Volume Title: Orders, Production, and Investment: A Cyclical and Structural Analysis

Volume Author/Editor: Victor Zarnowitz

Volume Publisher: NBER

Volume ISBN: 0-870-14215-1

Volume URL: http://www.nber.org/books/zarn73-1

Publication Date: 1973

Chapter Title: Cyclical Conformity and Timing

Chapter Author: Victor Zarnowitz

Chapter URL: http://www.nber.org/chapters/c3558

Chapter pages in book: (p. 521 - 587)

PART IV

ORDERS AND RELATED PROCESSES DURING BUSINESS CYCLES

11

CYCLICAL CONFORMITY AND TIMING

Introduction: Why Orders Are Expected to Lead

Earlier findings and general considerations suggest that new orders received by manufacturers usually lead at business cycle turns. The strong tendency of manufacturers' orders to lead industrial output and shipments is clearly evident (Chapters 4 and 5). It is also well known that manufacturing activity, as measured by comprehensive series on factory employment and production, has a historical record of a roughly coincident timing at cyclical revivals and recessions.[1] The implication is clear: If the turns of aggregate industrial output are typically synchronous with peaks and troughs of the business cycle, then the like turns in the corresponding total of new orders must typically lead these peaks and troughs. This should hold not only when new orders and production are measured in real terms (quantity index points or constant dollars) but also for current-dollar aggregates, since price movements do not, on the whole, strongly affect the timing characteristics referred to here.

These, however, are merely broad presumptions from which the facts may well deviate. Thus manufacturing, while important, is by no means necessarily predominant in the U.S. economy, and its weight has of late been decreasing. It is possible for movements in this sector to be offset by movements in other parts of the system. Clearly, one can no longer take for granted that fluctuations in manufacturing activity

[1] On the timing of factory and nonagricultural employment and of industrial production, see "Leading and Confirming Indicators of General Business Changes" and "Statistical Indicators of Cyclical Revivals and Recessions," in Geoffrey H. Moore, ed., *Business Cycle Indicators*, Princeton for NBER, 1961, Vol. I, pp. 56–57 and 244–45, respectively.

will always conform perfectly to business cycles at large, and it was never true that they must have synchronous timing at each revival and recession. Nevertheless, it still seems reasonable to expect roughly coincident timing for aggregate manufacturing production, as an average tendency over the succession of business fluctuations. This assumption pertains to a weighted average of outputs of all the component industries, not to each of the components. Historically, many manufacturing series show high over-all conformity; that is, the specific-cycle turns in large groups of series on industrial output or shipments tend to cluster about the peaks and troughs of the business cycle. This implies that the turns in the corresponding series on new orders tend to cluster about some earlier dates.

In the production process to which they give rise, new orders for industrial output stimulate ordering of other goods needed by the manufacturer. A firm that expects an increase in customers' orders may try to prepare for the event by stepping up its own buying of materials. If the rise in demand was not expected or if the materials requirements are specialized and difficult to predict, the firm will probably increase its purchases after its order receipts have begun expanding. The impact of the increases in new orders will be reinforced when they are accompanied by increases in the backlog of unfilled orders. When they are sufficiently sustained and associated with prospective capital shortages, the increases in orders received will also stimulate increases in outlays on capital equipment and plant.

The onset of a cyclical rise (decline) in manufacturers' orders indicates, therefore, that an upturn (downturn) of industrial output and employment is soon to follow. It also marks the beginning of a cumulative process whereby the increases (decreases) in orders spread throughout the economy. Thus new orders can be said to lead the business cycle because they lead the output of products to which they give rise and stimulate ordering of other goods needed for that production.

This is a comprehensive yet simple statement which certainly has merit as far as it goes; but saying that new orders lead the business cycle because they lead production is in a sense formal and limited to the surface of the matter. Clearly, the timing of new orders can never be *explained* by reference to the timing of production by the order-receiving industries: The causal connection runs from commitments or

sales to output, not the other way around. The second part of the statement, which says that manufacturers' new orders lead aggregate economic activity because they induce further buying, goes deeper. Investment in purchased-materials stocks, which leads at business cycle turns, is doubtless influenced in an important way by changes in manufacturers' unfilled orders. Although the latter depend strongly on changes in the rate at which new orders are received, they also depend on the speed with which orders are executed. That speed, in turn, depends on the conditions of supply as well as the urgency of demand. The cumulation of orders is suggested in various ways by the evidence already reviewed.[2]

If new orders can be expected to lead at business cycle peaks and troughs, how large and regular have these leads been in the past and how dependable do they appear as guides to the future? This is an empirical question, since the general argument above cannot go beyond a qualitative indication of the expected timing sequence.

New Orders for Major Industries and Sectors

The Record of Comprehensive Series

The lack of long comprehensive and consistent series on manufacturers' new and unfilled orders is a serious gap in the stock of the available statistical data. The OBE Industry Survey data include broad aggregates for all durable goods industries and the group of nondurable goods industries reporting order backlogs, which begin in 1939. (See Chapter 3 on the revised series that start in 1947 and are now published by the Census Bureau.) For earlier years, there are the monthly indexes of the value of new and unfilled orders, 1935–39 = 100, computed by the National Industrial Conference Board. They begin in 1929 for new orders and in 1935 for unfilled orders, and extend

[2] New investment orders and contracts show strong autoregressive properties: OC_{t-1} retains a major influence on OC_t in any combination with presumptive causal factors (Chapter 10). Where production involves relatively short delivery periods and in industries working largely to stock, new orders are apt to be still more autocorrelated; for example, they tend to be smoother for nondurables than for durables (shipments and production, of course, are generally smoother than new orders; see Chapter 3). Increases in the quantities of advance orders received and on hand anticipate rising production and are therefore likely to be associated with increased purchases of materials (Chapter 8). Finally, large and sustained rises in orders would tend to stimulate capital expenditure projects (as shown below, Charts 12-12 and 12-13 and text).

through mid-1944. They cover ten durable and six nondurable goods industries.[3]

For a still earlier period, 1920–33, indexes of the physical volume of new and unfilled orders (1923–25 = 100) were compiled by the Department of Commerce. Their components fall into six groups: iron and steel; transportation equipment; lumber; stone, clay, and glass; textiles; and paper.[4] The names of these groups might suggest broad industrial coverage, but in fact the basis of these indexes is narrow. However, other, more comprehensive indexes are not available for the period before 1929.[5]

Chart 11-1 presents the three most comprehensive new-order series. These cover both durables and nondurables, but not industries in which new orders are practically identical with shipments, or are assumed to be. Thus, of the major nondurable goods industries, only the four reporting order backlogs are included in the 1939–62 series of the Commerce Department (Office of Business Economics). Again, in the NICB series (1929–44) nondurables are represented only by textiles, clothing, leather, shoes, paper, and chemicals and drugs. Hence the weight of durable goods in these data is heavy.[6]

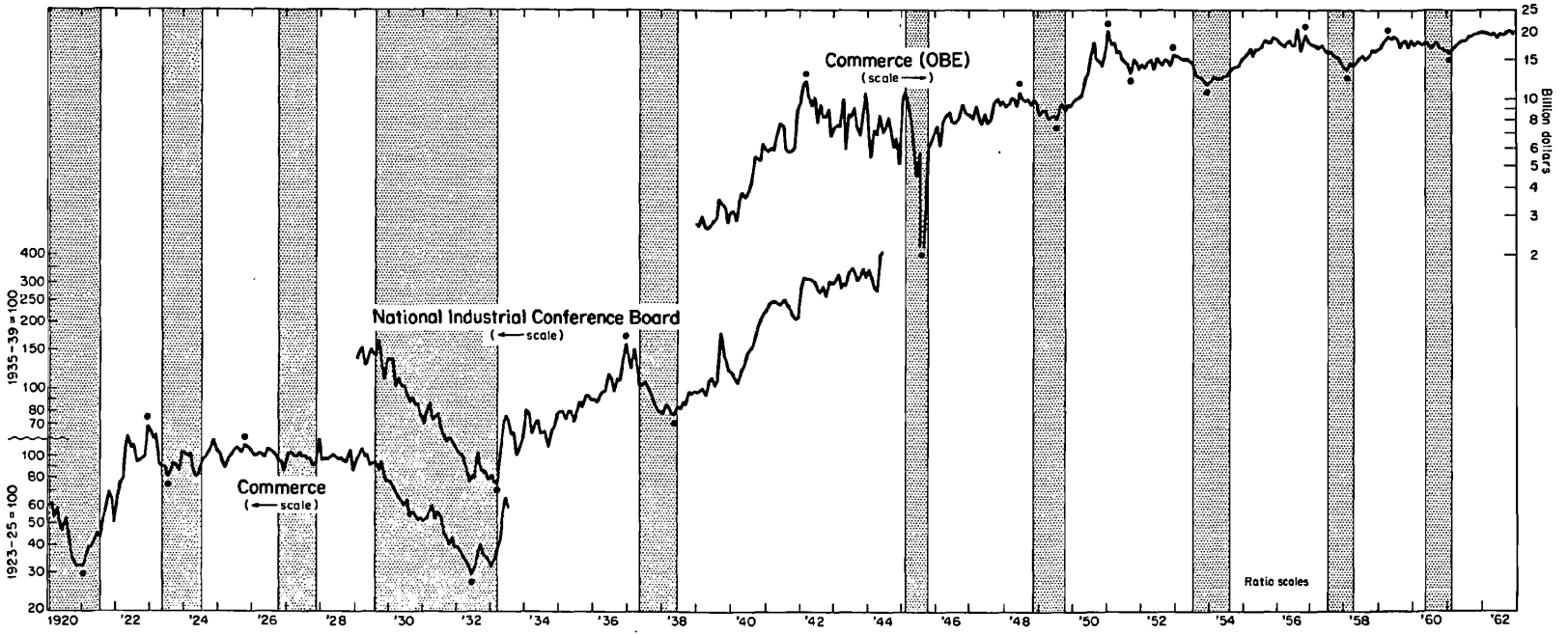
[3] The components of the new orders index since 1936 are the same as those of the unfilled orders index (see Chapter 6, note 6, for the list of industries covered). The indexes for total manufacturing comprise seventeen series, including a "miscellaneous" category not covered in either the durable or nondurable goods indexes. The weight for each industry was based on the total value of its product as reported in the Census of Manufactures of 1937. The seasonal adjustment of the chain indexes computed for each industry group was made by the NICB. For a more detailed description of the new-order index, see the *Supplement to the Conference Board Economic Record,* Vol. II, December 26, 1940.

[4] In unfilled orders, iron and steel accounts for nearly one-half of the weight total and lumber products for about 20 per cent; in new orders, these weights are approximately reversed. For the composition of the unfilled orders index and the source reference, see Chapter 6, note 4. A description of the new-order index is given in *Survey of Current Business,* September 1928, pp. 19–20. The commodities included and their percentage weights are as follows: Textiles (cotton finishing, hosiery, knit underwear), 15; iron and steel (steel sheets, malleable castings, steel castings, fabricated structural steel, fabricated steel plate, sanitary enamelware), 22; transportation equipment (locomotives, railroad cars), 7; lumber (furniture, lumber, flooring), 50; paper and printing (boxboard, labels, book paper), 5; clay and glass products (terra cotta, illuminating glassware), 2.

[5] On a state basis, a composite index of new orders has been compiled since 1924 by the Associated Industries of Massachusetts. This index (1926 = 100) is based on reports from a sample of 160–260 concerns classified as textile, leather and shoe, metal trade, paper, and "all other" (mostly consumer goods). It has a good record of cyclical conformity, with leads at six of the seven reference turns during 1924–38 and coincident timing at the June 1929 peak. Its average lead, about three months at business peaks as well as troughs, is much shorter than the average lead of the Commerce and NICB series in the same period (approximately six months; see Table 11-1, below).

[6] Most of the time, the course of the corresponding series on new orders for durables only was closely parallel to the course of the series plotted on Chart 11-1, but some differences will be noted later in the timing at individual business revivals and recessions.

Chart 11-1
Manufacturers' New Orders, Three Estimates, 1920–62



Note: Shaded areas represent business cycle contractions; unshaded areas, expansions. Dots identify peaks and troughs of specific cycles.

