100	+22	−23	+45
67	Durable goods	1919–1938	5	I–V	+100	+100	+100	+32	−38	+69
68	Nondurable goods[f]	1919–1938	5	I–V	+100	+60	+100	+14	−15	+28
69	Iron & steel products	1919–1938	5	I–VI	+100	+100	+100	+30	−33	+63
70	Machinery	1919–1938	5	I–VI	+100	+100	+100	+37	−40	+77
71	Transportation equipment	1919–1938	5	I–V	+100	+100	+100	+42	−46	+89
72	Building materials, total	1919–1938	5	I–V	+60	+100	+100	+26	−31	+57
73	Lumber & products	1919–1938	5	I–V	+100	+100	+100	+23	−31	+54
74	Cement, clay & glass	1919–1938	5	I–V	+60	+100	+100	+23	−26	+49
	Payroll indexes									
75	Factory, total	1919–1938	5	I–V	+100	+100	+100	+36	−40	+76
76	Durable goods	1919–1938	5	I–V	+100	+100	+100	+52	−55	+107
77	Nondurable goods[f]	1919–1938	5	I–V	+100	+60	+100	+26	−25	+51
78	Iron & steel products	1919–1938	5	I–V	+100	+100	+100	+54	−59	+113
79	Machinery	1919–1938	5	I–VI	+100	+100	+100	+55	−56	+111
80	Transportation equipment	1919–1938	5	I–V	+100	+100	+100	+53	−58	+111
81	Building materials, total	1919–1938	5	I–V	+60	+100	+100	+39	−44	+84
82	Lumber & products	1919–1938	5	I–V	+100	+100	+100	+39	−46	+85
83	Cement, clay & glass	1919–1938	5	I–V	+60	+100	+100	+33	−34	+67
	Other employment & wage series									
84	Wage earners, all construction work, Ohio	1914–1938	6	I–V	+100	+67	+82	+37	−33	+70
85	Av. hours worked per week, mfg. wage earners	1921–1938	4	I–V	+100	+100	+100	+8	−16	+25
86	Av. hourly earnings, 25 mfg. industries	1921–1938	4	I–VI	+100	−50	+71	+14	−5	+19

Table 16 (cont.)

	Series[a]	Period Covered[b]	No. of Reference Cycles	Expansion Stages	Index of Conformity to: *Expansion*	Index of Conformity to: *Contraction*	Index of Conformity to: *Business cycles*	Av. Reference-Cycle Amplitude: *Expansion*	Av. Reference-Cycle Amplitude: *Contraction*	Av. Reference-Cycle Amplitude: *Full cycle*[h]
	E BUSINESS INVENTORIES									
	Metals									
87	Iron ore at furnaces	1919–1938	5	V–IX	−60	−33	−60	−5	+12	−17
88	Pig iron at merchant furnaces	1919–1924	2	V–IX	−100	−100	−100	−54	+93	−146
89	Steel sheets, sold	1919–1933	4	I–VI	+100	+100	+100	+45	−47	+92
90	Steel sheets, unsold	1919–1933	4	V–IX	+20	−50	−50	−49	+82	−130
91	Refined copper	1912–1938[d]	6	V–IX	−33	−43	−64	−49	+66	−116
92	Tin, total visible supply	1894–1938[g]	10	VIII–V	+60	+83	+90	+32	−25	+57
	Building materials									
93	Portland cement	1912–1938	7	Irreg.	−14	−14	−23	−6	+17	−22
94	Southern pine lumber	1919–1938	5	V–IX	−100	−33	−60	−10	+7	−18
95	Oak flooring	1912–1933	6	III–VII	+100	+33	+67	+43	−12	+55
	Rubber & products									
96	Crude rubber	1924–1938	3	V–IX	+33	−50	−67	−13	+58	−71
97	Pneumatic casings	1921–1938	4	I–VI	+100	+100	+100	+41	−28	+69
98	Inner tubes	1921–1938	4	I–V	+100	+100	+100	+41	−32	+74
	Cattle hides & products									
99	Raw hides in all hands	1921–1938	4	I–IV	+50	+75	+100	+12	−24	+35
100	Raw hides at tanners	1924–1938	3	I–V	+33	+75	+33	+10	−15	+25
101	Leather in process	1921–1938	4	I–V	0	+100	+71	+2	−11	+13
102	Finished leather in all hands	1921–1938	4	Irreg.	−50	+100	−43	−16	−5	−11
103	Finished leather at tanners	1924–1938	3	Irreg.	−33	−33	−20	−26	+6	−32

Table 16 (cont.)

