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CHAPTER 5

Varieties of Cyclical Timing

I Our Measures of Cyclical Timing

According to our definition, the basic feature of business cycles is substantial agreement among many economic activities in the timing of their expansions and of their contractions. Yet less than half of the average patterns of the series in our sample characteristically reach their lowest points at reference troughs and their highest points at reference peaks. Our efforts to observe and to understand what happens during business cycles begin with the differences found in this fundamental trait.

First a word about how cyclical timing is determined. We plot the patterns traced by a series during successive reference cycles one above another, so that likenesses and differences can readily be seen. Seldom do the troughs of these patterns invariably fall in the same stage; not much oftener do the peaks. But usually there is a substantial preponderance of troughs in some one stage, likewise of peaks, and this preponderance fixes our tentative judgment concerning the timing characteristic of the series, which is then tested by comparisons with other arrangements of the data. "When a decision is finally reached, we usually feel reasonably certain that we have made that division into 'expansion' and 'contraction' which best represents the behavior of the series during successive reference cycles." When the behavior differs so erratically from one cycle to the next that there is serious doubt whether the series is correlated at all with business cycles, we classify the timing as 'irregular'.[1] A few series with rapidly rising trends and moderate cyclical movements do not decline in contractions; then we look for the stages during which the rise is usually accelerated and those

[1] For further details and illustrations, see *Measuring Business Cycles*, pp. 185–9.

Table 4

DISTRIBUTION OF 794 MONTHLY OR QUARTERLY SERIES ACCORDING TO THEIR CHARACTERISTIC CYCLICAL TIMING[a]

Reference-Cycle Stages Characteristic of		Type of	Timing at Reference-Cycle		No. of	% of
Expansion	*Contraction*	Timing	*Troughs*	*Peaks*	Series	Sample[b]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
V–VIII	VIII–V	Inverted	−1	0	7	0.9
V–IX	I–V	"	0	0	38	4.8
V–II	II–V	"	+1	0	3	0.4
VI–IX	I–VI	"	0	+1	5	0.6
VI–II	II–VI	"	+1	+1	3	0.4
VI–III	III–VI	"	+2	+1	2.5	0.3
VII–II	II–VII	"	+1	+2	4	0.5
VII–III	III–VII	Neutral	−2 or +2	−2 or +2	6.5	0.8
VII–IV	IV–VII	Positive	−2	−1	25	3.1
VIII–III	III–VIII	"	−1	−2	4.5	0.6
VIII–IV	IV–VIII	"	−1	−1	46.5	5.9
VIII–V	V–VIII	"	−1	0	69.5	8.8
I–IV	IV–IX	"	0	−1	17	2.1
I–V	V–IX	"	0	0	345	43.5
I–VI	VI–IX	"	0	+1	60.5	7.6
II–V	V–II	"	+1	0	11	1.4
II–VI	VI–II	"	+1	+1	14	1.8
II–VII	VII–II	"	+1	+2	6	0.8
III–VI	VI–III	"	+2	+1	8	1.0
III–VII	VII–III	Neutral	+2 or −2	+2 or −2	18.5	2.3
III–VIII	VIII–III	Inverted	−1	−2	0	0.0
IV–VII	VII–IV	"	−2	−1	6	0.8
IV–VIII	VIII–IV	"	−1	−1	5	0.6
IV–IX	I–IV	"	0	−1	4	0.5
Irregular	Irregular	Irregular	Irregular	Irregular	84.5	10.6
					794	100.0

[a] In inverted series the troughs are matched with reference peaks, and the peaks with reference troughs. In columns (4) and (5) of the first half of the table the 'minus' symbol represents a lead, 0 a coincidence, and 'plus' a lag. Numerals following one of the symbols indicate the number of reference-cycle stages by which a series leads or lags. Fractions occur in column (6) of the first half and columns (2)–(6) of the later half of the table because a few series fit two varieties of timing equally well and are credited half to each.

[b] Failure of detail to total 100 percent is due to rounding.

during which it is usually retarded—a remark that applies to declines in the even fewer series with rapidly falling trends. All of which means that 'characteristic' cyclical timing is an average representing the central tendency of the array of reference-cycle patterns from which it is drawn. Though not derived by numerical computation, it is brother to the average standings that determine the patterns of Chart 1.

Table 4 (concl.)

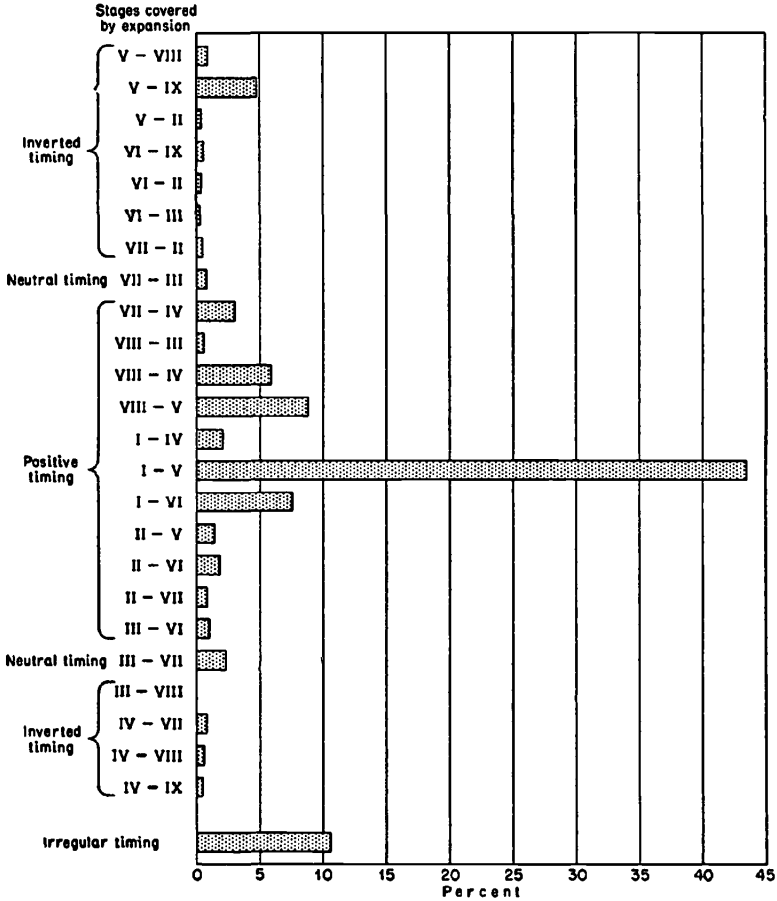
	SUMMARY BY TYPES OF TIMING				TOTAL	
	Positive	Neutral, Exp. III–VII	Neutral, Exp. VII–III	Inverted	No. of Series	% of Sample
(1)	(2)	(3)	(4)	(5)	(6)	(7)
No. of series	607	18.5	6.5	77.5	709.5	...
% of sample	76.5	2.3	0.8	9.8	...	89.4
	No. of series	*No. of series*	*No. of series*	*No. of series*		
BEHAVIOR AT TROUGHS						
2-stage leads	25	...	6.5[a]	6	37.5	4.7
1-stage leads	120.5	...	...	12	132.5	16.7
Coincidences	422.5	...	...	47	469.5	59.1
1-stage lags	31	...	...	10	41	5.2
2-stage lags	8	18.5[a]	...	2.5	29	3.7
All leads	145.5	...	6.5[a]	18	170	21.4
Coincidences	422.5	...	...	47	469.5	59.1
All lags	39	18.5[a]	...	12.5	70	8.8
BEHAVIOR AT PEAKS						
2-stage leads	4.5	...	6.5[a]	0	11	1.4
1-stage leads	88.5	...	...	15	103.5	13.0
Coincidences	425.5	...	...	48	473.5	59.6
1-stage lags	82.5	...	...	10.5	93	11.7
2-stage lags	6	18.5[a]	...	4	28.5	3.6
All leads	93	...	6.5[a]	15	114.5	14.4
Coincidences	425.5	...	...	48	473.5	59.6
All lags	88.5	18.5[a]	...	14.5	121.5	15.3