The series in Chart 11-1 show leads at virtually all recessions and revivals covered. The first Commerce index had an almost horizontal or just slightly downward trend during 1926–38, with no specific-cycle turns that could clearly be matched with the 1927 trough and the 1929 peak in the business cycle; but the beginning of the rapid decline in this series definitely preceded the general downturn in 1929. The timing of the NICB index at the 1929 peak seems about coincident but is uncertain because this series only began a few months earlier. The OBE series reached an early wartime peak in 1942 and had an "extra" decline in 1951, during the Korean War. These few particular episodes do not detract much from the excellent over-all record of conformity and early timing displayed by these series, especially in the more recent period for which more adequate and comprehensive data are available.[7]

Table 11-1 shows the timing of the series plotted on Chart 11-1 and of the corresponding indexes or aggregates for the durable goods industries at each business cycle turn from 1921–61. It suggests that the conformity to business cycles is high for durable goods orders and perhaps a little lower for nondurable goods orders. The timing of total advance orders, however, is in most instances identical or closely similar to the timing of new orders placed with manufacturers of durables. The leads at peaks are on the average considerably longer than the leads at troughs of the business cycle.

The recessions in 1957 and 1960 were preceded by periods of relative weakness and of labor unrest in manufacturing. Industrial production ceased rising earlier than the outputs of other sectors and of aggregate economic activity. Downturns in new orders gave advance signals of the retrenchment, thus anticipating the business cycle peaks by as much as 19 and 13 months.

During the long expansion of the 1960's, manufacturers' new orders, followed by shipments, declined twice for more than one or two months: in 1962 (very mildly) and in 1966–67 (somewhat more steeply). On both occasions, declines also occurred in other sensitive indicators, but the economy at large experienced only retardations of growth, not general business recessions. However, in the last four months of 1969, new orders in most durable goods industries reached peaks which, along with downturns in other leading indicators, point

[7] For more detail, see Victor Zarnowitz, "The Timing of Manufacturers' Orders During Business Cycles," in Moore, ed., *Business Cycle Indicators*, Vol. I, pp. 441–43.

Table 11-1
Timing of Comprehensive Series on New Orders at Each Business Cycle Turn, 1921–61

	Date of Reference Peak	Lead (–) or Lag (+) at Ref. Peaks (months)		Date of Reference Trough	Lead (–) or Lag (+) at Ref. Troughs (months)	
		Durable Goods (1)	Durable and Nondurable Goods (2)		Durable Goods (3)	Durable and Nondurable Goods (4)
1				July 1921	–6	–6
2	May 1923	–4	–5	July 1924	–12	–12
3	Oct. 1926	–12	–12	Nov. 1927	–4	
4	June 1929	–3		Mar. 1933	–4	–9
5				Mar. 1933	0[a]	0[a]
6	May 1937	–5	–5	June 1938	–2	–1
7	Feb. 1945	[b]	[b]	Oct. 1945	–2	–2
8	Nov. 1948	–3	–5	Oct. 1949	–4	–6
9	July 1953	–6	–6	Aug. 1954	–11	–5
10	July 1957	–19	–19	Apr. 1958	–3	–2
11	May 1960	–13	–13	Feb. 1961	–1	–1
12	Av. timing	–8.1	–9.3		–4.9	–4.9
13	Av. dev.	4.9	4.6		2.9	3.0

Source: Measures in lines 1–4 are based on indexes compiled by the Department of Commerce from various individual new-order series (see text and note 3). The indexes were seasonally adjusted for the National Bureau by the Census electronic computer method. Measures in lines 5 and 6 are based on the National Industrial Conference Board indexes (see text and note 2). Measures in lines 7–11 are based on the OBE-Census estimates of the dollar values of manufacturers' new orders (see text). The series used in lines 7–11, columns 2 and 4, was computed by adding the seasonally adjusted figures for new orders of all durable goods industries plus the four major nondurable goods industries reporting unfilled orders: textiles, leather, paper, and printing and publishing.

[a] Excluded from the average.

[b] Not matched. The specific-cycle peak of March 1942 preceded the February 1945 business cycle peak by thirty-five months.

to another and more serious economic slowdown, if not the fifth postwar recession. In this case, the leads seem to be short, perhaps not exceeding two or three months; but this is probably due to inflation as reflected in a strong upward movement in the price components of these

series. Real new orders would have shown earlier peaks and longer leads.[8]

Major-Industry Series: Timing at Successive Business Cycle Turns

Table 11-2 shows that each business recession in the post-World War II period was anticipated by downturns in the major-industry series for new orders and that each business revival was anticipated by upturns in these series. Lapses from this pattern were extremely rare. But the leads, while dominating throughout, varied greatly from turn to turn. They were relatively short at the recessions of 1948 and 1953, long at those of 1957 and 1960. New orders also turned upward early in the 1953–54 contraction for most industries, but their leads at other revivals were generally much shorter. The particularly sluggish timing of orders in 1958 deserves special mention as part of the remarkable "V pattern" of this recovery in which so many activities turned sharply upward within an unusually short span of time.

These cycle-by-cycle differences can be seen best in the observations for total durable goods industries. The timing of this aggregate and of total manufacturing as well (first two lines), represents in a sense weighted averages of the leads for the component industries. Simple averages of the leads of the components are similar, but usually somewhat shorter.

It must be emphasized that these comparisons are affected by errors in the reference dates but that direct comparisons between cyclical turning points in two or more specific series are not affected. (The assumption is that the specific turns are identified independently of the reference cycle chronology—otherwise the statement would be invalid. Working rules intended to justify this assumption are generally adopted in the NBER specific-cycle analysis.) The margin of error in the reference dates is unfortunately not something that can be precisely established, although it presumably can be reduced by a systematic review of the evidence including new and revised data. The important point is that the probability of error varies considerably with the type or "profile" of the cyclical reversal. Recessions or recoveries that are widely diffused produce gently rounded turns in the aggregates and are

[8] As these observations are added (June 1970), the peak in total advance orders (and in total durables orders) in current dollars can be placed in September 1969. This would be only one month ahead of shipments and two months after the July 1969 peak in the industrial production index. The tentative date for the business cycle peak is November 1969.

Table 11-2
Timing of Value of Manufacturers' New Orders at Each Business Cycle Turn, by Major Industries, 1948–61

Industry	Lead (−) or Lag (+), in Months, of New Orders at Business Cycle Turns							
	Peak Nov. 1948 (1)	Trough Oct. 1949 (2)	Peak July 1953 (3)	Trough Aug. 1954 (4)	Peak July 1957 (5)	Trough Apr. 1958 (6)	Peak May 1960 (7)	Trough Feb. 1961 (8)
All manufacturing	−3	−4	−6	−8	−7	−3	−13	−1
Durable goods industries, total	−3	−4	−6	−11	−19	−3	−13	−1
Primary metals	0	−3	−1	−11	−20	−2	−15	−10
Blast furnaces and steel mills	n.a.	n.a.	0	−11	−27	−2	−15	−11
Fabricated metal products	[a]	−5	−6	−10	−5	−5	−15	0
Elect. machinery [b]	−4	−6	−3	−5	−8	−4	−11	+1
Machinery, exc. elect.[b]	−5	+1	−6	−3	−8	−2	−12	−6
Transport. equip.	[c]	[c]	−7	−11	−7	−2	−13	−1
Other durable goods [d]	−7	−3	−6	−9	−18	−1	−13	−1
Nondurable goods industries, total	−2	+2	−9 [e]	−8	−7	−4	−12 [e]	−1
Reporting unfilled orders [f]	−11	−8	−7	−8	−3	−2	−5	−1
Not reporting unfilled orders [g]	−3	+3	−9 [e]	−8	−5	−4	n.t.	n.t.

n.a. = not available.

n.t. = no turn in new orders.

Note: The new Census data (1963 revision) are used for all manufacturing, total durables, and total nondurables for the entire period, November 1948–February 1961, and also for all measures for August 1954–February 1961 for the individual industry groups.

[a] Timing uncertain. The high in 1948 for this series is April; taking that date as a tentative peak would yield a lead of 7 months.

[b] Based in part on unpublished data received from the Department of Commerce, Office of Business Economics.

[c] This series shows a retardation in 1948–49, which began a few months before the 1948 reference peak and ended before the 1949 reference trough, but the precise timing of this episode is not identified.

[d] Includes professional and scientific instruments; lumber; furniture; stone, clay, and glass; and miscellaneous industries.

[e] These measures may be questioned because they refer to retardations or very mild and gradual declines whose beginning dates are particularly difficult to identify.

[f] Includes textiles, leather, paper, and printing and publishing.

[g] Includes the industries of food, beverages, tobacco, apparel, petroleum, chemicals, and rubber, for which the values of new orders and shipments are assumed to be equal.

particularly difficult to date, whereas the "angular" variety of relatively concentrated turning-point zones is fairly easy to deal with and much less likely to be seriously misdated. Imperfections of data and erratic events affect the former much more than the latter.[9]

The 1954 trough is clearly the "flat bottom" type and its selection was one of the most difficult on record. In choosing August as the reference date, the National Bureau picked a late low month, which had the advantage of pointing to a definite upturn; the uncertainty attaching to an earlier date would have been considerably greater. Recent data revisions, however, suggest that a shift of this reference trough to an earlier month may be advisable. April or May might be a more appropriate selection; if so, the leads in Table 11-2, column 4, would be biased; specifically, they would have overestimated the "true" leads by three or four months.

This is not the place to try to decide what should be the proper date of this or any other reference turn; it is merely suggested that an error in chronology is a possibility. Moreover, since the dates of specific turns are unaffected by errors in the dating of reference cycles, the important fact remains: Troughs in new orders came very early in this turning zone for most of the industries, but the recovery was quite sluggish and shipments did not turn up until much later (Table 4-6, column 6). If the reference trough were shifted to the earlier date, this would mean that orders preceded it by shorter intervals and outputs and shipments lagged it considerably.

It has also been suggested that the reference trough has been placed too late in 1949. The major steel strike that occurred when the contraction had nearly run its course complicates the issue, but so far sufficient evidence has not been offered for shifting this trough to an earlier date.[10] Such a shift would reduce the already short leads of orders (Table 11-2, column 2). The other reference dates in the postwar period are not in serious doubt.

Differences Among the Major Industries

The average leads of new orders at the business cycle turns during 1948–61 varied within the narrow range from 6.6 to 7.8 months for in-

[9] On this point and other problems in determining the reference turns, see Victor Zarnowitz, "On the Dating of Business Cycles," *Journal of Business*, April 1963, pp. 179–99.

[10] See George W. Cloos, "How Good Are the National Bureau's Reference Dates?" *Journal of Business*, January 1963, p. 28; and Zarnowitz, "On the Dating of Business Cycles," pp. 187–88.

dustries as diverse as primary and fabricated metals, transportation equipment, and the group of other durable goods (Table 11-3, column 10).[11] For each of the two machinery industries, the mean lead was about 5 months. The average for the durable goods sector as a whole, estimated as 7.5 months, lies near the top of the observed range.

Of nondurable goods industries, those reporting unfilled orders show more regular and on the average longer leads than do the others, but the difference is not very pronounced. The mean leads for these two groups and the total nondurable goods sector vary approximately between 4 and 6 months.

The over-all timing averages for these series, however, are rather unrepresentative. Separate summaries for peaks and troughs are indicated, since the differences between the two groups of observations are apparently systematic. For each industry, the average lead of new orders turns out to be longer at peaks than at troughs of business cycles, and the differences are substantial (Table 11-3, column 9). For the durable goods industries, the mean leads are about twice as long at peaks than at troughs, judging either from the record of the aggregate series or from averages of the comparisons for the component industries.

Even the separate peak and trough timing averages conceal a great deal of variation. For example, new orders of the primary metals industries were among the first to change direction at the recessions of 1957 and 1960, whereas their leads at the 1948 and 1953 peaks were the shortest on record (Table 11-2). No significant regularities appear in the observed sequences of peaks in the major-industry series for new orders, that is, none of these industries qualifies as a consistently early or a consistently late leader. Table 11-2 suggests that an analogous statement also applies to the timing sequences at revivals. All this, however, is based on very limited evidence for a small number of broadly defined industries. More formal tests applied to a larger number of industry series gave some indication of correlated sequences at troughs, but not at peaks.[12]

[11] The averages for the period since 1953 are larger, reflecting the prevalence of long leads at the cyclical reversals in 1954, 1957, and 1960. Thus the blast furnaces component of primary metals, a series that begins in 1953, shows a mean lead of 11 months.

[12] The leads of new orders for eleven major manufacturing industries were ranked at each of the eight business cycle turns of the 1948–61 period. Coefficients of concordance, W (see Chapter 6), computed for the rankings at peaks and at troughs, were found to equal 0.212 and 0.729, respectively. (This analysis was performed on the OBE series that predate the 1963 revision.)