	Cotton									
104	Visible supply	1870–1938	17	V–II	−41	−44	−59	−10	+26	−36
105	In public storage & at compresses	1914–1938	6	V–IX	−33	−43	−50	−22	+42	−63
106	At mills	1914–1938	6	I–V	+67	+100	+100	+24	−18	+42
	Newsprint paper									
107	At mills	1919–1933	4	V–IX	−60	−100	−100	−35	+53	−88
108	At publishers & in transit to them	1919–1933	4	III–VII	+80	+60	+78	+18	−7	+24
	Department store stocks									
109	Dollar volume, index	1919–1938	5	I–VI	+60	+40	+56	+15	−15	+30
	F SECURITY ISSUES AND INCORPORATIONS									
110	Cash from new issues on N.Y. Stock Exchange	1868–1921	14	VIII–V	+87	+73	+93	+58	−39	+97
111	Corporate issues, including refunding	1908–1938	8	VIII–IV	+100	+50	+60	+47	−46	+93
112	New corporate issues, total	1919–1938	5	I–V	+100	+20	+33	+78	−52	+130
113	New issues, stocks	1919–1938	5	I–V	+100	+60	+78	+135	−113	+248
114	New issues, short-term bonds & notes	1919–1938	5	I–V	+60	+60	+56	+136	−119	+255
115	New issues, long-term bonds & notes	1919–1938	5	I–VI	+60	−20	+33	+51	−26	+78
116	Refunding issues	1919–1938	5	VII–IV	+100	+60	+56	+61	−68	+129
117	Incorporations, no.	1861–1938	19	VIII–V	+68	+60	+84	+27	−10	+37
	G STOCK MARKET OPERATIONS									
	Trading on N.Y. Stock Exchange									
118	Shares sold, no.	1879–1938	16	VIII–IV	+88	+75	+94	+41	−36	+77
119	Bond sales, par value	1888–1938	14	VII–II	−57	−71	−70	−15	+35	−50
	Price indexes of securities									
120	Common stocks	1879–1938	16	VIII–IV	+88	+65	+88	+27	−20	+47
121	R.R. bonds	1858–1933	19	VII–III^{c}	+60	+37	+63	+6	−3	+9

Table 16 (cont.)

					Index of Conformity to			Av. Reference-Cycle Amplitude		
	Series[a]	Period Covered[b]	No. of Reference Cycles	Expansion Stages	*Expansion*	*Contraction*	*Business cycles*	*Expansion*	*Contraction*	*Full cycle*[h]
	H Bank Loans and Investments									
	Bank loans									
	National banks									
122	New York City	1868–1914	12	VII–IV	+100	+17	+52	+15	−1	+16
123	Reserve cities other than central	1885–1914	9	VIII–V	+100	−11	+88	+18	+1	+17
124	Country districts, total	1879–1914	10	I–VI	+100	−20	+89	+19	+1	+18
125	Country districts, per bank	1879–1914	10	I–VI	+100	+60	+100	+11	−5	+17
126	All national banks	1879–1914	10	VIII–V	+100	−40	+100	+18	+2	+16
	Member banks, Fed. Res. System									
127	Total loans	1921–1938	4	I–VI	+100	0	+14	+9	−14	+23
128	Loans on securities	1921–1938	4	I–V	+50	+20	+50	+7	−14	+21
129	All other loans	1921–1938	4	I–VI	+50	+60	+75	+8	−13	+21
	Bank investments									
	National banks									
130	New York City	1879–1914	10	VII–III	+100	−30	+37	+16	+10	+6
131	Reserve cities other than central	1885–1914	9	VII–IV	+100	−11	+59	+25	+5	+19
132	Country districts	1879–1914	10	VII–IV	+100	−70	+63	+24	+8	+16
133	All national banks	1879–1914	10	VII–IV	+100	−40	+58	+24	+7	+18
	Member banks, Fed. Res. System									
134	Total investments	1921–1938	4	VII–III	+100	−100	+71	+20	+9	+11
135	Investments other than 'governments'	1921–1938	4	VII–IV	0	0	+14	+5	+5	0

Table 16 (concl.)

I Interest Rates and Bond Yields

	Open-market rates									
136	Call money, N.Y.C.	1858–1914	14	I–V	+71	+100	+100	+90	–91	+181
137	Commercial paper, N.Y.C.	1858–1914	14	II–VI	+86	+73	+93	+31	–34	+65
138	90-day time money, N.Y.C.	1891–1914	7	I–VI	+100	+75	+86	+45	–51	+96
136	Call money	1919–1938	5	I–V	+20	+80	+78	+23	–59	+82
137	Commercial paper	1919–1938	5	II–VI	+60	+60	+100	+3	–32	+35
138	90-day time money	1919–1938	5	I–VI	+20	+80	+78	+11	–36	+47
139	Weighted av., open-market, N.Y.C.	1919–1938	5	I–V	+20	+100	+78	+8	–47	+55
	Customer rates									
140	New York City	1919–1938	5	II–V	+20	+100	+56	–2	–14	+13
141	8 northern & eastern cities	1919–1938	5	II–VI	+20	+100	+33	–3	–8	+6
142	27 southern & western cities	1919–1933	4	III–VI	+20	+50	+75	+3	–8	+11
	Bond yields									
143	Railroads	1858–1933	19	III–VII[c]	+37	+60	+58	+3	–6	+9
144	New England municipals	1858–1911	13	III–VII	+57	+57	+70	+4	–5	+8
145	High grade corp. & municipal	1900–1933	9	III–VII	+40	+40	+68	+5	–6	+11
146	Corporate, lowest rating	1919–1938	5	IV–VIII	–20	–20	–78	–21	+16	–37

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[a] For sources of data, see Appendix B.