[a] May with equal propriety be entered as lead or as lag.

Our decisions regarding the cyclical timing of all the series in the sample used here are summarized by Table 4 and Chart 2. Columns (1) and (2) of the table show the varieties of timing recognized by our standard analysis. Since we think of business-cycle expansions and contractions as cumulative movements usually lasting more than a year, we seldom admit that a series shares in the business-cycle consensus unless it rises for at least 3 consecutive stages, or falls for at least 3. Rigidly applied, this criterion bars from consideration all timing schemes other than 3 stages of expansion to 5 stages of contraction, 4 stages to each phase, or 5 stages of expansion to 3 of contraction. Since a series can begin to rise in any of the 8 stages and continue the movement for 3, 4, or 5 stages, there are 24 standard varieties of

Chart 2

Percentage Distribution of 794 Series According to Their Characteristic Cyclical Timing



See Table 4.

characteristic timing.[2] Irregular timing constitutes a 25th vari-

[2] We speak here of 8 instead of 9 'stages', because stage IX of one cycle is stage I of its successor. A series that expands in stages IX–IV is more conveniently described as rising in I–IV.

In two series of the present sample we have divided the 8 stages into 6 for expansion and 2 for contraction. One is Babson's, the other Partington's, estimate of railroad gross earnings in 1870–1908. Both rise characteristically from stage VIII of one cycle to stage VI of its successor. In Table 4 these series are entered under expansion stages VIII–V.

ety. All the varieties possible under this scheme are represented in our sample, except expansion in stages III–VIII. Some series conform about equally well to two varieties; they are credited half to one, half to the other. The timing schemes of the table are arranged to place the commonest variety (expansion in stages I–V) near the middle, so that the rough symmetry of the array may stand out clearly in the chart.

In column (3) of the table the 25 standard varieties of timing are classified under 4, or better 5, types. If a series moves in the same direction as general business in more than half of the reference-cycle stages, the timing is called 'positive'. If this proportion is less than half, the timing is 'inverted'. When the expansion in a series covers two stages of business-cycle expansion and two of contraction, the timing is 'neutral'. But this type should be divided, for it embraces two diametrically opposite schemes: expansion in stages III–VII and expansion in VII–III. The final type, 'irregular' timing, means that the expansion stages in a series differ erratically from cycle to cycle.

Columns (4) and (5) show the leads, coincidences, or lags implied by each variety of timing, and the length of the lead or lag in reference-cycle stages. Of course the peaks of positive series are compared with reference-cycle peaks, and troughs with reference troughs, while the peaks of inverted series are compared with reference-cycle troughs, and their troughs with reference peaks. Which way of matching is more significant in dealing with neutral series depends upon economic interpretations. For example, one may say that the rise of certain bond yields in stages III–VII means that the long-term interest rates implicit in these series lag two stages at revival; one may equally well say that the decline in these rates in VII–III leads revival by two stages. Hence the peculiar entries opposite both groups of neutral series in columns (4) and (5). Irregular series lead, coincide with, or lag behind reference-cycle turns in erratic fashion; they have no 'characteristic' timing.

At present we are not concerned with the marked preponderance of one variety of timing over all its rivals—that dra-

matic feature of Chart 2 will be duly exploited in Part III. Instead we concentrate upon the fact that more than half of the series in our sample, 56.5 percent to be exact, do *not* characteristically rise from our reference dates for business-cycle troughs to our reference dates for business-cycle peaks, and then fall to the next trough dates. How account for the 11 percent that show irregular timing and the 10 percent of inversions? Why do some series rise from the middle of business-cycle expansions to the middle of contractions and then fall to the middle of the following expansions, or behave in the opposite fashion? Among positive and inverted series, why do some lead and others lag at troughs and peaks?

In good part, the answers to these questions must be sought by analyzing the economic interrelations among the cyclical movements typical of different activities. Though we are not yet ready for systematic work of that sort, it is not premature to inquire what kinds of activities have irregular, inverted, and neutral timing, or what kinds lead and what kinds lag at revivals and recessions. Nor is it premature to draw some conclusions that information of this simple sort suggests.

II Irregular Timing

Of the 85 series in our sample classified as irregular in cyclical timing, 41 represent the output, prices, inventories, exports, imports, or sales of farm products or foods. If we included annual data in the present sample, most of the series on harvests, acreage planted, and yields per acre would be added to this timing type. Here we meet for the first time a peculiarity of farming that will reappear time and again in later chapters. Fortunately an explanation can be given at once that will be recalled frequently.