Table 11-3

Summary Measures of Timing of Value of Manufacturers' New Orders at Business Cycle Peaks and Troughs, by Major Industries, 1948–65

Period Covered[a] (1)	No. of Timing Observations[b] (2)	Bus. Cycle Turns Skipped[c] (3)	Extra Turns in New Orders[d] (4)	No. of Timing Observations at Peaks or Troughs[e] That Are: Leads (5)	Exact Coincidences (6)	Lags (7)	Rough Coincidences[f] (8)	Av. Lead (−) or Lag (+) (months): Peaks or Troughs[e] (9)	All Turns (10)	Av. Dev. from Av. Lead or Lag (months): Peaks or Troughs[e] (11)	All Turns (12)
ALL MANUFACTURING INDUSTRIES											
1948–65	8	0	4(2)	4			1	−7.2	−5.6	2.9	2.9
				4			2	−4.0		2.0	
DURABLE GOODS INDUSTRIES, TOTAL											
1948–65	8	0	4(2)	4			1	−10.2	−7.5	5.8	5.1
				4			2	−4.8		3.1	
PRIMARY METALS											
1948–65	8	0	8(6)	3	1		2	−9.0	−7.8	8.5	6.2
				4			2	−6.5		4.0	
BLAST FURNACES AND STEEL MILLS[g]											
1953–65	6	0	6(4)	2	1		1	−14.0	−11.0	9.3	6.7
				3			1	−8.0		4.0	
FABRICATED METAL PRODUCTS[h]											
1949–65	7	0	4	3				−8.7	−6.6	4.2	3.4
				3	1		1	−5.0		2.5	
ELECTRICAL MACHINERY[i]											
1948–65	8(1)	0	6(2)	4			1	−6.5	−5.0	3.0	2.5
				3		1	1	−3.5		2.2	
MACHINERY EXCEPT ELECTRICAL											
1948–65	8	0	4(2)	4				−7.8	−5.1	2.2	2.9
				3		1	3	−2.5		2.0	

TRANSPORTATION EQUIPMENT[j]										
1951–65	6	0	6	3			−9.0	−6.8	2.7	3.6
				3		2	−4.7		4.2	
OTHER DURABLE GOODS[k]										
1948–65	8	0	2	4			−11.0	−7.2	4.5	4.6
				4		3	−3.5		2.8	
NONDURABLE GOODS INDUSTRIES, TOTAL[l]										
1948–65	8(4)	0	2	4		1	−7.5	−5.1	3.0	3.9
				3	1	2	−2.8		3.2	
NONDURABLES INDUSTRIES REPORTING UNFILLED ORDERS[m]										
1948–65	8	0	4(2)	4		1	−6.5	−5.6	2.5	2.9
				4		2	−4.8		3.2	
NONDURABLES INDUSTRIES NOT REPORTING UNFILLED ORDERS[n]										
1948–65	6(2)	2	0	3		1	−5.7	−4.3	2.2	3.0
				2	1	1	−3.0		4.0	

[a] The first date identifies the year of the first reference turn at which the timing of the series could be determined. The last reference turn covered is in each case the 1961 trough, but the count of the "extra" turns in new orders (column 4) is extended through 1965.

[b] The number of reference turns matched by like turns in new orders. The figures in parentheses give the number of minor turns in new orders included in these observations.

[c] The number of reference turns not matched during the periods identified in column 1.

[d] The number of turns in new orders that do not correspond to reference turns. The figures in parentheses refer to minor turns that are included in these observations.

[e] For each item, entry on first line is for comparisons at peaks; entry on second line, for comparisons at troughs.

[f] Includes exact coincidences and leads or lags of one, two, or three months.

[g] Data begin in 1953.

[h] Data begin in 1948 but timing at the 1948 recovery is uncertain; to determine it earlier figures would be necessary.

[i] The pre-1953 measures are based on unpublished data.

[j] Series underwent a retardation in 1948–49, but its timing at the reference dates of the period cannot be adequately determined.

[k] Includes professional and scientific instruments; lumber; furniture; stone, clay, and glass; and miscellaneous industries.

[l] Columns 9, 10, 11, and 12 include two observations relating to retardations that are difficult to date (see Table 11-2, note e). When these are omitted, the average leads are −4.5 for peaks and −3.3 for all turns. The corresponding average deviations are 2.5 and 3.0.

[m] Includes textiles; leather; paper; and printing and publishing.

[n] Includes nondurable goods industries other than those listed in note m, for which the values of new orders and shipments are assumed to be equal. Columns 9, 10, 11, and 12 include one observation relating to a retardation that is difficult to date. When this is omitted, the average leads are −4.0 for peaks and −3.4 for all turns. The corresponding average deviations are 1.0 and 2.7.

The findings for the major-industry series included in Tables 11-2 and 11-3 receive broad support from measures based on the rather detailed industry breakdown available for the pre-1963 OBE data (see Appendix E, part II). The conclusion stands that on some occasions the demand for durable goods, as measured by new orders, has turned well ahead of the rest of the economy, while on other occasions its lead time was short. Different summaries of the data (averages of timing measures at each turn) show considerable agreement on the identity and ranking of these episodes. At the same time, however, the positions of the individual industries in the sequences of the leads shift a great deal between the different episodes, in what may simply be a random fashion.

Confirming evidence on the strong tendency of manufacturers' new orders to lead at business recoveries and (generally, by longer intervals) at recessions also comes from the Standard and Poor's indexes for ten major durable goods industries and four nondurable goods industries (Appendix B, part II).

Conformity to Business Cycles

If matching the business cycle turns is the criterion, the conformity record of the new-order series in Table 11-3 is nearly perfect. None of the series for the eleven industries or groups of industries that report advance orders ($N \neq S$) missed any of the cyclical reversals covered, although in 5 of the 83 opportunities to do so minor turns rather than specific-cycle turns in new orders were involved. Only in the series for nondurable goods manufacturers with no reported backlogs, which represents orders shipped, are some business cycle turns skipped (columns 2 and 3).

However, on the complementary criterion of "extra" turns that do not correspond to business revivals or recessions, the record of these series is not so good. All in all, there are 50 such turns listed (column 4). It is true that this count includes as many as 20 minor turns (figures in parentheses), but these are often difficult to distinguish from specific-cycle turns, except with the full benefit of hindsight. The extra turns must generally be regarded as lapses from conforming behavior. Most of them would probably also represent potentially misleading signals to a forecaster of cyclical reversals.

Had Table 11-3 been limited to the period 1948–61, as defined by the first and last of the reference turns covered, each of the series included

would have shown just two extra turning points, since new orders generally declined in 1951 from their early Korean War peaks to resume a more moderate rise in the following year. However, most of these series also show substantial extra declines in 1962 and 1966–67, periods in which there were marked though short-lived retardations in business activity.

The proportion of new-order turns matched varies from 50 to 80 per cent for the different series, with 66.7 per cent being the most frequent figure. These results, which incorporate minor as well as specific-cycle turns, would disqualify most of these series under the conformity test devised by Geoffrey Moore, in which the probability of 0.188 is the maximum acceptance level.[13] If the minor turns were excluded, however, most series would pass the test.

There are only four short lags and three "exact" coincidences among the 89 timing observations included in Table 11-3. Most of the leads are intermediate or long; only 24 (or about 29 per cent) are short, that is, three months or less. Altogether, a little more than one-third of the measures consist of "rough" coincidences or leads and lags not exceeding three months (columns 5–8).

The leads are about equally divided between peaks and troughs (the respective frequencies are 42 and 40). All four lags and 22 of the 31 rough coincidences, however, are at troughs.

Disaggregation has relatively little effect on the over-all conformity and timing record for manufacturers' new orders. This can be seen by comparing the summary statistics in Table 11-3 with their counterparts in Table E-3, which relate to the more detailed industrial breakdown of the orders data (Appendix E, part II).

Differences Among Market Categories

Table 11-4 records the timing of new orders for nine market categories at the five business cycle turns of 1954–61. These measures are

[13] "Statistical Indicators of Cyclical Revivals and Recessions," in Moore, ed., *Business Cycle Indicators,* Vol. 1, pp. 206–07. The assumptions underlying Moore's measures are that the probability that a series will rise in correspondence to a given business expansion is one-half and that the results in successive cycles are independent. Both assumptions can be questioned, but Moore found the method workable for rating and screening series to select business cycle indicators. Under these premises, the probability that no failures will occur on five occasions is $(1/2)^5$; that one failure will occur, $5(1/2)^5$; two failures, $10(1/2)^5$; and so on, as given by the binomial expansion. Cumulation gives the probability 0.1875 for as good a result as one lapse, the probability 0.5 for as good a result as two lapses (i.e., two, one, or zero lapses), etc. In Moore's work with conformity indexes based on the reference cycle patterns, series with probabilities of more than 0.188 (or the nearest approximation to that level possible in the given case) were rejected. The probabilities were computed separately for expansions and contractions and combined by multiplication.

Table 11-4
Timing of Value of New Orders at Each Business Cycle Turn, Nine Market Categories,[a] 1954–61

Lead (−) or Lag (+), in Months, of New Orders at Business Cycle Turns					Av. Lead or Lag (months)			Av. Dev. from Av. Lead or Lag, All Turns (months)
Trough Aug. 1954 (1)	Peak July 1957 (2)	Trough April 1958 (3)	Peak May 1960 (4)	Trough Feb. 1961 (5)	Peaks (6)	Troughs (7)	All Turns (8)	(9)
HOME GOODS AND APPAREL								
−9	−7	−1	−12[b]	−1[b]	−9.5	−3.7	−6.0	4.0
NONAUTOMOTIVE EQUIPMENT AND DEFENSE								
−5	−8	−3	+1	−4	−3.5	−4.0	−3.8	2.2
DEFENSE PRODUCTS								
−11	−11	−6	[c]	[c]	[d]	−8.5	−9.3	2.2
OTHER								
[e]	−8	−1	−5	−5	−6.5	−3.0	−4.8	1.9
AUTOMOTIVE EQUIPMENT								
−8	+2	−1	−3	−1	−0.5	−3.3	−2.2	2.6
MACHINERY AND EQUIPMENT INDUSTRIES								
−5	−8	−2	−8	−3	−8.0	−3.3	−5.2	2.2
MATERIALS, SUPPLIES, AND INTERMEDIATE PRODUCTS								
−10	−8	−3	−15	−1	−11.5	−4.7	−7.4	4.3
CONSTRUCTION MATERIALS, ETC.								
−10	−5	−1	−13	0	−9.0	−3.7	−5.8	4.6
OTHER MATERIALS, ETC.								
−11	−11	−3	−15	−1	−13.0	−5.0	−8.2	5.0

[a] For composition of these categories, see Chapter 3.

[b] The series declined between May and November of 1959; this movement, which ended six months before the onset of the 1960 business recession, was followed by a retardation that lasted through 1960 (Chart 3-3). The above observations are based on the May 1959 high and the January 1961 date terminating the retardation. If these marginal observations are excluded, the average lead for 1954–58 is −5.7 months with an average deviation of 3.1.

[c] Not matched.

[d] Only one observation is available.

[e] Timing uncertain, but the lead appears to be at least 7 months. Including this observation would yield averages of −4.3 for troughs and −5.2 (with an average deviation of 1.8) for all turns.

based on the current Census series (1963 revision) that were introduced and compared with the corresponding shipments data in Chapters 3 and 4 (see, in particular, Chart 3-3). The timing of these series at the 1953 recession is uncertain and not identified in the table, but minimum leads of six months can be established for several categories.[14]

Only one group of consumer goods is included in the table, consisting of nonautomotive household equipment and apparel (first line). New orders for this category led at the turning points of 1953–54 and 1957–58, but showed only a general weakness in 1959–60 that started well before, and continued through, the business contraction of 1960–61. The series for consumer staples has shown no cyclical declines at all in the years covered, but it did undergo retardations in 1953–54 and again briefly in 1957.[15] The totals for consumer durable goods, a series that begins in 1960, declined mildly during the business recession of 1960–61. In short, the behavior of new orders for consumer goods in this period can be described as trend dominated and relatively stable, with low scores on cyclical conformity going to the nondurable, primarily staple products (for which new orders and shipments generally coincide). The few timing comparisons that are available for these series, however, are mostly leads. The latter reflect almost entirely certain early turns in the production of consumer goods, since the observed delivery periods (lags of shipments relative to new orders, in monthly terms) are here usually very short or zero.

In contrast, new orders for machinery and nonautomotive equipment show large fluctuations in conformity to the business cycle movements of 1953–61. Their leads at the two recessions and the three revivals of that period averaged six to eight and three months, respectively (Table 11-4). Since early 1961 these series followed strong upward trends, interrupted by brief and shallow declines in 1962 and more pronounced contractions during the business slowdowns of 1966 and 1969–70.

New orders for defense products are the most erratic. The series

[14] The series that begin in 1953 and decline from the outset would presumably have leads of at least months (January–July 1957). This applies to home goods and apparel; equipment and defense products, except automotive; machinery and equipment industries; and the three materials series. The 1953 local high for defense products occurred in February.