[b] Identifies the complete reference cycles covered by the series. This period, however, may differ somewhat from that covered by one or more of the conformity indexes. See *Measuring Business Cycles*, Ch. 5, Sec. X.

[c] For a few series an alternative expansion period is equally acceptable. The results follow:

	Conformity			Amplitude		
	Exp.	*Contr.*	*Cycle*	*Exp.*	*Contr.*	*Cycle*
Steel sheet production, I–V	+100	+100	+100	+68	–65	+133
R.R. bond prices, VI–III	–47	–30	–68	–4	+7	–11
R.R. bond yields, III–VI	+47	+30	+68	+4	–6	+10

[d] Omits 1914–19.

[e] See Ch. 6, note 7.

[f] Introduced in table for comparative purposes.

[g] Omits 1914–21.

[h] In this table, as elsewhere in the volume, rounding of numbers occasionally produces a slight discrepancy between the phase amplitudes and the full-cycle amplitude.

ment of equipment, or of basic materials used in construction work and machine building. Here also the amplitudes and conformity indexes run high, but there are not so many leads at the cyclical turns as in the series on contracts and orders; for, in these branches of business, production follows sales. For the sake of contrast—and the contrast in amplitude is striking—two indexes of nondurable goods production are introduced.

Section D shows the effects of the highly variable demand for production of capital goods upon employment and consumer purchasing power. Again the contrast in cyclical variability between durable and nondurable goods industries is brought out by index numbers. Then it is shown that the average length of the working week, and average rates of pay per hour fluctuate with employment, though less violently. The result is that payrolls attain amplitudes decidedly higher than the corresponding employment series, and comparable with the amplitudes prevailing in the production of durable goods.[36]

Section E, devoted to inventories, illustrates the diversity of cyclical behavior characteristic of this highly important factor in business, but only in that sense does it offer a summary. The timing varieties of inventories have been stressed in Chapter 5; they are explored far more fully in Abramovitz' monograph, which analyzes the cyclical movements of additions to inventories as well as of inventories proper. Here I note only that the durability of goods, or their ultimate destination as ingredients of capital, seems not to rule the amplitudes of inventories so strictly as the amplitudes of production and employment.

In Section F we turn from the realms of industry and commerce to the realm of finance. Issues of corporate securities have amplitudes corresponding to those of contracts and orders; even the steadiest series of the lot (long-term bonds and notes) rises and falls 78 percent. The conformity to business cycles is lower on the whole than many may expect, but that disappointment may arise from thinking of security dealing as the quintessence of American business.

Section G gives a condensed view of activities at this focus of financial interests. The picture is not sensational. Even the

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[36] Cf. Table 13.

most volatile of these series—the number of shares sold on the New York Stock Exchange—has amplitudes decidedly lower than those in Section C for the production of durable goods.[37] And stock prices, according to what we have chosen as the most representative long-range index number, have much lower amplitudes than shares sold. The most important behavior traits of bond sales and prices are their quasi-inverted timing and modest or low amplitudes.

Section H suggests that the Federal Reserve System did not alter radically the relations between banks and their customers. The reference-cycle amplitudes of both loans and investments remain low. Here, of course, we are measuring the volume of loans outstanding; that is, the measures correspond logically to those of Section A on stocks of industrial equipment, and differ from the measures of contracts, orders, production, etc. in later sections. In bank loans there is a marked shift in the *trend* component from a rapid rise before World War I to decline since then; but the *cyclical* component, which is best represented by the full reference-cycle amplitude, remains much as it was. Investments, we noted above, grew even faster than loans under the National Banking System, and their secular rise has been if anything expedited since loans began to shrink. Bank investments are especially interesting because of their cyclical leads. But this and various other features of the exhibit will mean more to us at a later stage of the investigation.

The last section of the table, interest rates, reveals an unusually wide diversity of cyclical behavior, and demonstrates how inadequate was the happily obsolescent practice of treating 'the' interest rate as a factor in cyclical movements. The durability of a loan clearly does not affect the cyclical amplitudes of interest rates as the durability of commodities affects the cyclical amplitudes of orders, employment, and production. On the contrary, the shortest of loans have the most variable interest rates. But that is not so much because the loans

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[37] Taking the amplitudes for the period common to both series, 1919-38, would not reduce the difference much. On that basis we have +42, —40, +82 for shares sold, and +44, —57, +101 for the production of durable producer goods.