The chief reason why the basic industry of growing crops does not expand and contract in unison with mining, manufacturing, trading, transportation, and finance is that farmers cannot control the short-time fluctuations in their output. To a limited extent they can shift their acreage from one crop to another, and alter the intensity of cultivation. But the factor

that dominates year-to-year changes in the harvests is that intricate complex called weather. Plant diseases and insect pests also exert an appreciable influence. "The best laid schemes o' mice and men gang aft a-gley" was written by a farmer of the eighteenth century; his successors remain almost as much at the mercy of nature's freaks as was Robert Burns.

Though no one practically familiar with crop raising is likely to hold that farmers can adjust their output neatly to the rhythm of business, distinguished theorists from W. Stanley Jevons to Henry L. Moore have held that the rhythm of business is dominated by the crops. Moore formulated this view in the following 'law':

> The weather conditions represented by the rainfall in the central part of the United States, and probably in other continental areas, pass through cycles of approximately thirty-three years and eight years in duration, causing like cycles in the yield per acre of the crops; these cycles of crops constitute the natural, material current which drags upon its surface the lagging, rhythmically changing values and prices with which the economist is more immediately concerned.[3]

That our observations do not obey this 'law' appears from the reference dates. According to them, the duration of business cycles in the United States between 1854 and 1938 ranged from 17 to 101 months, and averaged 48 months. Nor can one get a neat series of eight-year cycles by adding the durations of consecutive cycles in our list. For that matter, we cannot confirm the eight-year cycle in crops or in yields per acre. Our analysis of specific cycles in the official index of crop production gives an average duration of about 49 months, while for yields per acre we get means of 35 months for wheat, 39 for oats, 37 for corn, 38 for potatoes, and 32 for cotton. Our British, French, and German series on crops behave much like the American series, aside from differences in trend. Even when the average duration of the specific cycles in an agricultural series agrees closely with the corresponding average of business cycles, the two sets of cycles seldom if ever approxi-

[3] *Economic Cycles: Their Law and Cause* (Macmillan, 1914), p. 149. Cf. Moore's later book, *Generating Economic Cycles* (Macmillan, 1923), in which "the eight-year generating cycle" is traced to an astronomical cause.

mate one-to-one correspondence. In no other great industry for which we have records are the cyclical fluctuations so irregularly related to business cycles as in crop husbandry. And the farmer's inability to control his output leads to many irregularities in the cyclical timing of agricultural shipments, processing, prices, inventories, exports, imports, and domestic sales.

These statements do not imply that crop husbandry is a negligible factor in business cycles. On the contrary, no one can understand the cycles of actual experience unless he takes account of the changing fortunes of farmers as consumers and borrowers, the changing prices of the great staples they sell to merchants and manufacturers, food costs in family budgets, or the farmer's share in foreign trade. There will be frequent occasion to dwell on such matters even in this preliminary discussion of the typical features of business cycles. If we were dealing with individual cycles, agricultural factors would play a still more prominent role; now and then they would appear to dominate the cyclical tides for a while.[4] What our findings mean is merely that these patent influences upon the economic state of the nation sometimes tend to enhance and perhaps as often tend to restrain expansions; sometimes to mitigate and sometimes to aggravate contractions. Whether times are good or bad, we never know what nature will do to next year's crops.[5]

Numerous factors besides dependence on the weather may prevent activities from rising and falling with the cyclical tides. Private construction rises when the prospects of profits improve and declines when these prospects fade, but 8 of our series on public construction work have irregular timing, because governments do not build for profit to themselves. Just why they time the letting of contracts for public buildings, roads, bridges, sewers, waterworks, docks, dams, and power houses as they do is a question that has many answers—pressing

[4] Interesting examples occurred in 1878 and 1891.

[5] Geoffrey H. Moore's forthcoming monograph, "Harvest Cycles", deals thoroughly with fluctuations in agricultural output and their relation to business cycles.

needs for more schoolrooms, sanitary requirements, desire to provide work in hard times, local pride, political jobbery, and so on. It would be hard indeed to determine the motives animating the men jointly responsible for the decisions. What matters for present purposes is that half of our series on public construction show no regular relation in time to business cycles, while most of the others usually, though not always, rise in cyclical expansions and fall in cyclical contractions.[6]

A third group of irregular series, 12 in number, is made up of 'sticky' prices, clerical wage rates and earnings, railway rates, and street-car fares. The commodity prices in the list relate to one grade of men's shoes, anthracite coal in New York, asphalt, sulphuric acid, haymowers, and passenger automobiles. Those in position to 'administer' the prices of their products often seek to avoid frequent changes. They do not regularly charge all that the traffic would bear in brisk times, and they do not regularly offer cuts when demand falls off. Presumably street-car companies and in less measure railways, even when left to themselves, prefer constant to variable rates under ordinary circumstances, though they may make drastic changes under pressure of rapidly rising costs or rapidly falling traffic. Public supervision, with its time-consuming hearings and quasi-judicial decisions, is likely to interfere still further with the prompt adjustment of rates to the cyclical tides. Collective bargaining has a similar effect upon changes in wage rates, especially when it is elaborate and results in formal contracts running for a year or longer.[7]

Over the remaining 24 irregular series I shall pass lightly, mainly for lack of knowledge. Eleven represent inventories of building materials, raw silk, or cattle-hide leather. Petroleum production from the old Appalachian field was highly irregular because intermixed surface holdings and American

[6] Arthur F. Burns has in hand a monograph upon cyclical movements in construction that will deal more adequately with this problem—and many others. The completion of this monograph has been delayed by other pressing tasks.

[7] See Daniel Creamer, "Behavior of Wage Rates during Business Cycles" (National Bureau, *Occasional Paper 34*).

law concerning ownership of minerals under ground forced drillers to pump oil as fast as they could, with little regard to market demand, in order to prevent wells on neighboring plots from draining the whole pool. Even in recent years, stocks of crude petroleum and of gasoline at refineries have fluctuated irregularly. Three of our 14 series on security issues, and one of our 11 series on bond yields, belong here. So also do new postal savings deposits, imports of lead, the production of knit underwear, and 2 series whose regularity of timing we cannot judge because they cover a single cycle. The last in the list is one of the most important—the monetary gold stock of the United States since 1879. That the basic element in our monetary system rose and fell with slight regard to the nation's business meant that whatever 'elasticity' the circulating medium attained came from some form of credit currency.