[15] The first of these retardations began at least four to six months before the July 1953 peak; it ended October 1964, two months after the reference trough. The second retardation started in February, five months before the business cycle peak, and ended in October 1957, six months before the reference trough.

shows a very large random component in its short up-and-down movements superimposed upon a rising trend (Chart 3-3). One would not expect it to respond positively in a regular fashion to business cycles, and it does not, judging from the short record of the recent years. However, large fluctuations in defense purchases could well be a major destabilizing factor in the economy at the high levels that such spending has presently attained. In particular, large declines in defense orders may contribute significantly to a developing weakness. Actually, new orders for defense products did decline substantially *before* the business downturns of both 1953 and 1957, causing subsequent cutbacks in defense output and shipments during and after each of the two business contractions of the 1950's. The orders increased *during* each of these contractions, but very irregularly and apparently too weakly to result in any significant increases of shipments in either of the downswing-and-recovery phases, 1954–55 and 1958–59. In the 1960–61 recession these orders declined a little. Defense expenditures declined along with shipments in 1953–55, remained stable in 1957–58, and rose somewhat in 1960.[16]

New orders for automotive equipment moved close to shipments and turned close to business cycle peaks and troughs in the period after 1955 (see Chart 3-3 and Table 11-4). The only long lead was at the 1954 revival. The timing of automotive orders and production, then, was in recent years nearly synchronous with the business cycle turns.[17] Extra movements, however, result in a low conformity of these series. There were definitely two specific cycles between the troughs of 1954 and 1958, with peaks in 1955, troughs in 1956, and lower peaks in 1957. Substantial declines also occurred during the business slowdown of 1966–67. Furthermore, rates of orders and shipments of motor vehicles were sharply reduced in the second half of 1959 because of the protracted steel strike and in the latter part of 1964 because of strikes in the automobile industry itself. On the other hand, it is notable that the widespread slowdown of economic activity in 1962 had very little restraining effect on new orders and shipments of automotive equipment.

[16] See the section on "Defense Products" in Chapter 4, with Chart 4-2, for further discussion of military orders, obligations, and expenditures, including a brief account of later developments during the 1960's, which came to be dominated by the Vietnam War and inflation.

[17] The latest contractions in these series started in July 1969 (for production) and in September 1969 (for new orders in current dollars). These downturns might come to be recognized as involving relatively short leads of perhaps four and two months.

New orders for materials, supplies, and intermediate products conformed well to the recent cyclical movements of the economy, as did the corresponding shipments series. Both new orders and shipments turned down before each of the three recessions of the period (1953, 1957, and 1960). The downturns in 1959 preceded the steel strike and led the business peak by long intervals. As elsewhere, early though slow recoveries of orders occurred in the 1953–54 contraction, but the upturns in 1958 and 1961 were nearly coincident with business troughs (Chart 3-3 and Table 11-4). Mild declines in these series mark the business retardation phases in 1962 and 1966–67.

Construction accounts for about one-fourth of total materials, supplies, and intermediate products, and for this part new orders and shipments move closely together. The other, larger part comprises many made-to-order products of the metalworking industries; it shows somewhat greater cyclical sensitivity than do the construction series, and appreciably longer leads of new orders. On the whole, however, the behavior of the two components of total materials has been rather similar (including the most recent episode in which both series on new orders turned down in September 1969, one month ahead of shipments).

Close inspection of the data gives no indication that the categories tend to turn up or down in any particular sequence at business troughs or peaks.

New Orders for Individual Industries or Products

The measures presented in this part relate to thirty series on new orders for a variety of manufactured goods. Six of these are in current dollars, and the rest are in physical units. The data give better representation to the largely made-to-order producer goods than to the largely made-to-stock consumer goods. Most of the former are durables; only four of the series refer to nondurable goods.

Averages, Distribution, and Probabilities of Leads and Lags

The full record of performance at business cycle turns of these series is summarized in Table 11-5. The table leaves no doubt about the strong tendency of new orders for various products to turn down

Table 11-5

Summary Measures of Timing of New Orders[a] at Business Cycle Peaks and Troughs, Thirty Individual Industries or Products, Various Periods, 1873–1957

	Period Covered[b] (1)	No. of Timing Observations[c] (2)	Bus. Cycle Turns Skipped[d] (3)	Extra Turns[e] in New Orders (4)	No. of Timing Observations at Peaks or Troughs That Are: Leads (5)	Exact Coincidences (6)	Lags (7)	Rough Coincidences[f] (8)	Av. Lead (−) or Lag (+) (mos.) Peaks or Troughs (9)	All Turns (10)	Av. Dev. from Av. Lead or Lag (mos.) Peaks or Troughs (11)	All Turns (12)
	WATER-TUBE BOILERS[g]											
1.	1927–57	5	1	2	4	0	1	1	−15.8	−9.2	11.8	10.2
2.		5	1	2	3	0	2	3	−2.6[h]		4.3	
	SOUTHERN PINE LUMBER											
3.	1918–54	7	2	4	7	0	0	0	−11.3	−9.1	5.5	4.0
4.		9	0	3	9	0	0	2	−7.3		3.2	
	OAK FLOORING											
5.	1913–54	9	1	5	9	0	0	0	−9.2	−8.2	3.6	3.2
6.		9	1	4	9	0	0	2	−7.2		2.9	
	CLAY AND GLASS PRODUCTS (2)											
7.	1921–33	3	0	0	3	0	0	1	−8.0	−7.4	3.3	3.1
8.		4	0	0	4	0	0	1	−7.0		3.0	
	RAILS											
9.	1873–1949	16	3	9	12	0	4	3	−8.4	−6.9	8.2	6.6
10.		13	6	11	11	1	1	7	−5.0		4.6	
	BATH TUBS											
11.	1918–29	3	2	0	3	0	0	2	−5.7[h]	−6.7	4.9	4.0
12.		3	1	0	3	0	0	0	−7.7		2.9	

	STEEL SHEETS										
13.	1919–33	4	0	0	4	0	0	0	−7.2	−6.2	1.9	2.5
14.		5	0	0	5	0	0	2	−5.4		3.5	
	IRON AND STEEL PRODUCTS (6)											
15.	1921–33	3	0	0	3	0	0	2	−6.0	−6.1	4.0	3.6
16.		4	0	0	4	0	0	1	−6.2		3.2	
	RAILROAD LOCOMOTIVES											
17.	1873–1954	18	2	5	17	0	1	5	−7.3	−5.8	5.9	5.4
18.		20	0	3	16	1	3	6	−4.6		5.2	
	PAPERBOARD											
19.	1924–54	5	1	5	5	0	0	2	−4.4	−5.7	2.5	2.7
20.		5	2	4	5	0	0	1	−7.0		2.4	
	PAPER AND PRINTING (3)											
21.	1923–33	3	0	0	3	0	0	0	−7.3	−5.7	2.4	4.0
22.		3	0	0	2	1	0	2	−4.0		4.7	
	RAILROAD FREIGHT CARS											
23.	1873–1954	18	2	6	14	1	3	6	−6.2	−5.6	5.8	4.8
24.		18	2	6	16	0	2	7	−5.0		4.0	
	FABRICATED STRUCTURAL STEEL											
25.	1910–54	10	1	6	9	0	1	8	−3.4	−5.4	2.6	4.3
26.		10	1	6	10	0	0	3	−7.4		5.1	
	LUMBER (3)											
27.	1921–33	2	1	0	2	0	0	0	−7.0[h]	−5.4	3.0	3.3
28.		3	1	0	3	0	0	2	−4.3		3.1	
	PAPER, EXCLUDING BUILDING PAPER, NEWSPRINT, AND PAPERBOARD											
29.	1937–54	3	1	3	2	1	0	1	−3.7[h]	−4.7	2.6	2.1
30.		3	1	3	3	0	0	1	−5.7		1.8	
	ARCHITECTURAL TERRA COTTA											
31.	1919–38	5	0	1	4	0	1	2	−6.4	−4.7	8.9	6.2
32.		6	0	0	4	0	2	2	−3.3		4.3	

(continued)

Table 11-5 (concluded)

	Period Covered[b] (1)	No. of Timing Observations[c] (2)	Bus. Cycle Turns Skipped[d] (3)	Extra Turns[e] in New Orders (4)	No. of Timing Observations at Peaks or Troughs That Are: Leads (5)	Exact Coincidences (6)	Lags (7)	Rough Coincidences[f] (8)	Av. Lead (−) or Lag (+) (mos.) Peaks or Troughs (9)	All Turns (10)	Av. Dev. from Av. Lead or Lag (mos.) Peaks or Troughs (11)	All Turns (12)
	RAILROAD PASSENGER CARS											
33.	1873–1954	20	0	7	12	0	8	6	−3.4	−3.9	8.3	6.8
34.		18	2	8	15	0	3	5	−4.5		5.1	
	FURNITURE											
35.	1924–45	4	0	1	3	1	0	2	−4.5	−3.8	4.0	2.8
36.		4	1	1	3	1	0	2	−3.0		1.5	
	WOODWORKING MACHINERY											
37.	1923–38	4	0	1	4	0	0	1	−5.8	−3.5	3.1	2.9
38.		4	0	1	3	1	0	4	−1.2		0.9	
	TEXTILE PRODUCTS (3)											
39.	1921–33	2	1	3	2	0	0	1	−3.5[h]	−3.5	1.5	4.2
40.		4	0	2	3	0	1	1	−3.5		5.5	
	MILL AND INDUSTRIAL SUPPLIES[i]											
41.	1949–54	1	0	1	1	0	0	1	−3.0	−3.0		0.0
42.		2	0	1	2	0	0	2	−3.0		0.0	
	MERCHANT PIG IRON											
43.	1919–26	2	1	0	1	1	0	2	−1.0[h]	−2.8	1.0	1.8
44.		3	0	0	3	0	0	2	−4.0		2.0	

	FOUNDRY EQUIPMENT										
45.	1921–54	5	3	3	3	0	2	2	−3.6[h]	−2.6	3.7	2.7
46.		7	0	2	5	2	0	6	−1.9		1.6	
	MACHINE TOOLS											
47.	1919–54	7	1	1	6	1	0	5	−3.3	−2.1	2.7	1.8
48.		7	2	2	5	1	1	7	−0.9		1.1	
	LAVATORIES											
49.	1918–29	4	1	0	3	0	1	2	−3.5[h]	−2.1	4.0	4.4
50.		4	0	0	3	0	1	1	−0.8		5.4	
	KITCHEN SINKS											
51.	1918–29	4	1	0	3	0	1	2	−3.2[h]	−2.0	3.8	4.2
52.		4	0	0	3	0	1	1	−0.8		4.9	
	ELECTRIC OVERHEAD CRANES											
53.	1926–45	3	1	1	2	0	1	0	−3.7[h]	−1.7[h]	5.1	4.3
54.		3	1	1	1	0	2	3	+0.3[h]		2.2	
	FABRICATED STEEL PLATE											
55.	1924–38	3	0	0	2	0	1	2	−1.7[h]	−1.6	1.8	2.5
56.		4	0	0	2	1	1	2	−1.5[h]		3.0	
	OIL BURNERS											
57.	1933–49	1	2	3	1	0	0	1	−2.0[h]	−1.0[h]		1.3
58.		3	2	3	1	0	1	2	−0.5[h]		1.5	
	MISCELLANEOUS ENAMELED SANITARY WARE											
59.	1918–29	2	3	0	1	0	1	1	+4.0[h]	−0.8[h]	5.0	4.9
60.		2	2	0	2	0	0	0	−5.5[h]		1.5	
	Totals											
61.	Peaks	176	31	67	145	5	26	61				
62.	Troughs	188	26	63	158	9	21	80				
63.	All turns	364	57	130	303	14	47	141				

Notes to Table 11-5

Note: In columns 2–9 and column 11, entries on the first line for each series are for comparisons at peaks; entries on the second line, for troughs. Entries in columns 10 and 12 pertain to all turns (peaks and troughs).

[a] The series are ranked by the length of the average lead for all turns (column 10), from longest to shortest. Figures in parentheses indicate the number of items included in the component series of the Department of Commerce index of new orders in physical terms, 1920–33, as follows: Line 7—terra cotta, illuminating glassware; line 15—steel sheets, malleable castings, steel castings, fabricated structural steel, fabricated steel plate, enameled sanitary ware; line 21—boxboard, labels, book paper; line 27—furniture, lumber (5 kinds), flooring (2 kinds); line 39—cotton finishing, hosiery, knit underwear.

[b] Identifies the complete business cycle phases covered by the given series.

[c] Number of recorded timing comparisons (leads, lags, and coincidences) at business cycle peaks or troughs.

[d] Number of business cycle peaks or troughs that are not matched by cyclical turns in the given series. Corresponding entries in columns 2 and 3 add up to the total number of business cycle turns (peaks or troughs) covered.