are payable on call, as because they are made with marginal banking funds, and to clients whose credit needs have been subject to sharp fluctuations. All open-market rates have been much steadied by the changes in banking organization effected by the Federal Reserve System, but the contrast between open-market and customers' rates remains striking in 1919–38. Customers' rates are what we should have in mind when thinking about the rates paid by the mass of business enterprises and individuals for bank loans. As it happens, the secular decline in bank loans has been accompanied by a secular decline in rates. This decline seems more striking in bank rates than in the yields of bonds, but that is because of differences in the periods covered by the two sets of series.[38] The last entry in the table reminds us of a feature too often slighted in cyclical studies—the risk factor in the interest rates of practical business. Where risk is believed to be considerable, bond yields attain relatively large amplitudes; and their cyclical timing shifts from the standard neutral pattern of expansion in stages III–VII to the definitely inverted pattern of expansion in stages IV–VIII. Of course, rising bond yields mean falling bond prices; inversion is to be expected in the mathematically indicated yields of risky investments.

F CYCLICAL AMPLITUDES OF PRICES AND PRODUCTION

In preceding sections we have given only passing attention to the relation between the cyclical patterns of prices and production. This relation poses an interesting problem. We know that increases in supply tend to depress prices and that increases in demand tend to raise them; but how will prices behave in a cyclical expansion when both supply and demand rise, or in a contraction when both supply and demand shrink? It is in this theoretically indeterminate form that price problems confront students of business cycles. What to expect we learn from experience: most prices rise and fall with the cyclical

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[38] For example, the average reference-cycle amplitudes of the series on high grade corporate and municipal bond yields during 1919–33 are +1.3, −9.4, +10.7.

tides of business activity most of the time—not always. For example, the best American index of wholesale prices fell in the expansions of 1891–93 and 1927–29; it rose in the contraction of 1899–1900; in the other 23 cyclical phases from 1890 to 1938 prices moved in the same direction as production. A keen British theorist, noting similar movements in England, has remarked:

> This fact, that prices rise when goods are turned out in greater abundance and fall in the opposite situation, is a striking paradox and requires to be seen to be believed. It is one of the very few generalizations vouchsafed by empirical observation in economics; and it is probably the best established of any.[39]

Our evidence on the cyclical behavior of prices and production consists not merely of comprehensive index numbers, but also of numerous series representing single commodities, which we can classify by various criteria. For some 60 commodities we have both price and production records covering identical periods, which enables us to make more than usually exact comparisons.[40] The considerable size and varied composition of our sample put us in a position, not only to confirm the basic generalization of which Harrod writes, but also to improve it by a qualification, and to supplement it by certain related generalizations of scarcely less moment.

To begin with the direction of price movements during business-cycle phases: 87 percent of the 147 price series in our standard sample have positive timing; that is, they characteristically rise when activity expands and fall when activity contracts. This is a higher ratio than we find among our 188 series on production, of which less than 82 percent have positive timing—a difference that is significant because 35 percent of the price series and only 25 percent of the production series represent agricultural products. Irregular cyclical timing is less common among price than among production series, despite the

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[39] R. F. Harrod, *The Trade Cycle* (Oxford, Clarendon Press, 1936), p. 41.

[40] These paired series are being intensively studied by Frederick C. Mills, whose monograph *Price-Quantity Interactions in Business Cycles* (National Bureau, 1946), will be followed by further instalments.

larger proportion of foods and other farm products in the sample of prices.[41]

Mills provides fuller detail regarding his 64 pairs of series on prices and quantities. In expansion he finds that both prices and quantities rise on the average in 47 pairs, that one rises and the other falls in 13 pairs, and that one shows no net change while the other does change in 4 pairs. In contraction prices and quantities both fall in 42 pairs, while in 22 they move in opposite directions. Of the 13 pairs showing opposite movements in expansion, 10 pairs represent foods or other farm products; so also do 20 of the 22 pairs showing opposite movements in contraction.[42] Thus the empirical generalization that prices rise when goods are turned out in greater abundance, and vice versa, should be confined to industries in which producers have effective short-period control over output. The rule fails about as often as it holds with respect to farm products. Another qualification suggested by our evidence, though less emphatically, is that the rule applies better to competitive than to administered prices. The prices of plate glass, asphalt, passenger automobiles, and iron ore do not rise on the average in the expansions covered by Mills' analyses.

When producers lack effective short-run control over output, prices conform better than production to business cycles, and have higher reference-cycle amplitudes. When producers possess such control, production conforms better than prices and has higher reference-cycle amplitudes. Table 17[43] sums

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[41] The timing types of our price and production series are as follows:

	NUMBER OF SERIES		PERCENTAGES	
TYPE OF TIMING	Prices	Production	Prices	Production
Positive	128	154	87.1	81.9
Neutral	1		0.7	
Inverted	5	7	3.4	3.7
Irregular	13	27	8.8	14.4
Total	147	188	100.0	100.0

[42] Mills, *ibid.*, Table 8, Part 2, pp. 32-3.

[43] The sample of paired series used here was arranged by Geoffrey H. Moore, and is almost identical with the sample used above in Chapter 6, note 5. For my purposes it is better suited than Mills' similar sample, because the amplitudes are directly comparable with those shown in other tables, war cycles have been omitted from the averages, and the ratio of foodstuffs and other farm products to all pairs of commodities is 30 instead of 58 percent (see Mills, *ibid.*, p. 118).