Writers who form their concepts or 'models' of business cycles without careful study of actual processes are prone to overlook the sectors of the economy that do not regularly expand and contract in unison. It might be argued that irregular series have no share in the cyclical tides and that omitting them from consideration is a proper simplification of the theorist's task. One who wishes to deal with actual cycles cannot accept such a view. Surely the behavior of the activities that expand and contract in unison would be other than it is if farming followed the timing of steel, if all inventories were either positive or inverted, if the prices of no commodities or services were 'sticky', and if governments used all their construction projects as a balance wheel to moderate fluctuations in employment. Successive business cycles would differ less from one another than they do if these cyclical recalcitrants could be brought into line. We could draw a more elegant sketch of what typically happens during a cycle if we dropped the 11 percent of irregular series from our sample. But in so doing we would be distorting the facts, and discarding many of the materials needed to account for the cyclical behavior of the series we kept.

III Inverted Timing

Whether a series that keeps step with business cycles has a positive or an inverted pattern depends upon the form in which it is recorded. For example, trade unions sometimes report the number or percentages of their members out of work; the Bureau of Labor Statistics reports the number of men employed. Railroads record both the number of surplus freight cars (an inverted series), and freight car shortages (which move positively). Our 14 ratios of bank reserves are all inverted; they would become positive if the ratios showed demand liabilities divided by reserves instead of reserves divided by liabilities. Price series can be inverted by computing how many commodity units are sold for a dollar, production series by computing time per unit of product instead of product per unit of time.

However, the form in which economic records are kept is seldom arbitrary. The purpose for which the figures are to be used and ease of compilation are controlling considerations. A factory manager wants to know how many articles he can produce in a day or week; a consumer wants to know how many of his dollars he must spend for the goods he needs; a banker wants to know whether his reserves are adequate to protect the liabilities he will assume by increasing loans or investments; the nation is interested in both employment and unemployment, but finds it easier to count men at work, while a trade union needs to know how many members are drawing unemployment benefits from its treasury.

Our practice is to accept time series in their original form, trusting that the familiar figures will be more readily understood. On the few occasions when a change in form helps to clarify a special point, we reverse signs, or play other tricks, though never without due warning. What really matters is that we think about the economic meaning of the data. If we realize just what a given series represents, we should be able to draw the same conclusion from the figures whether they

are stated in a form that involves a positive or an inverted relation to business cycles.

Seventy-seven series in our sample are inverted and a 78th may equally well be treated as expanding in stages VI–III, which means inversion under our rules, or as expanding in VII–III, which means neutral timing. In some instances the reasons for inversion are obvious; in others they are readily found; but there remain numerous puzzles.

In the obvious group belong the records of unfavorable business developments—our 7 series on commercial failures, and the railway series on idle freight cars. Unemployment percentages would belong here, but we have shifted them to percentages of union members employed.

A second group includes various records of a less desirable alternative that is chosen more frequently in bad times than in good. Certain production series seem to illustrate such choices. Beef is generally preferred to mutton or pork, but it is more expensive. Hence cattle slaughter has positive timing, while sheep and hog slaughter are inverted.[8] Perhaps a hard-times shift of demand toward cheap vegetable foods explains the inverted timing of the wholesale prices of wheat, wheat flour, potatoes, and bananas—which are often the cheapest of fruits on a poundage basis. Presumably the inverted timing of the imports of coffee is due to its relatively low cost. A similar shift from a more to a less desirable alternative dominated the cyclical changes in national bank circulation before 1914. The conditions under which notes could be issued left a narrower margin of profit than could be had from the extension of credit in the form of deposits. Hence national banks reduced their note issues in brisk times, and increased them again when they could find no more profitable way of using funds.

Another situation that produces numerous inversions arises

[8] Probably in no case do the factors mentioned in the text account fully for the cyclical timing of a series. A complete analysis of hog slaughter, for example, would deal with prospects at the time sows are bred, the period of gestation, the ratio between the prices of hogs and corn, and the changing efficiency of a pig in converting corn into pork as its age increases. More thorough treatment may be expected in our monographs.

when the supply of some good is not reduced by cyclical contraction as much as demand falls off. For example, when domestic demand for cotton expands, we use a larger fraction of our output at home; when contraction comes, production usually contines to rise, we use less cotton at home, and sell more abroad.[9] Again, the flow of milk seems to be the steadiest production process of which we have a record. Most of the current supply is sold to families, and the remainder turned into a wide variety of products, among which butter bulks larger than all the rest. When contraction forces painful economies upon many consumers, sales of fresh milk grow more slowly or shrink a little. Then the volume of milk used in factory production rises; so do the production and market receipts of butter. The price falls sharply at retail as well as wholesale, and the consumption of butter rises faster than it had risen during expansion. But consumption runs smaller than production, and cold-storage holdings of butter therefore rise. On somewhat similar lines we can account, at least in part, for the inverted inventories of tallow, oats, cotton, cottonseed, and cottonseed oil.

[9] Here as elsewhere I am dealing, not with what happens in every cycle, but with what happens as a rule. Between 1867 and 1938, the American cotton crop increased in 10 and declined in 8 expansions; it increased in 12 and declined in 6 contractions. Even domestic consumption does not respond to the cyclical tides with perfect regularity. In the period covered by our analysis (1914–38), it rose in the mild contraction of 1926–27 and fell a trifle in the succeeding expansion; that is, there were 2 countermovements in the 12 phases for which we have evidence. American exports of cotton are influenced by business conditions abroad as well as at home, and, while cyclical fluctuations in different countries influence one another, they often move in opposite directions for a while. Other factors influencing cotton exports from the United States are the changing supplies from competing areas, and the changing policies of foreign governments concerning imports. Yet, in the 18 American cycles of 1867–1938, cotton exports fell in 12 expansions and rose in 13 contractions. However, the larger exports in contraction offset only partly the joint effects of bigger crops and smaller domestic consumption; for the visible supply of cotton rose in 12 and fell in 5 of the 17 contractions between 1870 and 1938, while it fell in 12 and rose in 5 of the 17 expansions.

Similar elaborations might be made of what is said briefly about the cyclical timing characteristic of other series.