[e] Number of specific-cycle peaks or troughs in the given series that do not match business cycle turns. Corresponding entries in columns 2 and 4 add up to numbers of new-order turns (peaks or troughs) covered.

[f] Includes exact coincidences and leads and lags of one, two and three months.

[g] Index of new orders for stationary water-tube boilers received by a company accounting for a large proportion of the boiler industry.

[h] Given the numbers of turns covered and the distribution of the timing comparisons by type, the probability of obtaining this result exceeds 0.223 (or the nearest approximation to that level possible). See the accompanying text.

[i] Index of new orders received by a cross section of members of the American Supply and Machinery Manufacturers' Association (producers of a variety of supplies such as abrasives, beltings, hoists, saws, tools, etc.).

before the peaks and to turn up before the troughs in aggregate economic activity. For each item, new orders show an average lead at business cycle turns (column 10). These mean leads differ greatly in length, descending from nine months at the top of the table to slightly less than one month at the bottom, but they exceed three months for two-thirds of the list.

Separate averages of the timing observations at peaks and at troughs (column 9) indicate that leads prevail heavily at either type of turn. Of the sixty averages only two are lags, both in very short series (lines 54 and 59). The mean leads are longer at peaks than at troughs for nineteen of the thirty series, and shorter for only nine. The mean leads at peaks range approximately from 16 months to 2, those at troughs from 8 months to less than 1 month.

Timing varies considerably in the successive revivals and recessions, as seen by the average deviations in columns 11 and 12. But leads account for the great bulk (83 per cent) of all comparisons, and short leads of less than 3 months are less frequent than the intermediate and long leads for most of the industries or groups of products included. For all series, if the observations at peaks and troughs are combined, 13 per cent are lags, 14 per cent are exact coincidences, and 39 per cent are rough coincidences.

In Moore's screening procedure for business cycle indicators, the significance of a given record of timing is judged by computing the probability that, for a certain number of reference peaks (or troughs), a specified number of timing comparisons of a given type will be equaled or exceeded by chance.[18] As with conformity, the assumptions are ones on which the binomial distribution can be applied. The maximum acceptance level adopted in this case corresponds as nearly as possible to the probability (0.223) that four or more timing comparisons will appear in a given group (leads, lags, or rough coincidences) when the series covers six reference turns. The longer the series (the more turns it covers), the lower the probability for any given proportion of successes (say, leads for a leading indicator). Thus, the maximum acceptable proportion of failures is directly related to the length of the series.[19]

Separate probabilities were computed for peaks, troughs, and all turns from the distributions of timing observations shown in Table 11-5, columns 5–8. Note h in that table denotes the cases in which these probabilities are sufficiently high to admit, under the assumptions just stated, the null hypothesis that the observed timing distribution may represent merely the working of chance. The underlying probabilities are based on the number of leads at reference turns in the period covered; in another set that was also computed, the probabilities were based on the number of leads at new-order turns covered. The

[18] This approach parallels that adopted to evaluate the conformity measures, as summarized in note 13 above. For details, see Moore, ed., *Business Cycle Indicators*, Vol. 1, p. 209.

[19] For the timing probability criterion, an exact coincidence was counted as a half-lead and a half-lag. Thus, for leads the "successes" are represented by leads and half the number of exact coincidences and the "failures" by lags and half the number of exact coincidences; while for lags the reverse applies. Of course, a series cannot be both a "significant" leader and a "significant" lagger according to these tests. The test for the significance of rough coincidences treats all leads and lags that are longer than three months as failures. Success in this last test does not preclude a series from also passing the test as a leader (if short leads prevail strongly in its record) or as a lagger (if short lags prevail).

latter probabilities are higher than the former ones for several items, reflecting the fact that extra turns are more frequent than skipped ones. It should be noted that many of the high probabilities relate to short series, that is, items for which the evidence is skimpy.

The probability approach discloses no significant lagging tendency in any of the series but does indicate the significance of rough coincidences (short leads and lags within the range of −3 to +3 months centered on the reference turn) in a few cases. These relate to six items: fabricated structural steel, woodworking machinery, merchant pig iron, foundry equipment, machine tools, and electric overhead cranes. However, the probabilities for leads are also below the acceptable maximum levels in all these cases except one (electric overhead cranes at troughs), and indeed are in most instances lower than or equal to the rough-coincidence probabilities. The evidence of the timing probabilities is summarized in the tabulations below.

	Number (and Percentage) of Series for Which					
	Leads Are Significant at			*Rough Coincidences Are Significant at*		
Probabilities Based on	*Peaks*	*Troughs*	*All Turns*	*Peaks*	*Troughs*	*All Turns*
Business cycle turns	18(60)	25(83)	27(90)	2(7)	4(13)	3(10)
New-order turns	18(60)	21(70)	20(67)	2(7)	4(13)	2(7)

Conforming Behavior: The Turning Points

Timing regularities should be appraised against the background of conformity measures. A consistent leader is a series that leads at a large proportion of the reference turns *covered.* A series would not deserve a high consistency rating even if it led at each turn *matched,* if it matched only a few of the revivals and recessions through which it passed. However, columns 2 and 3 of Table 11-5 indicate that new orders turn in sympathy with the large majority of peaks and troughs in the business cycles they cover.

Skipped turns are one type of nonconforming behavior. There is no turn in the series that can be matched to a particular business cycle turn. The occurrence in the series of an extra turn which cannot be matched with a peak or trough of the business cycle is another type.

The percentage of matched business cycle turns measures (inversely) the frequency of skipped turns. To allow for the frequency of extra turns, we compare the number of "matchings" with the number of specific-cycle turns in a given series. To take account of both the skipped and the extra turns, we simply average the percentage of business cycle turns matched and the percentage of specific turns matched. Given a sufficient number of observations, the percentages matched can provide meaningful measures of conformity and can be computed separately for peaks and troughs as well as for all turns combined.

Table 11-6 presents the distributions of the conformity measures of the thirty series on new orders for individual industries or products. The average percentages (column 7) are heavily concentrated in the upper end of the scale; two-thirds of them are in the 80–100 range and all but four exceed 70. Typically, the extra turns outnumber the skipped ones in the series examined, and so the percentages of business cycle turns matched tend to be larger than the percentages of new-order turns matched, and the associated probabilities tend to be lower for the former than for the latter measures (compare columns 1 and 4, 2 and 5, and 3 and 6).

The figures in the next to last line of Table 11-6 give a count of the cases in which the number of failures to match a business cycle turn exceeds the acceptable maximum, that is, as good a result as one lapse in five occasions (any instance of an unmatched turn is treated as a lapse in conformity). Specifically, these are the instances where, given the assumptions of the method (see note 13, above), the probability of obtaining the observed result by chance exceeds 0.188 or the nearest approximation to that figure. For peaks, such cases represent 30 per cent of the series covered; for troughs, 20–27 per cent; and for all turns, where more observations are available, 10–17 per cent.[20]

Most of the large probabilities refer to series that are short, covering six or fewer turns. This applies principally to the percentages of business cycle turns matched, where only one of the nine series, with an

[20] It should be noted that in these probabilities for all turns no distinction is made between peaks and troughs; the timing measures are treated as being part of a single universe. In a more stringent test, assuming two separate universes, "product probabilities" would be computed by multiplication of the peak and trough probabilities. The product probabilities would be lower than the independently computed probabilities for all turns, and would require a lower maximum acceptance level, say, 0.035. The criterion thus defined would not be passed by any of the series that failed the criterion applied in Table 11-6 (columns 3 and 5, $P > 0.188$ line).

Table 11-6
Thirty New-Order Series for Individual Industries or Products, Distribution by Percentage of Cyclical Turns Matching Business Recessions and Revivals, 1919–38, 1948–57

Percentage of Turns Matched[a]	Frequency Distributions Based on the Percentages of: Business Cycle Turns Matched — Peaks (1)	Troughs (2)	All Turns (3)	New-Order Turns Matched — Peaks (4)	Troughs (5)	All Turns (6)	Bus. Cycle and New-Order Turns Matched, Av., All Turns (7)
			NUMBER OF SERIES				
100.0	10	15	8	11	12	11	5
90.0–99.9	4	4	5	0	0	1	5
80.0–89.9	6	2	9	4	3	4	8
70.0–79.9	3	6	5	5	6	5	8
60.0–69.9	5	1	1	5	5	4	3
50.0–59.9	0	2	0	3	3	4	0
Less than 50	2	0	2	2	1	1	1
Total	30	30	30	30	30	30	30
$P = .188$[b]	9	6	3	9	8	5	n.a.
			PER CENT				
Av. % of turns matched[c]	85.0	87.8	86.5	72.4	74.9	73.7	80.1

[a] For columns 1–3: Ratio of the number of business cycle turns matched to the number of business cycle turns covered by the given series, multiplied by 100.

For columns 4–6: Ratio of the number of business cycle turns matched to the number of new-order turns covered, multiplied by 100.

For column 7: Average of the percentages used for the distributions in columns 3 and 6.

[b] Given the numbers of turns covered and matched, the probability of obtaining this result by chance exceeds 0.188 (or the nearest approximation to that level possible). On the assumptions underlying the probability measures, see text.

[c] Average, for all thirty series, of the percentage-matched figures on which the distribution in lines 1–9 is based.

indifferent performance at peaks, is relatively long (Table 11-5, line 23). However, for percentages of new-order turns matched, half of the ten series with high probabilities for at least one type of turn are long series with 10 to 29 observations each.

To sum up, few business cycle turns are skipped by the series on new orders: The proportion is less than 1 in 8. Extra turns in new orders are more frequent, but the fact remains that as many as three-quarters of the recorded specific peaks and troughs in these series can be matched to the peaks and troughs of business at large (Table 11-6).

A Summary of Cycle-by-Cycle Performance

Most of the timing observations for the individual series refer to the business cycle turns of the interwar years, 1919–38; the period after World War II is less well represented. Table 11-7 shows the distribution of the leads and lags of new orders at each of the eight revivals and seven recessions during 1919–38 and 1948–54 (most of the series included failed to match the short business contraction in 1945). Upturns in newly received business are seen to precede each of the troughs in aggregate economic activity by average intervals of about three to six months. Downturns led the business peaks by more variable intervals—by long leads, averaging seven to eleven months, in 1926, 1948, and 1953, and by short leads and rough coincidences, averaging less than one month, in 1920. At the other peaks—1923, 1929, and 1937—the leads averaged three to five months.

Closer inspection of the distributions indicates that a prior turn in most categories of new orders is a highly regular characteristic of a business revival or recession. Leads outnumber lags and coincidences combined at each of the business cycle turns covered, and they outnumber rough coincidences on each occasion except one. Since revivals and recessions are matched by all but a very few of the series, and since the bulk of the matchings are leads, a timing record of substantial consistency results. At ten of the reference turns, leads account for 74–100 per cent of all *possible* comparisons; at the other five, for 53–65 per cent.

Relating the Timing Patterns for New Orders and Shipments

Comparisons by Type of Manufacture

Table 11-8 presents a summary of the timing at business peaks and troughs of two groups of new-order series representing production to

Table

Distribution of Timing of New Orders of Individual Industries or

	Trough April 1919	Peak Jan. 1920	Trough July 1921	Peak May 1923	Trough July 1924	Peak Oct. 1926
						NUMBER OF TIMING
Lead (−) or lag (+), mos.						
−13 to −24				1	2	5
−7 to −12		2	12	4	3	12
−4 to −6	6	1	3	8	1	4
−1 to −3	8	5	1	6	10	
0		2			1	
+1 to +3		2	4		1	1
+4 to +6	1	2				
+7 to +12		1		2		
						MONTHS
Av. lead (−) or lag (+)	−2.6	−0.4	−5.2	−4.1	−4.2	−10.4
Av. dev.	1.5	3.3	3.1	3.4	4.1	3.2
						SUMMARY: NUMBER
Leading	14	8	16	19	16	21
Coincident		2			1	
Lagging	1	5	4	2	1	1
Roughly coincident [a]	8	9	5	6	12	5
Matching the turn, total	15	15	20	21	18	22
Included, total	15	15	20	22	25	26

Note: The table includes observations for the thirty series identified in Table 11-5. Only the measures relating to the periods 1919–38, 1948–54 are included.

order and production to stock. The timing of new orders in either category is shown to be on the average somewhat earlier at peaks than at troughs. The measures offer no evidence of a systematic difference in cyclical timing between the two groups of series. This contrasts with the finding that leads of new orders *relative to shipments* are (as would be expected) longer for made-to-order products than for products made to stock (Chapter 4). According to the averages in column 6, series representing manufacture to stock turned, if anything, somewhat *earlier* than the other series at business revivals and recessions. Hence the measures imply that some industries that customarily fill

11-7
Products at Each Business Cycle Turn, 1919–38, 1948–57

Trough Nov. 1927	Peak June 1929	Trough Mar. 1933	Peak May 1937	Trough June 1938	Peak Nov. 1948	Trough Oct. 1949	Peak July 1953	Trough Aug. 1954
COMPARISONS								
1	2	1			3		1	1
6	6	5		6	4	3	3	4
3	5	4	8	4	2			2
5	4	7	8	3	1	8	3	5
2		3	1	1			1	
1	5	1		3		1	1	
1	1	1	1					
3		1						
−2.8	−4.5	−3.2	−3.1	−3.5	−10.7	−3.7	−7.3	−5.7
6.2	4.5	3.8	1.9	3.2	5.4	1.5	7.1	3.2
OF SERIES								
15	17	17	16	13	10	11	7	12
2		3	1	1			1	
5	6	3	1	3		1	1	
8	9	11	9	7	1	9	5	5
22	23	23	18	17	10	12	9	12
26	26	23	18	17	11	12	12	12

[a] Includes exact coincidences and leads and lags of one, two, or three months.

their orders on receipt or on short notice experience cyclical turns in their activity relatively far ahead of peaks and troughs in general business; their new orders *and their shipments* are early leaders.