Table 17

REFERENCE-CYCLE CONFORMITY AND AMPLITUDE OF SERIES ON PRICES AND PRODUCTION

	Number of Series		Mean Index[a] of Conformity to Business Cycles		Mean Reference-Cycle Amplitude[a]	
	Full sample[b]	*Paired series*	*Full sample*	*Paired series*	*Full sample*	*Paired series*[c]
ALL SERIES						
Prices	147	60	60	66	26	35
Production	188	60	74	66	58	47
COMPREHENSIVE SERIES[d]						
Broadest index						
Prices	1	1	100	100	18	27
Production	1	1	100	100	53	55
Farm products						
Prices	1	1	43	14	21	40
Marketings	1	1	33	14	2	2
Nonagricultural products						
Prices	1	1	100	100	25	25
Production	1	1	100	100	68	72
FARM PRODUCTS AND FOODS						
Prices	51	17	52	55	25	33
Production	47	17	42	38	15	13
OTHER PERISHABLES						
Prices	22	11	63	69	30	40
Production	29	11	83	82	51	43
SEMIDURABLES						
Prices	18	10	52	52	24	33
Production	29	10	79	70	48	45
DURABLES						
Prices	45	19	65	81	26	35
Production	57	19	82	80	101	82

[a] All averages are taken without regard to sign.

[b] The full number of series on prices (147) includes 8 indexes, besides the three listed, that cannot be classified according to durability. Likewise, the full number of series on production (188) includes 23 indexes, besides the three listed, that cannot be thus classified.

[c] Based on movements between stages I–V and V–IX. Means in the three preceding columns are based on characteristic stages of expansion and contraction.

[d] The comprehensive series used are as follows:

Bureau of Labor Statistics index of wholesale prices, 'all' commodities: 11 cycles, 1891–1914 and 1921–38, in columns for full sample; 4 cycles, 1921–38, in columns for paired series.
Federal Reserve Bank of New York index of production: 5 cycles, 1919–38, in columns for full sample; 4 cycles, 1921–38, in columns for paired series.

Bureau of Labor Statistics index of wholesale prices of farm products: 11 cycles, 1891–1914 and 1921–38, in columns for full sample; 4 cycles, 1921–38, in columns for paired series.
Department of Commerce index of agricultural marketings: 5 cycles, 1919–38, in columns for full sample; 4 cycles, 1921–38, in columns for paired series.

Bureau of Labor Statistics index of wholesale prices of nonagricultural commodities: 4 cycles, 1921–38, in both comparisons.
Federal Reserve Board index of industrial production: 5 cycles, 1919–38, in columns for full sample; 4 cycles, 1921–38, in columns for paired series.

up the evidence for this double-barreled generalization, and also demonstrates that the durability of goods has far less influence upon the cyclical amplitudes of prices than of production.[44]

Judged by the amplitudes of their reference-cycle movements, prices are tied together more closely than are physical outputs. This difference can be seen in the group averages of Table 17. It stands out more boldly among individual series. The highest reference-cycle amplitude of any price in our sample (steel scrap) is 87; that figure is exceeded by more than a fifth of our production series. On the basis of a still wider survey Mills reports:

> The median advance of 241 production series between reference-cycle stages I and V was 20.3 (in reference-cycle relatives); the median advance of 132 price series was 8.0 (war cycles were excluded . . .). The price movements were much more compact and uniform than the production movements, a condition evidenced by an interquartile range of 5.8 for the price series, at stage V, and a corresponding interquartile range of 17.0 for the production series.[45]

In these few paragraphs we have flushed a rather terrifying list of theoretical problems. Why should most commodity prices rise when supply is being enlarged and fall when supply is being reduced? Why should the reference-cycle amplitudes of prices be greater than the corresponding amplitudes of production when producers cannot adjust output to current demand, and why should prices fluctuate less than production when producers can control output? Why should the cyclical movements of prices be more uniform than the cyclical movements of production, and yet have on the whole lower indexes of conformity to business cycles?

Price theory may be the most highly developed section of

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[44] I may note that if coke were transferred from 'other perishables' to 'durables', as it might be in view of its chief use, the amplitudes of the production groups in the table would fit our earlier analysis somewhat better. That transfer would reduce the amplitude of other perishables from 51 to 50 in the full sample, and from 43 to 39 in the sample of paired series. In prices, the corresponding shifts would be from 30 to 27 in the full sample and from 40 to 36 in the sample of paired series.

[45] *Ibid.*, p. 32, footnote. See also pp. 76, 77, 108.

economics, but it has not been designed to raise or to settle problems of this character. Quite obviously these problems involve the relations of present prices to past prices of the same goods; the relations of present prices of different goods to prospective profits and family comfort, and the relations of all prices to the supply of 'money'—the most ambiguous of economic terms, and therefore perfectly adapted to use in a list of unknowns. Not until we enter upon our full analysis of what happens from stage to stage of a business cycle will it be prudent to attack these complications.