Perhaps the same principle can be stretched to cover inverted inventories at large. Almost all industries require the carrying of stocks at each stage of the process from producing raw materials to distributing finished products to final consumers. To keep these stocks adjusted to the current volume of business is extremely difficult. Especially when efficient operation requires the placing of firm orders some months before goods are needed, or when a considerable volume of goods must be kept 'in process' for weeks or months, there is grave danger that any slackening of sales will cause some stocks of materials and products to pile up rapidly in the hands of reluctant holders. Although aggregate inventories appear to keep step with business except for a lag at cyclical turns, in many industries technological necessity or commercial organization puts certain enterprises 'on the spot'. They must assume the risk that a slackening of sales will cause their stocks to accumulate, and in such cases the statistics register inverted inventory cycles. Clearly the dangers become especially great when a sudden recession occurs in business activity.[10]

Banking provides other cases of inversion. The volume of coin and paper money has not been regularly adjusted to cyclical changes in the dollar volume of transactions. In expansion the public absorbed a larger fraction of the circulating money and left a smaller fraction in the banks; in contraction the reduction of wage disbursements and till money held by retail stores reversed this flow and let 'idle' money pile up in the banks. Hence the 'lawful money holdings' of all national banks before 1914 had an inverted pattern. More emphatically inverted were the patterns of money holdings of the national banks in New York and the class of 'central reserve cities' (New York, Chicago, and St. Louis). In other 'reserve cities'

[10] Little has been known about this important feature of production and trade, but Moses Abramovitz has prepared a monograph upon cyclical changes in manufacturers' stocks, which should be followed in due course by similarly thorough analyses of stocks held by other agencies. See his *Inventories and Business Cycles, with Special Reference to Manufacturers' Inventories* (National Bureau, 1950).

and 'country districts', banks were able to adjust their money holdings to current requirements by drawing needed currency from or shipping surplus currency to their correspondents in the financial centers.

In turn the cyclical changes in the distribution of lawful money between banks and the public contributed to the inversion of bank reserve ratios. But here another factor comes into play. Banks make their profits primarily by lending or 'investing'. They can lend more and find more attractive investments in expansion than in contraction. Deposits keep fairly close step with loans plus investments, and hence have positive timing. Of course these positive movements produce inverted movements in reserve ratios, unless the reserves rise faster than deposits in expansion and fall faster in contraction. That they did not do under the National Banking System, and that they have not done under the Federal Reserve System. So all our American reserve ratios are inverted.

There remain 9 or 10 cases of inversion that must be explained in other ways. The short series on mileage of federal-aid roads under construction has a declining trend in 1924–38; it falls in each expansion, but in contraction the decline had been checked or reversed spasmodically by efforts to provide work for the unemployed. The mildly inverted movements in the average revenue received by railroads for hauling a ton of freight one mile are tentatively ascribed by Thor Hultgren to cyclical changes in the composition of traffic and the lagged timing of rate decisions by the Interstate Commerce Commission.[11] The remaining cases are either complicated or obscure, or both, and I pass them by in silence.

All the preceding suggestions regarding the reasons for cyclical inversions require further study, and I shall be surprised if some of them are not amended or replaced in due time. But, even in their present imperfect form, I hope these suggestions suffice to show that business cycles themselves generate

[11] See Hultgren's *American Transportation in Prosperity and Depression* (National Bureau, 1948), Chapter 9 and the section on "Changes in the Composition of Traffic" in Chapter 1.

numerous movements counter to the tides of expansion and contraction. Brisk business increases the domestic demand for textile goods and so diminishes the exports of raw cotton; it increases the sale of fresh milk and so restricts the production of butter; it increases the volume of coin and paper money held by the public and stimulates borrowing from the banks, thereby enlarging demand liabilities and tending to impair reserve ratios; it leads department stores to carry larger stocks of merchandise and lowers the piles of iron ore at blast furnaces; it activates share transactions on stock exchanges and discourages transactions in bonds. The declines in this list, and many others, are as characteristic a feature of business cycles as the advances. We could reverse the signs of measures showing the cyclical response of business failures and idle freight cars with a clear conscience. But to reverse the signs of hog slaughter and coffee imports would distort the facts; in expansion the nation does not have more beef and more pork, more coffee and more milk; instead it has more beef and less pork, more milk and less coffee. Just as a realistic picture of what happens during business cycles should include the considerable list of activities having no regular relation in time to the cyclical tides, so it should include the activities that contract when the majority expand and expand when the majority contract.

IV Neutral Timing

The perfect poise maintained by 25 of our series between a positive and an inverted response to business cycles presents especially subtle problems with which we cannot deal effectively until we are ready to follow the stage-by-stage interactions among various industrial, commercial, and financial processes. For the present, I shall merely indicate the character of the series that rise from the middle of business-cycle expansions to the middle of contractions, then fall from the middle of contractions to the middle of expansions, and the character of the series that behave in the opposite fashion.

Among the 18½ series that rise in III–VII, bond yields are

most numerous.[12] Four series on the ratio of national bank loans to individual and to net deposits belong here; so also do the total cash and the gold reserves of Federal Reserve Banks (not the reserve ratios). The number of commercial failures is clearly inverted; but the number of banks suspended is neutral, if we may believe the three brief time series available. There remain two inventories (newsprint at publishers and oak flooring), a wage rate (average hourly earnings in northern cotton mills), and the price of iron ore.

The 6½ series that rise from the middle of contraction to the middle of expansion include three on bank investments, the individual deposits of national banks in New York City, plans filed for new buildings in Manhattan, new orders for oak flooring (which move oppositely to inventories), and one of the two ways in which the timing of Macaulay's railroad bond prices can be treated. Even this brief list, like its longer predecessor, is varied enough to suggest that neutral timing may arise from quite different situations, among which chance happenings should be included.

V Positive Timing

I have thought it necessary to discuss at some length the types of timing that are likely to receive little attention. Together they constitute less than 24 percent of our sample. Whether this proportion is representative of the American economy, I have no satisfactory basis for judging; but I can say that we have neither excluded any series because its timing is peculiar, nor hunted for odd cases.

In effect, I have been trying to answer the question: Why do not certain series rise and fall with the cyclical tides of expansion and contraction? Here there may be suspected a tacit

[12] The awkward half-number in this group comes from Macaulay's series on the yields of American railroad bonds, 1858–1933. Its timing fits equally well into the (positive) III–VI and the (neutral) III–VII group. When this series of yields is converted into a series of bond prices, the timing fits equally well the (inverted) VI–III and the (neutral) VII–III group. Hence it provides also the half-number in the second type of neutral timing.

assumption that positive timing is 'normal', and only the deviations from it need be accounted for. On the contrary, positive timing is just as much a puzzle as the four other types. From our viewpoint, the central problem of business-cycle theory is to learn why a large majority of economic series rise and then fall in unison. The heavy preponderance of positive series in our sample is statistical evidence that this problem is presented to us by 'real life'—not by fancy. We cannot expect to solve it in an introductory chapter.