Direct evidence on this is given in Table 11-9, part I, which shows the average cyclical timing of new orders and shipments for those industries in our sample for which corresponding series on the two variables are available. The list includes seven items representing manufacture to stock. In this group, turns in new orders preceded business peaks and troughs by greatly varying but predominantly long intervals, as indicated by the measures in columns 4, 7, and 10. Since these goods

Table 11-8
Timing of Thirty Series on New Orders at Business Cycle Turns, Distribution of Leads and Lags by Type of Turn and Type of Manufacture, 1873–1957

Line		Leads (1)	Exact Coinci-dences (2)	Lags (3)	Rough Coinci-dences[a] (4)	Total (5)	Av. Lead (−) or Lag (+)[b] (months) (6)
				AT REFERENCE PEAKS			
1	Manufacture to order[c]	107	5	22	49	134	−5.7
2	Manufacture to stock[d]	38	0	4	12	42	−6.6
3	Total (30 series)	145	5	26	61	176	−5.9
				AT REFERENCE TROUGHS			
4	Manufacture to order[c]	114	9	15	66	138	−4.2
5	Manufacture to stock[d]	44	0	6	14	50	−4.9
6	Total (30 series)	158	9	21	80	188	−4.4
				AT ALL REFERENCE TURNS			
7	Manufacture to order[c]	221	14	37	115	272	−4.9
8	Manufacture to stock[d]	82	0	10	26	92	−5.7
9	Total (30 series)	303	14	47	141	364	−5.1

[a] Includes exact coincidences and leads or lags of one, two, or three months.

[b] Weighted by the number of observations for each component item.

[c] This group includes all nineteen series in Table 11-5 other than those listed below in note d.

[d] This group includes the following eleven series (see Table 11-5): southern pine lumber, oak flooring, clay and glass products, bath tubs, lumber, architectural terra cotta, textile products, lavatories, kitchen sinks, oil burners, miscellaneous enameled sanitary ware.

have short order periods (columns 2, 5, and 8), their shipments, too, turned substantially ahead of business revivals and recessions (columns 3, 6, and 9).

The made-to-order capital goods in Table 11-9 present a different picture. On the average, turns in new orders for these products anticipated the reversals in aggregate economic activity by from two to six months (the leads tend to be longer at peaks than at troughs). The delivery periods were apparently longer than these leads, so that for most items in this group, and on the average, shipments lagged. The lags are

more pronounced at troughs than at peaks. Where shipments of these goods led rather than lagged business reversals, the leads were typically short.

Rank correlations between the columns of Table 11-9 indicate that the average leads of new orders relative to shipments are not significantly associated with the average leads of new orders at business cycle turns. The latter do show positive correlations with the average leads (or lags) of shipments at business turns. (The lags are treated as negative leads.) Also, negative rank correlations exist between the order-shipment leads and the leads and lags of shipments at business revivals and recessions. The correlations vary between ±.5 and ±.8. While these results help to summarize the evidence presented in Table 11-9, one must be cautious in generalizing from them because the samples used are small and perhaps not sufficiently representative.

In Table 11-9, part II, matched data on new orders and production for six individual industries provide some additional evidence. With one exception, the products covered here are also included in part I, and their outputs and shipments are on the whole closely associated. Hence, the net informational gain from these measurements is small.

Whether for items produced to order or to stock, new orders lead output by short intervals averaging about two months (manufacture to order is in these measures represented only by some industrial materials). Output of made-to-stock items, like shipments, shows substantial leads at business cycle turns.

Obviously, at least as far as comparatively small segments of total manufacturing are concerned, long leads of new orders relative to production or shipments in a given industry need not necessarily be associated with long leads of new orders at business cycle turns. The cyclical timing patterns of orders, output, and shipments, which are of course interrelated, are very diverse.

The Dispersion of Turning Points in Paired Series

For any item, the timing of shipments is determined by the timing of new orders and the delivery lag. Suppose the length of the latter is four months, and new orders lead at a given business turn by six months; then the lead of shipments is, of course, two months. This simple relationship between the three timing variables implies that their dispersions are interdependent according to the general formula

Table 11-9

Average Timing of New Orders (*N*), Shipments (*S*), and Production (*Z*) at Business Cycle Turns, Twenty Individual Industries or Products Classified by Type of Manufacture, Various Periods, 1919–54

Line	Industry or Product[a] and Period[b] (1)	Average Lead (−) or Lag (+), in Months: At Peaks[c] *N* vs. *S* or *Z* (2)	At Peaks[c] *S* or *Z* vs. Bus. Cycles (3)	At Peaks[c] *N* vs. Bus. Cycles[d] (4)	At Troughs[c] *N* vs. *S* or *Z* (5)	At Troughs[c] *S* or *Z* vs. Bus. Cycles (6)	At Troughs[c] *N* vs. Bus. Cycles[d] (7)	At All Turns[c] *N* vs. *S* or *Z* (8)	At All Turns[c] *S* or *Z* vs. Bus. Cycles (9)	At All Turns[c] *N* vs. Bus. Cycles[d] (10)
	I. NEW ORDERS AND SHIPMENTS									
	RAILROAD PASSENGER CARS (OR)									
1	1919–54 (17)	−9.5	−3.8	−6.0	−8.7	+7.2	−1.6	−9.1	+5.6	−3.9
	FABRICATED STRUCTURAL STEEL (OR)									
2	1926–54 (12)	−6.4	+2.2	−4.2	−8.8	+1.2	−7.6	−7.6	+1.7	−5.9
	RAILROAD LOCOMOTIVES (OR)									
3	1919–38 (11)	−5.4	+1.4	−4.0	−9.2	+10.0	−1.3	−7.3	+6.1	−2.5
	RAILROAD FREIGHT CARS (OR)									
4	1919–54 (17)	−6.2	−0.7	−6.8	−5.1	+2.6	−2.3	−6.0	+1.1	−4.4
	ELECTRIC OVERHEAD CRANES (OR)									
5	1926–45 (8)	−6.6	+3.0	−3.7	−4.0	+4.3	+0.3	−5.3	+3.7	−1.7
	MERCHANT PIG IRON (OR)									
6	1919–24 (5)	−4.0	+3.0	−1.0	−4.0	0.0	−4.0	−4.0	+1.2	−2.8
	STEEL SHEETS (OR)									
7	1919–33 (9)	−5.8	−1.5	−7.2	−2.4	−3.0	−5.4	−3.9	−2.3	−6.2
	MACHINE TOOLS (OR)									
8	1927–54 (11)	−4.0	−1.0	−2.3	−2.8	+1.4	−1.4	−3.1	+0.5	−1.8

	WOODWORKING MACHINERY (OR)									
9	1923–38 (8)	−3.2	−2.5	−5.8	−1.0	−0.2	−1.2	−2.2	−1.4	−3.5
	OAK FLOORING (ST)									
10	1913–54 (20)	−3.0	−7.0	−9.2	−0.9	−5.5	−7.2	−1.9	−6.2	−8.2
	FURNITURE (OR)									
11	1926–45 (8)	−1.0	−1.3	−4.5	−2.5	−0.5	−3.0	−1.9	−0.9	−3.8
	SOUTHERN PINE LUMBER (ST)									
12	1918–54 (18)	−2.7	−8.6	−11.3	−0.8	−6.6	−7.3	−1.6	−7.4	−9.1
	PAPER, EXCLUDING BUILDING PAPER, NEWSPRINT, AND PAPERBOARD (OR)									
13	1937–49 (6)	−3.0	−2.5	−5.5	+0.5	−5.5	−5.0	−1.2	−4.0	−5.2
	KITCHEN SINKS (ST)									
14	1919–26 (6)	−3.0	−2.0	−5.0	+0.7	−4.7	−4.0	−1.2	−3.3	−4.5
	BATH TUBS (ST)									
15	1919–26 (6)	−0.5	−6.5	−7.0	−0.5	−5.0	−5.5	−0.5	−5.8	−6.2
	LAVATORIES (ST)									
16	1919–26 (6)	−0.3	−5.0	−5.3	0.0	−4.3	−4.3	−0.2	−4.7	−4.8
	OIL BURNERS (ST)									
17	1933–49 (7)	0.0	−2.0	−2.0	0.0	−0.5	−0.5	0.0	−1.0	−1.0
	FOUNDRY EQUIPMENT[e]									
18	1926–38 (6)	+1.7	−6.7	−5.0	−0.3	−2.7	−3.0	+0.7	−4.7	−4.0
	MISCELLANEOUS ENAMELED SANITARY WARE (ST)									
19	1919–23 (4)	+2.0	+2.0	+4.0	+3.5	−9.0	−5.5	+2.8	−3.5	−0.8
	Group averages[f]									
20	11 OR items	−5.6	+0.4	−5.0	−4.9	+2.2	−2.8	−5.2	+1.4	−3.9
		(41)	(43)	(46)	(50)	(52)	(51)	(91)	(95)	(97)
21	7 ST items	−1.9	−5.6	−7.4	−0.2	−5.5	−6.0	−1.0	−5.6	−6.7
		(25)	(25)	(27)	(29)	(29)	(30)	(54)	(54)	(57)
22	All 19 items	−3.9	−2.0	−5.9	−3.1	−0.6	−4.0	−3.5	−1.2	−4.9
		(69)	(71)	(76)	(82)	(84)	(84)	(151)	(155)	(160)

(continued)

Table 11-9 (concluded)

Line	Industry or Product[a] and Period[b] (1)	Average Lead (–) or Lag (+), in Months: At Peaks[c] *N* vs. *S* or *Z* (2)	At Peaks[c] *S* or *Z* vs. Bus. Cycles (3)	At Peaks[c] *N* vs. Bus. Cycles[d] (4)	At Troughs[c] *N* vs. *S* or *Z* (5)	At Troughs[c] *S* or *Z* vs. Bus. Cycles (6)	At Troughs[c] *N* vs. Bus. Cycles[d] (7)	At All Turns[c] *N* vs. *S* or *Z* (8)	At All Turns[c] *S* or *Z* vs. Bus. Cycles (9)	At All Turns[c] *N* vs. Bus. Cycles[d] (10)
					II. NEW ORDERS AND PRODUCTION					
	MERCHANT PIG IRON (OR)									
23	1919–24 (5)	–5.5	+4.5	–1.0	–5.3	+1.3	–4.0	–5.4	+2.6	–2.8
	STEEL SHEETS (OR)									
24	1919–33 (9)	–3.5	–3.8	–7.2	–2.0	–3.4	–5.4	–2.7	–3.6	–6.2
	OAK FLOORING (ST)									
25	1918–54 (18)	–3.3	–7.2	–9.5	–1.9	–3.7	–6.6	–2.5	–5.3	–8.1
	PAPER EXCLUDING BUILDING PAPER, NEWSPRINT, AND PAPERBOARD (OR)									
26	1937–49 (6)	–4.0	–1.5	–5.5	+0.5	–5.5	–5.0	–1.8	–3.5	–5.2
	SOUTHERN PINE LUMBER (ST)									
27	1919–54 (17)	–0.3	–12.2	–11.3	–2.6	–4.0	–7.3	–1.6	–7.5	–9.1
	PAPERBOARD (OR)									
28	1926–54 (12)	–1.8	–2.6	–4.4	–0.4	–6.6	–7.0	–1.1	–4.6	–5.7
	Group averages[f]									
29	4 OR items	–3.2	–1.7	–4.9	–1.8	–3.8	–5.6	–2.5	–2.8	–5.3
		(13)	(13)	(13)	(15)	(15)	(15)	(28)	(28)	(28)
30	2 ST items	–1.8	–9.7	–10.3	–2.3	–3.9	–7.0	–2.1	–6.4	–8.6
		(12)	(12)	(15)	(15)	(15)	(17)	(27)	(27)	(32)
31	All 6 items	–2.6	–5.5	–7.8	–2.0	–3.8	–6.3	–2.3	–4.6	–7.0
		(25)	(25)	(28)	(30)	(30)	(32)	(55)	(55)	(60)

Notes to Table 11-9

[a] (ST) signifies goods made primarily to stock; (OR), goods made primarily to order. This classification is identical with the division made in Chapter 4 (Tables 4-1 and 4-2) between the group of eleven items representing manufacture to order and the group of seven items representing manufacture to stock.