V THE PROBLEM OF COMPARING AND COMBINING REFERENCE-CYCLE AMPLITUDES

In comparing reference-cycle amplitudes of different processes in this chapter, we have glossed over some conceptual problems that should be faced explicitly. The three ways of comparing reference-cycle amplitudes used in Table 17 will serve our purpose. The first involves averaging the amplitudes of all price series belonging to a given group or combination of groups, then making corresponding averages for production. In the second only commodities and periods are included for which both price and production records have been analyzed. The third relies upon comprehensive indexes. The three methods yield broadly similar results, but there are also numerous differences, of which some are considerable. How should these differences be interpreted? Should we take them as warnings that all measures in this field are exceedingly rough? Or should we conclude that one method of comparing amplitudes is right and the others are wrong? Or do the differences have economic meanings that, when grasped, illuminate the subject and increase our confidence in the measures?

A AMPLITUDES OF COMPREHENSIVE SERIES AND THEIR COMPONENTS

Consider first the comprehensive series. In the last section of Chapter 6 we observed that wide coverage tends to raise the numerical value of conformity indexes, because the larger the number and greater the variety of activities represented by a series the more chances have irregular movements to offset one another. Table 17 illustrates this effect afresh—perfect conformity to business cycles appears only in the most comprehensive indexes of prices and production, and in the indexes covering all nonagricultural products. But the table suggests that inclusiveness has the opposite effect upon reference-cycle amplitudes: the broader an index number or aggregate, the lower tends to be its reference-cycle amplitude in relation to the mean amplitude of its component series.

This generalization can be deduced from our method of computing reference-cycle amplitudes and what we know about varieties of cyclical timing. When analyzing a series, we measure its net rise from the first to the last of the stages that we have judged to be characteristic of its expansions, and we measure its fall in similar fashion—unless the cyclical timing is irregular, in which case we measure the rise from stage I to stage V and the fall from V to IX. The average group amplitudes for full samples in Table 17 are simple averages of measures made in this way, taken without regard to sign.

The amplitude of an index or aggregate would equal the similarly weighted mean of the amplitudes of its component series, provided all components had the same variety of cyclical timing. But if the components reach their peaks in different stages, the highest point in the pattern of the comprehensive series will not be so high as the similarly weighted average of the peaks of the individual components. Nor will the trough of the comprehensive series be so low as the similarly weighted mean of the troughs of the component series, when these troughs are scattered among different stages. Of course lowering peaks and raising troughs diminishes amplitudes. The wider the variety of timing in a group of series, the lower tends to be the amplitude of an aggregate or index that covers the whole group in relation to the mean amplitude of the individual series. The difference in Table 17 between the amplitude of the Bureau of Labor Statistics index of wholesale prices (18) and the mean amplitude of all our 147 series on prices (26) illustrates this effect, and so also does the difference between the amplitude of the New York Federal Reserve Bank index of production (53) and the mean of all our series on production (58); though in neither case are all the individual series components of the index, and though both indexes have components not separately included in our sample.

Such differences in results are not discrepancies. The means compared are measures of two distinct aspects of business cycles: (1) the mean cyclical fluctuations in national output and in what is called the price 'level', (2) the mean cyclical fluctuations to which individual prices and industries are exposed. We should not ask which of the two measures is better, for they serve different purposes, both important. For example, when we ask how violent are the cyclical fluctuations in aggregate demand for labor, we want the answer given by the most comprehensive index available. When we ask what is the average unemployment hazard in American industries, we want the higher answer yielded by a properly weighted mean of the amplitudes of many series. If a similar question were asked about the average enterprise, or average union, or average individual, we should want the still higher figures that could be had only from far more detailed information than is currently published.

B AMPLITUDES OF PAIRED SERIES AND FULL SAMPLES

In Table 17 the shift from full samples to paired series raises the reference-cycle amplitudes of prices and reduces the amplitudes of production.[46] Is this curious difference an inscrutable matter of chance, or has it a lesson to teach?

The comparisons confined to paired series in Table 17 involve three sacrifices of information. (1) All price series not matched by records of production, and all production series not matched by price records, must be dropped. Manifestly, the 60 price series in our sample of pairs do not represent the

[46] This observation applies to all the group averages in the table, but not to all series in the groups. Nor does it apply to the comprehensive series in the table.

cyclical behavior of prices so adequately as do the 147 price series in our full sample, and the like is true of the production data. (2) From the price series kept in the sample of pairs all months are dropped that are not matched in the corresponding production record, and vice versa. When there is a difference in the number of cycles covered, the full-sample average of a series is more representative than the paired-sample average. (3) In making the paired-sample averages of Table 17, we base all amplitudes on movements between stages I–V and V–IX. For most purposes, we prefer the amplitudes that take account of leads and lags, as do those of the full samples.