VI Leads and Lags

Yet Table 4 and Chart 2 raise another timing problem that should be stated here. According to our decisions about the cyclical timing characteristic of each series in our collection, three-tenths of our positive and four-tenths of our inverted series lead or lag by one or two stages at business-cycle troughs, and almost as many at peaks. All the neutral series also may be thought of as leading or lagging by two stages at both turns. These are rough measures at best, expressed in an overlong unit (a reference-cycle stage) that varies from one business cycle to the next. More precise measures in months can be made by matching the dates of comparable specific- and reference-cycle turns. But in many series the number of comparable turns is small, or the arrays of monthly leads and lags are excessively scattered. Later I shall use what monthly figures seem to be significant, though they may not give so systematic a view of leads and lags as the coarser measures implicit in judgments about the reference-cycle stages during which a series characteristically rises.

The summary of these rough measures in Table 5 can be made to tell much about the round of developments within the economy that transform expansions into contractions and contractions into expansions—so far as our sample covers and mirrors what typically happens. But the table must be scanned with a mind alert to its omissions and tacit implications no less than its explicit entries. A few general observations may heighten the reader's curiosity about what the table shows, and his impatience to follow the clues it offers.

1) Only the 30 percent of our series that characteristically lead or lag at reference-cycle troughs or peaks, or both, are allowed to appear; those that coincide at the turns or have irregular timing are conspicuous by their absence. Focusing attention upon the vanguard and the rear guard of the cyclical procession is necessary; we get clearer impressions by keeping them apart for a while; but before we are done we must put them back in their proper places in front of or behind the mass of the marchers, and intermingled with the considerable number of stragglers.

2) The table distinguishes between one-stage and two-stage leads and lags—clearly a matter of moment. No three- or four-stage leads or lags are entered because a series that begins to fall in I–II or II–III, or begins to rise in V–VI or VI–VII, gets classed as inverted; with coincident timing at the turn if the change starts in I–II or V–VI, with a lag if it starts in II–III or VI–VII. But from the viewpoint of business-cycle theory, some of these inverted movements are the longest of leads; that is, they represent the beginning of readjustments within the economy that culminate many months later in general recessions or revivals. To repeat what has already been said, careful thought about the activity represented by a series, and its relations to the rest of the economy, is needed to grasp the meaning of its cyclical timing.

3) This last remark applies emphatically to the neutral series. In Table 5 I have entered those which rise in VII–III as leading by two stages at both turns, and those which rise in III–VII as lagging equally far behind the procession. As suggested above, that is a formal arrangement and might be reversed. Both of these timing groups must later be considered series by series, and more discriminating judgments formed concerning their roles in the business-cycle complex.

4) The descriptions of series in the table are exceedingly general, but I hope they suggest the character of the business factors that lead or lag. That should suffice for the present. No attempt is made to explain why the series behave as they do, but anyone who goes over the entries thoughtfully will find his mind seething with rationalizations, and with conjectures

Table 5

Economic Character of Series That Lead or Lag at Reference-Cycle Troughs and Peaks[a]

TROUGHS

Leads	*Lags*
TWO-STAGE LEADS	TWO-STAGE LAGS
Neutral Series (6½)[b]	Neutral Series (18½)[b]
1 new orders	6 bank reserves (not ratios) and ratios of loans to deposits
1 construction contracts	5½ bond yields
4 bank investments and deposits	3 bank suspensions
½ bond prices	4 scattering
Positive Series (25)	Positive Series (8)
13 bank holdings of lawful money, loans, investments, interbank or individual deposits	5½ interest rates or bond yields
12 investment (mainly early stages): security issues, orders, contracts, production of building materials	1 locomotive shipments
	1½ scattering
Inverted Series (6)	Inverted Series (2½)
3 ratios of loans to deposits, and reserve ratios	Orders for rails, bond prices, imports of coffee
3 liabilities of commercial failures	
ONE-STAGE LEADS	ONE-STAGE LAGS
Positive Series (120½)	Positive Series (31)
52½ investment (mainly early stages): security issues, orders, contracts, production of building materials and other durables	4 bank holdings of lawful money, and ratios of loans to deposits
10 bank loans, interbank or individual deposits	5½ interest rates or bond yields
10 bank clearings or indexes of business activity	15½ commodity prices
7 stock exchange transactions or prices	1 vessels under construction
7 commodity prices	5 scattering
11½ production of semidurables	
4 inventories	
18½ scattering	
Inverted Series (12)	Inverted Series (10)
7 bank note circulation and reserve ratios	3 bank reserve ratios and lawful money holdings
2 liabilities and number of failures	1 bond sales
3 scattering	1 exports of raw cotton
	3 inventories
	2 prices, wheat and wheat flour
Total number of leads: 170	*Total number of lags:* 70

[a] The fractions occur because a few series fit equally well two of our standard varieties of timing.

Table 5 (concl.)

PEAKS

Leads	*Lags*
TWO-STAGE LEADS	TWO-STAGE LAGS
Neutral Series (6½)[b] Same as two-stage, neutral, leads at troughs	Neutral Series (18½)[b] Same as two-stage, neutral, lags at troughs
Positive Series (4½) 2 stock exchange transactions and prices 1 orders for steel sheets 1 consumption of tobacco ½ prices, brick	Positive Series (6) 4 bank loans and ratios of loans to deposits 1 vessels under construction 1 payrolls, bakeries
No Inverted Series	Inverted Series (4) 1 bank holdings of lawful money 1 bond sales 2 prices, wheat and wheat flour
ONE-STAGE LEADS	ONE-STAGE LAGS
Positive Series (88½) 25 are same as 25 two-stage, positive, leads at troughs 32 investment (mainly early stages): orders, contracts, security issues, production of building materials and other durables 6 stock exchange transactions or prices 4 bank clearings or indexes of business activity 7½ prices of commodities 14 scattering	Positive Series (82½) 8 are same as 8 two-stage, positive, lags at troughs 9 investment (mainly late stages): production and employment in durable goods industries, construction in process, contracts, security issues 9 hourly wages, weekly earnings, payrolls 4 bank loans and investments 17½ consumer goods: production, employment, trade 22 prices of commodities 3½ interest rates, short-term 9½ scatteting
Inverted Series (15) 5 bank note circulation, ratios of loans to deposits, reserve ratios 2 bond yields 1 prices, newsprint paper 3 inventories 4 liabilities or number of failures	Inverted Series (10½) 5 bank holdings of lawful money, ratios of loans to deposits, reserve ratios 1 orders for rails 1 prices, bananas 2 inventories 1 imports, coffee ½ bond prices
Total number of leads: 114½	*Total number of lags:* 121½

[b] See Table 4, note *c*.

regarding the effects produced by the recorded movements.