The list in part I of the table includes those items in Table 11-5 for which corresponding series on new orders and shipments are available; the list in part II includes those of the items for which corresponding series on new orders and production are available. The items in lines 1–19 are ranked by the length of the average lead of new orders relative to shipments, and the items in lines 23–28 relative to production, beginning in both cases with the longest lead (column 8).

[b] The years identify the first and last reference turns matched by both the new-order and the shipment (production) series. Figures in parentheses identify the number of reference turns in the periods thus defined. The periods differ in some cases from those given for the corresponding items in Table 11-5, column 1, because shipments (production) are not always available for the entire interval covered by the new-order series.

[c] The averages for new orders versus shipments (production) do not include comparisons at "extra" turns, but only those between specific turns related to the same reference dates. They are therefore not necessarily identical with the corresponding figures in Tables 4-1 and 4-2, columns 9 and 10. The averages for the timing comparisons at business cycle turns include all observations at the reference turns covered by periods identified in column 1 (see note b).

[d] These measures are identical with the entries for the corresponding items in Table 11-5, columns 9 and 10, except when the periods covered are different. In general, column 4 ≃ column 2 + column 3; (7) ≃ (5) + (6); and (10) ≃ (8) + (9). More specifically, they are equal to these sums, except in those cases in which any of the reference turns during the period covered were matched by new orders but not by shipments (production), or vice versa.

[e] Available information does not permit classification of this item as either (OR) or (ST) (cf. note 4 in Chapter 4). It is excluded from the averages in lines 20–21, but included in the over-all averages in line 22.

[f] Weighted by the number of observations for each component item. Number of observations covered is given in parentheses.

for variances of sums or differences. Denote the standard deviation of the timing of new orders and shipments at a business cycle turn as σ_n and σ_s, respectively, and the standard deviation of the timing of new orders relative to shipments (of the "delivery lags") as σ_d. Then, for matched observations relating to a given set of industries or products,

$$\sigma_s^2 = \sigma_n^2 + \sigma_d^2 - 2r_{nd}\sigma_n\sigma_d, \tag{1}$$

where r_{nd} is the coefficient of correlation between the leads (or lags) of new orders at the particular recession or recovery and the corresponding delivery lags.

It is clear that the diversity of supply conditions and business operat-

ing policies and practices, as expressed in the variance of the delivery periods (σ_d^2), makes a gross contribution to the dispersion of turns in shipments (σ_s^2); this contribution is in addition to that due to the dispersion of turns in new orders (σ_n^2). This would be the whole story if the delivery lags were independent of the cyclical leads of new orders. The dispersion of shipments would then always be greater than the dispersion of new orders, since, with $r_{nd} = 0$, $\sigma_s^2 = \sigma_n^2 + \sigma_d^2$. If the correlation were negative ($r_{nd} < 0$), this conclusion would be reinforced. In fact, σ_s^2 would then exceed not just σ_n^2 but the sum of both variances ($\sigma_n^2 + \sigma_d^2$). For $\sigma_s^2 < \sigma_n^2$, r_{nd} would have to be positive and larger than $\sigma_d/2\sigma_n$ (i.e., large enough to make $|2r\sigma_n\sigma_d| > \sigma_d^2$).

Economic considerations join the statistical analysis in suggesting the likelihood that $\sigma_s^2 > \sigma_n^2$. Cyclical forces operate primarily on the demand side, giving rise to interdependent and, in a substantial measure, convergent processes. On this premise, one would expect that the cyclical timing of many new-order series would be alike. But, since delivery periods vary among different industries and products, the timing of production and shipments would vary even for items for which the effective demand, as measured by new orders, fluctuated in unison.

On the other hand, anticipations of buyers of materials and investors in equipment could be such as to make for more dispersion in orders placed and less in outputs and shipments. Expectations of, say, a downturn in business may cause purchasers of items with long delivery periods to curtail their orders early and purchasers of items with short delivery periods to do so later. In the extreme case of correct anticipations of this sort, peaks and troughs in outputs and shipments would cluster closely about the dates of business recessions and revivals, and the leads of new orders at these dates would reflect the delivery periods for the products concerned.

Actually, neither of the extreme situations is very realistic, since *close* clusters of turns in either group of series are likely to be the exception rather than the rule. But the weight of our argument favors the presumption that new orders would typically show less dispersion than shipments, and the evidence to be presented is not inconsistent with this hypothesis.

Table 11-10 shows that the dispersion of leads and lags was greater for shipments than for new orders at nine of the eleven business

Table 11-10

Average Timing and Dispersion for Paired Series on New Orders and Shipments at Each Business Cycle Turn, 1919–38

(timing and deviation in months)

Reference Turn	No. of Indust. or Prod. Covered[a] (1)	Timing of New Orders at Business Cycle Turns: Av. Lead (−) or Lag (+) (2)	Timing of New Orders at Business Cycle Turns: Stand. Dev. (3)	Timing of Shipments at Business Cycle Turns: Av. Lead (−) or Lag (+) (4)	Timing of Shipments at Business Cycle Turns: Stand. Dev. (5)	Timing of New Orders at Shipments Turns: Av. Lead (−) or Lag (+)[b] (6)	Timing of New Orders at Shipments Turns: Stand. Dev. (7)	Corr. Bet. Avg. Leads in Cols. 2 and 6 (8)
Trough Apr. 1919	11	−2.6	2.5	0.0	5.0	−2.6	3.7	−.29
Peak Jan. 1920	11	−1.4	4.1	+1.7	7.2	−3.1	6.7	.19
Trough July 1921	11	−5.5	3.0	−5.7	7.9	+0.2	5.9	−.51
Peak May 1923	12[c]	−4.0[d]	5.6[d]	+3.0	4.4	−7.0	5.7	.65
Trough July 1924	11[e]	−4.1	4.3	+1.0[f]	7.5[f]	−5.1	7.2	.23
Peak Oct. 1926	14	−11.5	4.0	−10.1	5.0	−1.4	5.5	.49
Trough Nov. 1927	12	−3.8	6.7	+1.2	6.6	−5.0	4.7	.37
Peak June 1929	12	−5.0	5.0	−1.0	6.8	−4.0	4.9	.07
Trough Mar. 1933	13	−2.3	4.9	+0.8	6.6	−3.1	6.6	.37
Peak May 1937	13	−2.9	2.8	+0.3	3.8	−3.2	3.5	.29
Trough June 1938	13	−4.2	3.0	−0.4	4.2	−3.8	4.4	.39

Note: The observations summarized in this table relate to series identified in Table 11-9.

[a] Equals the number of observations included in each of the averages on the given line, columns 2 to 7, except as noted below.

[b] Taken with opposite sign, these are the inferred average "delivery periods." They equal the algebraic differences of the corresponding entries in columns 2 and 4.

[c] The entries in this line are based on nine observations. Three series of shipments skip this turn.

[d] Two series of new orders skip this turn. If all ten observations are used (instead of the nine that correspond to the shipments turns), an average lead of −4.8 is obtained, with a standard deviation of 5.8.

[e] The entries in this line are based on seven observations. Four series of new orders skip this turn.

[f] Three series of shipments skip this turn. If all eight observations are used (instead of the seven that correspond to the new-order turns), an average lead of +0.4 is obtained, with a standard deviation of 7.2.

cycle turns of the interwar period (cf. columns 3 and 5).[21] Only at the 1923 recession was σ_s considerably smaller than σ_n; at the 1927 recovery the two were approximately equal. In other instances, σ_s/σ_n falls within the range 1.3–2.6.

The standard deviations of the leads of new orders at turns in shipments, i.e., of the delivery periods (σ_d), are also usually smaller than σ_s, but larger than σ_n. (A comparison of corresponding entries in columns 3, 5, and 7 of the table will show two exceptions from either part of this statement.)

The cyclical leads of new orders and the delivery periods are positively correlated in all but two of the eleven episodes covered (column 8). But the correlations are typically not high enough to vitiate the hypothesis that $\sigma_s > \sigma_n$.

Thus, data for individual industries (covering mainly the interwar period) suggest that the cyclical turns of shipments tend to be more widely dispersed than the cyclical turns of new orders: a tentative finding in favor of the hypothesis.[22] The same type of dispersion analysis was applied to the paired aggregative series for 1948–61, first to the pre-1963 OBE data and then to the current Census series when these became available. Table 11-11 presents the results, beginning with those based primarily on the current data.

The first section of the table refers to six major durable goods industries and the group of nondurable goods industries reporting unfilled orders. Standard deviations are larger for shipments than for new orders on four occasions.[23] In the other four episodes the opposite ob-

[21] These measures are based on a subsample of observations for paired order and shipments series drawn from the sample of Table 11-9. The number of series included at the successive turns varies, since the series differ in length and timing. Here and elsewhere in the tests discussed in this section only the matching new-order and shipments turns are included, but adding the few unmatched turns would not alter the results in any significant way.

Corresponding measures were also compiled for 1948–54, but only five to seven items are covered. The results tend to confirm the hypothesis. At the peaks of 1948 and 1953, σ_s equals 5.8 and 8.9; σ_n equals 5.8 and 3.9. At the troughs of 1949 and 1954, σ_s equals 5.4 and 5.3; σ_n equals 2.5 and 2.4.

[22] The leads and lags of two series at a common set of reference dates would be influenced in a parallel fashion by any errors in these dates, which may introduce a bias toward positive correlation between such timing observations. However, this should not have any systematic effect on the measures of timing dispersion. A shift in a reference date has the effect of adding a constant algebraically to each of the leads and lags measured from that date; it has no effect at all on the deviations of the leads and lags from their own mean, since these depend only on the dates of the specific turns involved, which are given.

[23] Compare the second and fourth lines of Table 11-11. Because of the disturbing influence of the 1956 steel strike, entries in column 5 exclude primary metals. Inclusion of the observations for this industry would result in a value of σ_n slightly higher than σ_s (the figures are 6.0 and 5.7, respectively).

tains, that is, $\sigma_s < \sigma_n$, but in two of these cases the observed differences are small and probably insignificant. However, σ_n definitely exceeds σ_s at the 1953 recession and the 1961 recovery.

The new data for market categories permit comparisons at the five business cycle turns of the period 1954–61. On two of these occasions, the differences between the standard deviations are very small or negligible, and on two others σ_s is much greater than σ_n. The remaining episode, in which σ_n is clearly larger than σ_s, is for the 1956–57 period, when there was a major steel strike with particularly strong effects on the relative timing of new orders and shipments.

The third section of Table 11-11 is based on the pre-1963 OBE series for seven major durable goods industries and four major nondurable goods industries. These data provide greater diversity of industrial coverage, which is a favorable factor in the present context. Broad coverage seems required by the hypothesis tested inasmuch as it produces that diversity of supply conditions which is expected to make the scatter of turning points on the production side wider than the corresponding scatter on the demand (i.e., new-order) side. The results for this set of eleven industries are again mixed, but the dispersion of turning points is somewhat greater for shipments than for new orders. In four instances, the differences between σ_n and σ_s are negligible (and, incidentially, evenly divided as to their signs). In three others, $\sigma_s > \sigma_n$. Only at the 1961 recovery did σ_n definitely exceed σ_s according to these data.

Finally, for the set of twenty-seven components of the durable goods sector, $\sigma_s \simeq \sigma_n$ at two of the seven business cycle turns covered; $\sigma_s > \sigma_n$, at three of them; and $\sigma_s < \sigma_n$ at two.

To sum up, the measures assembled in Table 11-11 are on the whole consistent with the hypothesis that new orders show more agreement in their timing at business recoveries and recessions than do shipments. However, an appreciable part of the assembled evidence is neutral or unfavorable to the hypothesis. Averages of the standard deviations weighted by the numbers of observations at each turn are larger for shipments than for new orders in all cases, but the margins of difference are small. This is shown in the first two lines of the tabulation on page 566, which are computed from the four sets of measures given in Table 11-11.