While it may be readily granted that the full samples represent the cyclical behavior of prices and production more adequately than do the paired samples, that does not mean that the full samples provide more trustworthy *comparisons* of the cyclical amplitudes characteristic of prices and production. (1) Price amplitudes differ widely from one commodity to another; production amplitudes differ still more. Hence, full-sample comparisons will be swayed by dissimilarities in the lists of commodities for which there are price and production records. (2) Successive business-cycle expansions and contractions differ widely in intensity, which means among other things, differences in the amplitude of the price and production movements they excite. Full-sample amplitudes aim to *minimize* the effect of these intercycle differences by basing the averages upon all the acceptable cycles in the price series, and also all the acceptable cycles covered by the output data. The paired samples aim to *equalize* the effect of intercycle differences upon prices and production by making the lists of cycles identical. Is not this aim more attainable than the other? (3) Differences in cyclical timing can be taken into account when dealing with paired series as readily as when dealing with full samples, provided stress is not laid upon strict identity of the period covered.

Table 18 shows how the first two factors bear upon the results presented by Table 17. The chief reason why the mean amplitudes of prices are higher in the paired than in the full

Table 18

Analysis of Differences between Mean Reference-Cycle Amplitudes of Full Samples and Paired Series in Table 17

	NUMBER OF SERIES			MEAN NUMBER OF REFERENCE CYCLES COVERED BY			MEAN REFERENCE-CYCLE AMPLITUDE[a]			
				Paired Series			Paired Series			
	Paired series	Other series	Full sample[c]	*As used in price-quantity comparison*	*As they come in full sample*	Other Series in Full Sample	*As used in price-quantity comparison*	*As they come in full sample*	Other Series in Full Sample	All Series in Full Sample
PRICES										
Farm products & foods	17	37	51	5.6	10.6	7.2	33.2	27.9	23.3	24.9
Other perishables	11	11	22	4.4	7.9	6.0	40.1	34.5	24.5	29.5
Semidurables	10	10	18	3.5	9.1	10.3	33.1	23.2	24.1	24.1
Durables	19	27	45	4.4	9.6	8.4	35.4	27.1	25.9	26.3
All price series[b]	57	96	147	4.6	9.5	7.8	35.3	28.1	24.1	25.7
PRODUCTION										
Farm products & foods	17	30	47	5.6	8.4	6.8	13.0	14.9	15.5	15.3
Other perishables	11	18	29	4.4	5.9	6.1	42.6	42.9	56.6	51.4
Semidurables	10	19	29	3.5	4.3	4.7	45.2	47.1	47.8	47.6
Durables	19	39	57	4.4	6.1	4.3	82.0	81.4	110.5	100.8
All production series[b]	57	132	188	4.6	6.4	5.3	47.4	48.2	62.2	57.7

[a] Amplitudes are taken without regard to sign. In the column headed 'price-quantity comparison', the amplitude measures are all based on movements between stages I–V and V–IX. In the remaining three columns they are based on movements during characteristic stages of expansion and contraction.

[b] See Table 17, note *b*.

[c] The total of paired and other series can exceed the number of series in the full sample because in setting up pairs we have several times compared one price series with two production series, and once compared a production series with two price series.

sample is a cultural lag—the long delay in collecting statistics of production—coupled with the world developments responsible for the unusual violence of economic fluctuations in 1919–38. Prices are easier to ascertain than output in most branches of business; and they have been systematically recorded from earlier dates. A large part of our price collection is taken from the Bureau of Labor Statistics and runs back to 1890; there was no comparable effort to collect production statistics until World War I had given a costly demonstration of the nation's need of fuller industrial records. Table 3 shows that in our basic sample, 59 percent of the 147 series on commodity prices cover more than 5 reference cycles; only 28 percent of the 188 series on production have such a span. Hence when we pair series on prices and production, we have to discard part of the price record far more often than part of the production record. Table 18 shows that the 57 price series that are paired with series on production cover 9.5 reference cycles on the average in the full sample, but are cut to only 4.6 cycles on the average in the paired sample, while the corresponding cut in production series is only from 6.4 to 4.6 cycles. Of course, it is usually the earlier cycles that are cut off. Evidence that reference-cycle amplitudes have been higher on the average since World War I than before was presented in the second section of this chapter. Hence, discarding part of the record to fit the shorter member of a pair tends to raise mean reference-cycle amplitudes, and, as matters stand, this effect is felt much more keenly by prices than by production.