Especially noteworthy are the readjustments in banking conditions that occur in contraction, and the opposite movements in expansion. In good part they are inverted movements entered as lags at peaks and also at troughs. In contraction these movements pave the way for and directly contribute toward the revival in financial activities, many of which antedate cyclical turns in the processes of producing and distributing commodities and personal incomes. In expansions the early banking changes are precursors of recessions. No one should be disturbed by the fact that a given banking item sometimes appears in the column for leads and also in the opposite column for lags. Often the explanation is that one entry refers to banks in the financial centers, the other to banks in 'country districts'. Sometimes the explanation is of a technical sort: a two-stage lead of an inverted series at reference troughs means that it reached a peak in stage VII, and a two-stage lag of a neutral series at reference troughs implies exactly the same thing.

Closely associated with banking leads at troughs is the early upturn in preparations for investing capital—issuing corporate securities, placing orders for durable goods, entering into contracts for construction work, and the like. Such actions do not mean an immediate increase in employment and production, though the statistical record indicates that the output of some building materials responds promptly. In general, these preliminaries to the actual investment of capital lead also at recession, though seemingly by shorter intervals.

Other early signs of change are the decline after stage VII in the number of bank suspensions and the liabilities (not the number) of commercial failures; likewise their rise after stages III or IV. Stock market transactions and prices follow suit a little later, rising before the trough in general business activity is reached and falling before the peak; so also do bank clearings in New York City and in less measure outside clearings. The latter leads, however, are not so numerous at peaks as at troughs.

Among lags at troughs, the most notable are bond yields and

interest rates. More than twice as many commodity prices lag as lead, whereas a substantial minority of our series on production lead and only two lag, both representing the execution of plans for investment entered into much earlier. Another interesting group of lags relates to banking—the amounts of 'lawful money' held by national banks, ratios of loans to deposits and of reserves to demand liabilities.

Lags at peaks are much more numerous than at troughs. Interest rates, bond yields, bank loans and their ratios to deposits, lawful money holdings, reserve ratios, and commodity prices reappear—the list of prices increased by half. They are joined by series representing the execution of plans for investing, wage rates, weekly earnings, payroll disbursements, and numerous series on the production and distribution of consumer goods. Rising trends combined with moderate cyclical movements are responsible for many of these lags.

Doubtless the reader has noticed that the leads reported in Table 4 and classified roughly in Table 5 outnumber the lags by over two to one at reference-cycle troughs, whereas at peaks the lags are slightly more numerous than leads. If we omitted the neutral series, which may be called 'ambivalent', the contrast between the two turns as pictured by our measures of characteristic timing would be yet more striking. To what is the contrast due?

Probably in part—I think small part—to errors in our choices of reference dates. As explained in Chapter 4 of *Measuring Business Cycles*, these dates were determined by studying arrays of the specific-cycle troughs and peaks in numerous series, making due allowances for what we knew about their conformity to business cycles, their relative scopes, their secular trends, their timing propensities, and other traits. As a rule, these arrays are less compact at troughs than at peaks. Hence it is usually more difficult to date the ebb of contraction than the crest of expansion. Since our present chronology was drawn up, we have had occasion to reexamine our reference dates since World War I, and now believe that two trough dates should be put earlier, one by a single month, the other by

two months, while a third trough date should be set a month later.[13] No change in peak dates seems necessary. The relative scarcity of data for earlier years makes equally intensive work impossible before 1919, but a careful consideration of all the series we now have in the light of our fuller knowledge of cyclical behavior will doubtless lead to further revisions. Whatever alterations are finally made will certainly affect the *monthly* leads, coincidences, and lags ascertained by comparing specific-cycle with reference-cycle troughs. What effect they will have upon the measures of characteristic cyclical timing is harder to gauge. One month is a minor fraction of most reference-cycle stages, and reference-date shifts of that length will probaby cause few alterations in the stages already chosen to represent the expansions characteristic of a series. It would take a heavy preponderance of backward shifts of at least two or three months to make the lags at the troughs equal the leads in number.[14]

A second factor in causing leads to outnumber lags at the troughs is our concept that, ideally, the reference dates should mark the 'culminations' of expansions and contractions in 'general business activity'. That is, a peak should show the last month before this rather nebulous congeries enters a sustained contraction, and a trough should mark the last month before a sustained expansion starts. When the expansion culminates in a flat top, or in two approximately equal peaks separated by a brief interval, we choose, not the central month in this time of hesitation, but the final month. The same rule with the proper reversals of terms applies to contractions. Obviously, this rule tends to place our turning dates in months that are more often

[13] See note to Table 1.

[14] Subsequent studies by G. H. Moore indicate that revisions of reference dates prior to 1919 will shift more of the troughs back than forward, will shift more of the troughs than the peaks, and will shift about as many peaks one way as the other. However, such revisions will not eliminate the difference in the distribution of timing observations at peaks and troughs. See Moore's "Statistical Indicators of Cyclical Revivals and Recessions" (National Bureau, *Occasional Paper 31*).

preceded than followed by specific-cycle turns, and tends also to make leads average longer than lags.

Both tendencies are clearly revealed by our measures of characteristic cyclical timing at troughs. If we omit the ambivalent neutral series, the leads outnumber lags by about three to one; the two-stage leads number 31, the two-stage lags 10.5. But at peaks these tendencies are virtually counteracted by other influences. Positive and inverted leads number 108, while lags number 103; two-stage leads number 4½, two-stage lags number 10. Now this difference between troughs and peaks is not due to the rule that we shall date 'culminations', for that rule is applied to both turns. It is due mainly to a difference between peaks and troughs in the average character of the arrays of specific-cycle turning dates to which the rule is applied. At the peak these arrays on the average are relatively compact and symmetrical; at the trough the arrays are more dispersed and skewed toward leads. The differences between the arrays mean that what happens at revivals is not a replica in reverse of what happens at recessions. The economic conditions that encourage men to expand operations at the culmination of contraction are not direct opposites of conditions that force men to contract operations at the culmination of expansion. Other measures will confirm and amplify what the varieties of cyclical timing suggest.

VII Summary, Doubts, and the Next Step

A pause to reflect upon what we have done so far will make clearer what we have next to do. To begin once more at the beginning: we assumed on the basis of sketchy evidence that business cycles consist of "expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals". Our first tasks were obviously to determine whether this basic assumption is valid, and, if so, to replace the vague phrases 'about the same time' and 'many economic activities' by more definite statements. Toward these ends we collected as large and varied a

sample of time series as our means allowed, identified the specific cycles in these series by the dates of their troughs and peaks, and from the clusters found in specific-cycle turns derived reference dates purporting to show when business-cycle expansions and contractions culminated. By applying this chronology to the series of our sample we could find out what activities have risen in business-cycle expansions and fallen in contractions. As in measuring other behavior traits, we wanted to ascertain what cyclical timing is 'characteristic' of each series. By studying the timing of a series in successive reference cycles, we formed judgments concerning the group of consecutive stages over which the cyclical movement was upward and the stages over which the cyclical movement was downward, or, when no sustained decline occurred, the stages over which the rise was accelerated and the stages over which the rise was retarded.

It is these judgments that we have just been summarizing, then reviewing in some detail. The findings reveal, not uniformity of cyclical timing, but as wide a diversity as our analysis allows. All of our 25 varieties of timing except one are represented by at least two series in the present sample, and any day some new series may pop into the 'empty box' (expansion in stages III–VIII, contraction in VIII–III).

Numerous as the varieties of cyclical timing are, they form a rather orderly array, as Chart 2 shows. Very much the commonest kind coincides neatly with business cycles—expansion in stages I–V, contraction in V–IX. Nearly 44 percent of all series in our sample belong in this group. That is still a minority. But many other series rise characteristically in one or more of the stages dominated by business-cycle expansion, and fall characteristically in the stages dominated by contraction. If we count all the series that move in successive stages with the cyclical tides, we get substantial majorities of our sample. During the 4 stages of expansion, 74, 77, 78, and 69 percent of all series characteristically rise; during the 4 stages of contraction, 68, 77, 76, and 63 percent characteristically fall. The phrases 'many economic activities' and 'about the same time' in our

basic definition are made less vague by these percentages. But the word 'characteristically' now requires clarification, which will be offered in the next chapter.

Even the figures just given considerably understate the extent to which business cycles dominate the American economy. For when we examine the series that lead or lag at the troughs and peaks of business cycles, the neutral series that move half of the time with and half of the time counter to the general tides, and the series that move inversely in all or a majority of stages, we can often ascribe their characteristic timing to the impact of business cycles upon the economic activities represented. To account for the timing of any series we have to know something, the more the better, about the conditions under which the activity it records is conducted. The incompleteness of the preceding explanations is due partly to my ignorance, and partly to the desirability of postponing complicated analyses. Pending the appearance of evidence to the contrary, I shall assume that every variety of *characteristic* timing means that the cyclical movements of the activities represented are dominated by business-cycle expansions and contractions. On this hypothesis, 89 percent of our series should be thought of as typically swayed by the cyclical tides throughout reference cycles. Only in the 11 percent of irregular series do cyclical influences fail to dominate the short-run movements.

Objection may well be raised to this blunt statement. It suggests argument in a circle. First we define business cycles as a congeries of roughly synchronous expansions in many activities followed by similarly general contractions; then we attribute the cyclical movements in a large majority of individual series to the cyclical tides, which are merely a summation of movements in individual series.

At best, the phrases I have used are elliptical; but I think this is also the worst that can be said against them. When the analysis is written out in full it becomes a long chain of commonplace observations upon familiar experiences. Department stores sell more goods in expansion because income payments

to individuals have increased. Less butter is produced because families buy more milk as their incomes rise; the flow of milk cannot be increased as rapidly as consumption grows, so less milk is turned into butter. Essentially similar reasoning can be extended to all sectors of the economy. Every enterprise finds its customers among other enterprises, or among individuals who are receiving wages, rent, interest, dividends, or profits. If we accept the statement that a national economy is a system of interrelated parts, we must accept the corollary that every part is influenced by changes in other parts. Expansion in activity X tends to produce expansions in certain activities but contractions in others; in some directions the effects are vigorous, in others slight; some effects are felt immediately, even anticipated, while others are spread over considerable periods or long delayed; the influences exerted by X are nullified in some sectors by opposing factors, in other sectors they are unopposed or even reinforced by special conditions; whatever effects the expansion in X produces will presently react upon X itself, these reactions will differ in the ways suggested, and the new changes thus produced in X will set going a new wave of repercussions upon other activities. X stands for any activity; the reasoning is general. But in thinking about business cycles, we should not invoke a *ceteris paribus* clause. Never do the cyclical fluctuations spread through the economy without being reinforced and also opposed by noncyclical factors, some of which can be identified and accounted for. To follow the complicated interactions in detail exceeds the power of economic analysis; however, given adequate statistical records, we can ascertain the general outcome by empirical observation.

That is what we have done by assembling our measures of characteristic cyclical timing. It is not surprising to find that the bulk of the activities represented by our sample of time series fluctuate in unison. Nor is it surprising to find that many of the positive series lead or lag at business-cycle troughs and peaks, or that some series have neutral timing, or that others characteristically move counter to the general tides, or that an appreciable number reveal no regular relation in time to busi-

ness cycles. Indeed, these differences of characteristic timing make it easier to grasp the way in which business cycles propagate (I do not say cause) themselves. But that is a later part of the complicated story.

Meanwhile we should note that the interpretation here put upon neutral and inverted timing, as well as on the leads and lags of positive series, suggests a revision of our basic definition. If our sample is representative, business cycles consist not only of roughly synchronous expansions in many activities, followed by roughly synchronous contractions in a slightly smaller number; they consist also of numerous contractions while expansion is dominant, and numerous expansions while contraction is dominant. This amendment might have proved confusing had we thought of adopting it at the outset of our study; later it will prove clarifying.

The next step concerns the representative value of the timing measures themselves. As explained in Chapter 3, our indexes of conformity measure the regularity with which series rise between the first and last of the stages thought to be characteristic of their expansions, and the regularity of their behavior during the stages when we think they characteristically decline. The best way to appraise our judgments of characteristic timing is to examine these conformity indexes.