The use of I–V timing in measuring amplitudes of all series in the paired sample (as opposed to whatever timing is judged to be characteristic of the series) exercises an influence opposed to that of amputating cycles, tending to make the mean amplitudes smaller in the paired than in the full samples. This effect is felt much more by the series on production than by those on prices; for of the 57 paired series only 10½ price series[47]

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[47] Sometimes we cannot decide which of two timing schemes fits a series better; then we use both and take an average of the two sets of conformity or amplitude measures. Hence the fraction.

and just twice as many production series have other than I-V timing.[48]

The main issue remains: How do the series in the paired sample compare with those in the full sample? There is a difference of only 4 points between the mean amplitude of the 57 price series used in the paired sample, when computed for the full ranges of cycles covered, and of the mean amplitude of the 96 other series on commodity prices we have analyzed. The corresponding difference between the amplitudes of the 57 production series in the paired sample and of the 132 other series is 14 points. The latter difference occurs mainly in durable goods, where the paired series have a mean amplitude of 81, while 39 other series have a mean amplitude of 110. The discrepancy of 29 points arises chiefly because of another cultural lag. We have not yet learned how to make satisfactory price records of the complicated durable goods we fabricate from lumber, cement, glass, and metals, though we can make clumsy production records by casting up the square feet of floor space represented by construction contracts, or by counting the number of motor vehicles, industrial pumps, railroad locomotives, etc. that we turn out. In our full sample there are 16 series on the output of vehicles, of industrial equipment, and the volume of construction work in process. These production series are matched by a single curious series on the price of passenger automobiles. While the 41 series on production of durable materials and fittings have a mean reference-cycle amplitude of 79, the 16 series on the elaborate products typically made from these materials have a mean amplitude of 157. It is primarily the virtual omission of these most characteristic products of our industrial age from our paired sample for lack of price data that makes the amplitudes of production in our paired sample 10 points lower than its amplitude in the full sample.

This analysis shows, I think, that to achieve the best comparisons of the cyclical behavior of prices and production we

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[48] Strictly speaking, other than I-V or irregular timing; but irregular and I-V timing come to the same thing in measuring amplitudes.

should use both our paired samples and our full samples. Each method has something to tell us that the other tells less well or not at all. And this remark applies to many other comparisons we shall have to make among economic variables. Yet evidence upon differences between measures made in different ways, and the confidence-inspiring fashion in which these differences often turn out to be significant when traced to their sources, should not blind us to the residual differences we cannot yet explain. Nor should an anxious concern with minor differences, whether accounted for or not, dull us to broad similarities among measures that do not, and should not, agree closely.

Finally, this experiment with prices and production illustrates the advantages of having at our disposal numerous series to use in treating problems that could not have been foreseen in detail when we began compiling our sample of time series. No collection of general indexes or aggregates, however skilfully manipulated, could tell us what we have learned by very simple operations upon good sized samples of series on prices and production.

C THE AMPLITUDES OF BUSINESS CYCLES

At the outset of this chapter I put the reference-cycle amplitudes of all 794 series included by our full sample into a single chart and table. The latter presents medians and arithmetic means of the whole array. Then I ranked 29 groups of series in Table 11 according to their mean amplitudes, and later swept these groups together into a few much broader classes.

While useful for exhibiting the range and distribution of reference-cycle amplitudes, these statistical compilations do not yield averages into which we can read much economic meaning. The lack of systematic weighting, while a grievous fault, is less fundamental than the fact that the series do not all stand in an additive relation to one another. Even the fairly homogeneous groups of Table 11 sometimes jumble together broad series and their components. What sense is there in an average amplitude that includes a general index and a dozen series from which the index itself has been computed? The broader classes of Table 11 and the full arrays of Table 10 suggest worse absurdities. We do not add the prices and the output of pig iron; we multiply one by the other. Then why should we include the amplitudes of price and output series in a single average? When Frederick Mills multiplies quantities supplied by unit prices to get 'buyers' outlays' or 'sellers' revenues', he contributes a fresh set of series to our records—a set that has meaning, and that, among other advantages, enables him to determine the relative influence exercised by changes in prices and in quantities upon the amplitude of their joint product.[49] Once again, it produces little except confusion to average bank loans *outstanding* with monthly issues of securities, or tonnage of vessels under construction with building contracts let. The fluctuations in a stock of goods in existence and the fluctuations in the stream of goods flowing into or out of that stock can be made to illuminate one another, but not by simple averaging.

So it goes throughout our sample. Yet the hypothesis that all economic activities are interrelated, at every moment of time and over time, implies that the reference-cycle amplitudes of all the series in our sample, and of the vastly larger number that would be needed to complete it, are functionally related to one another. It is not absurd to think of all these amplitudes as constituting a system of mutually determining members. Indeed, the chief job before us may be defined as that of learning what we can about the ways in which the cyclical fluctuations characteristic of many segments of the economy arouse, reenforce, deaden, and reverse one another. Somehow the whole congeries of squirming entities manages to swell in volume for a while; then to shrink for another while, only to repeat once more what it has already done time and again. Obviously, our very concept of general tides implies overall amplitudes. Thus we are left confronting an important problem: How can we sum up movements in the whole economy, and how can we measure their amplitudes? But that is

[49] See his *Price-Quantity Interactions in Business Cycles.*

obviously a problem for Part III, The Consensus of Cyclical Behavior. What Part II on Varieties of Cyclical Behavior contributes is a warning not to mistake the average reference-cycle amplitudes of our sample for measures of the cyclical tides that sweep over the American economy.