Table 11-11

Average Timing and Dispersion for Paired Series of New Orders and Shipments at Each Business Cycle Turn, Major Manufacturing Industries and Divisions and Market Categories, 1948–61

	Lead (–) or Lag (+), in Months, at Business Cycle Turns							
	Peak Nov. 1948 (1)	Trough Oct. 1949 (2)	Peak July 1953 (3)	Trough Aug. 1954 (4)	Peak July 1957 (5)	Trough April 1958 (6)	Peak May 1960 (7)	Trough Feb. 1961 (8)
SEVEN MAJOR INDUSTRIES [a]								
New Orders								
Av. lead (–) or lag (+)	–5.4	–4.0	–5.1	–8.1	–8.2	–2.6	–12.0	–2.6
Standard deviation	3.6	2.8	2.1	2.9	4.7	1.3	3.2	3.7
Shipments								
Av. lead (–) or lag (+)	–2.6	–0.8	–1.1	–0.7	–6.7	+1.1	–5.4	–0.1
Standard deviation	4.5	2.3	1.1	2.8	6.2	6.0	5.0	1.0
SIX MARKET CATEGORIES [b]								
New Orders								
Av. lead (–) or lag (+)				–8.0	–6.2	–1.8	–8.3	–1.7
Standard deviation				2.3	4.1	0.9	5.7	1.4
Shipments								
Av. lead (–) or lag (+)				–3.7	–3.8	+0.7	–8.2	–0.3
Standard deviation				3.9	2.9	1.6	5.6	1.1

				ELEVEN MAJOR INDUSTRIES[c]				
New Orders								
Av. lead (−) or lag (+)	−6.6	−3.8	−5.8	−7.5	−8.0	−1.4	−7.3	−2.9
Standard deviation	3.8	2.5	3.4	2.3	3.8	2.7	5.6	2.2
Shipments								
Av. lead (−) or lag (+)	−3.6	−0.8	−1.8	−1.1	−4.6	+0.1	−5.0	−1.6
Standard deviation	4.7	2.3	3.2	4.4	4.9	2.8	5.7	1.2
				TWENTY-SEVEN DURABLE GOODS SUBDIVISIONS[d]				
New Orders								
Av. lead (−) or lag (+)		−4.2	−6.8	−6.3	−12.0	−1.7	−8.1	−2.4
Standard deviation		3.0	6.4	2.7	6.2	2.6	5.7	3.0
Shipments								
Av. lead (−) or lag (+)		+0.2	−2.6	−0.3	−7.0	+1.0	−6.1	−0.9
Standard deviation		4.0	5.2	4.4	7.6	2.5	4.2	3.0

[a] Based on new Census data since 1953 and on the older OBE data for the earlier years. The seven industries are primary metals, fabricated metal products, electrical machinery, machinery except electrical, transportation equipment, other durable goods, and nondurable goods industries reporting unfilled orders. All observations for these industries that are listed in Table 11-2 are included, except primary metals at the 1957 peak. The observations for shipments match those for new orders. The numbers of leads or lags included in each of the entries for these seven industries are: column 1, five; columns 2 and 5, six; other columns, seven.

[b] Based on new Census data beginning in 1953. The six market categories are home goods and apparel; nonautomotive equipment and defense; automotive equipment; machinery and equipment industries; construction materials, supplies, and intermediate products; and other materials, supplies, and intermediate products. All observations for these categories that are listed in Table 11-4 are included. The observations for shipments match those for new orders. Each of the entries covers six leads or lags.

[c] Based on OBE data of pre-1963 vintage. The eleven industries are primary metals, fabricated metal products, electrical machinery, machinery except electrical, motor vehicles and parts, other transportation equipment, other durable goods, textile-mill products, leather and leather products, paper and allied products, and printing and publishing. Matching observations only are used for new orders and shipments. The numbers of leads or lags included in each of the entries for these eleven industries are: column 1, seven; columns 2 and 8, eight; columns 3 and 4, ten; columns 5 and 7, nine; and column 6, eleven.

[d] Based on OBE data of pre-1963 vintage. See Table E-1, lines 1–27, for the industries covered and the observations for new orders included in the entries here. The relatively few and uncertain timing measures for the 1948 peak are excluded. Matching observations only are used for new orders and shipments. The numbers of leads or lags included in each of the entries for this group are: columns 2 and 7, twenty-one; columns 3 and 8, twenty; column 4, twenty-two; columns 5 and 6, twenty-five.

Weighted Average Standard Deviation

	Seven Major Industries	*Six Market Categories*	*Eleven Industries*	*Twenty-seven Subdivisions*
$\bar{\sigma}_n$	3.33	2.88	3.27	4.22
$\bar{\sigma}_s$	3.55	3.02	3.65	4.45
$\bar{\sigma}_d$	2.97	2.78	3.29	4.28

The last line of the table lists the corresponding averages of standard deviations for the leads of new orders at turns in shipments. It shows that the dispersion of these delivery lags is either somewhat smaller or about as large as the dispersion of the leads of new orders at business cycle turns.

The leads of new orders at business cycle turns and the leads of new orders at turns in shipments are as a rule positively, but not closely, correlated. The higher these correlations and the lower the relative dispersion of the delivery lags, the greater is the chance that the hypothesis will be contradicted by the data.[24]

Theories of business cycles that stress factors which are supposed to produce comovements of demand across industries would be supported by the finding that new orders and contracts for various types of products tend to reach peaks and troughs at about the same time. Other hypotheses may involve systematic sequential developments on the demand side, rather than more concentrated and randomly ordered turning points, and they may imply different results. Some monetary theories of the cycle might belong to the former category, some investment theories to the latter. Such considerations suggest that an extended and improved analysis along the above lines should be of substantial interest. However, the information on hand is too limited for this task, and more comprehensive data for longer historical periods are not available.

[24] Recall that

$$\sigma_s^2 = \sigma_n^2 + \sigma_d^2 - 2r_{nd}\sigma_n\sigma_d$$

[see equation (1), above]. If $0 < r_{nd} > (\sigma_d/2\sigma_n)$ then $\sigma_s < \sigma_n$. In the case of $\sigma_d = \sigma_n$, for example, this result would require that r_{nd} exceed $+0.5$; assuming that $\sigma_d = 0.8\sigma_n$, it would require only that r_{nd} exceed $+0.4$.

Unfilled Orders: Aggregate and Individual Series

Measures of cyclical timing and conformity for the series on unfilled orders are presented in several tables. It will be seen that they parallel to a large extent the measures developed in Chapter 6 for the relations between unfilled orders and shipments (used as an indicator of industrial activity). References to these similarities help to shorten the exposition below.

Durable and Nondurable Manufactures

Table 11-12 lists the timing of the most comprehensive series of order backlogs at each recession and recovery since 1920. It shows the same type of differences between peaks and troughs and between strong and weak backlog expansions as were observed before in Chapter 6 (where the series are plotted in Charts 6-2, 6-3, and 6-4).

Unfilled orders appear to have been relatively small and declining during most of the 1920's, and their timing then was irregular but on the average roughly coincident, judging from the rather narrowly based Commerce index (Table 11-12). They were, of course, very small in the depression of the next decade, and their broad movements were then closely synchronous with the course of manufacturing and general economic activity. But when the backlogs grew very large relative to production, in the 1940's, their leads at business cycle peaks as well as at the downturns in manufacturing output and shipments became very long. The tendency of unfilled orders to coincide at business troughs (Table 11-12, columns 4–6) also recalls the results obtained from the relative timing analysis of the manufacturing series, as does the reduction in the leads of durables backlogs at the more recent recessions as compared with the early postwar ones.

The evidence suggests that backlog contractions are often much slower and longer when they start from very high levels than when they start at relatively low peaks. Of course, this is not inevitably so. The reverse could happen if the average rate of *net* backlog liquidation were sufficiently higher in the cycle with the larger accumulation of unfilled orders. But this is apparently not a very likely situation, for reasons that are not difficult to perceive. It is in the advanced stages of vigorous business expansions that unfilled orders become exceed-

Table 11-12
Timing of Comprehensive Series on Unfilled Orders at Each Business Cycle Turn, 1920–61

	Date of Reference Peak	Lead (–) or Lag (+), in Months: Durable and Nondurable Goods (1)	Durable Goods (2)	Nondurable Goods (3)	Date of Reference Trough	Lead (–) or Lag (+), in Months: Durable and Nondurable Goods (4)	Durable Goods (5)	Nondurable Goods (6)
1	Jan. 1920	+4			July 1921	+6		
2	May 1923	–2			July 1924	–1		
3	Oct. 1926	–10			Nov. 1927	0		
4	Aug. 1929	–4			Mar. 1933	–2		
5	May 1937	–1	–1	–1	June 1938	–1	0	–5
6	Feb. 1945	–26[a]	–26[a]	–21[a]				
7	Feb. 1945	–27	–27	–18	Oct. 1945	0	0	0
8	Nov. 1948	–22	–25	–18	Oct. 1949	–2	–1	–4
9	July 1953	–10	–10	[b]	Aug. 1954	0	0	–8
10	July 1957	–7	–5	–20	Apr. 1958	+5	+5	–1
11	May 1960	–6	–7	–4	Feb. 1961	+1	+1	–1
	Av. lead (–) or lag (+)				Av. lead (–) or lag (+)			
	1920–60	–8.5			1921–61	+0.6		
	1937–60	–12.2	–12.5	–12.2	1938–61	+0.5	+0.8	–3.2
	Av. dev. 1937–60	8.2	9.0	7.8	Av. dev. 1938–61	1.7	1.4	2.5

Source: Measures on lines 1–4 are based on indexes compiled by the Department of Commerce from individual unfilled orders series (see text and note 3). Measures on lines 5 and 6 are based on the National Industrial Conference Board indexes (see text note 2); and those on lines 7–11, on the OBE-Census estimates of the dollar value of manufacturers' unfilled orders (see text above).

[a] Excluded from the average.

[b] Not matched. The specific-cycle peak of March 1951 is regarded as an "extra" turn associated with Korean War developments (see Chart 6-4).

ingly high. Buyers then still attempt to place large amounts of new orders. If the net rates of backlog decumulation are to be increased, producers must limit acceptance of new commitments and/or speed up deliveries. Drastic measures of either kind may be necessary to obtain the desired effect, and many manufacturers will probably be partly unwilling and partly unable to take them. Order limitation is known to be practiced in some industries, but it is difficult to detect its effects in the aggregate data. Certain relevant factors are essentially beyond the manufacturers' control, at least in the short run: the capacity limits on the firms' current operations and the rates at which customers try to place new orders, as well as the urgency of their efforts to buy. When all this is considered, it is not surprising that the net outcome should be *gradual* reductions of backlogs from their top levels. But as long as unfilled orders while slowly receding are still voluminous, current manufacturing operations have a firm basis—indeed, here is a factor that can (and at times demonstrably does) contribute substantially toward the maintenance and prolongation of industrial prosperity. Hence, we see the long backlog leads at the peaks of those business cycles to which the large backlog cycles correspond.

Major-Industry Series

The comprehensive series on manufacturers' unfilled orders turned down late in 1946 or early in 1947 and declined gently for a long time before falling off more sharply during the 1948–49 recession (Chart 6-4). Their major downturns thus preceded the 1948 business peak by as much as seven quarters or two years (Table 11-13, column 1). At the next recession, in 1953, the lead of aggregate backlogs was ten months —again quite substantial but less than half as long as at the first postwar expansion. Smaller and less pervasive reductions in this lead can be observed at the 1957 and 1960 recessions, when unfilled orders for all manufacturers and the durable goods sector turned down five to seven months before the reference dates (cf. Table 11-13, columns 3, 5, and 7).

As was shown in Chapter 6, the timing of aggregate backlogs at successive peaks in shipments shifted even more drastically: from very long leads in the late forties and the early downturns in 1952 to short leads and, even, frequent lags during 1957–62. On the hypothesis that this trend is associated with the decrease in the relative size and pro-

Table 11-13
Timing of Value of Manufacturers' Unfilled Orders at Each Business Cycle Turn, by Major Industries, 1948–61

Industry	Lead (−) or Lag (+), in Months, of Unfilled Orders at Business Cycle Turns							
	Peak Nov. 1948 (1)	Trough Oct. 1949 (2)	Peak July 1953 (3)	Trough Aug. 1954 (4)	Peak July 1957 (5)	Trough Apr. 1958 (6)	Peak May 1960 (7)	Trough Feb. 1961 (8)
All manufacturing	−22[a]	−2	−10	0	−7	+5	−6	+1
Durable goods, total	−25[a]	−1	−10	0	−5	+5	−7	+1
Primary metals	+1	−1	−11	0	−11	+2	−6	+1
Blast furnaces and steel mills	n.a.	n.a.	n.a.	0	−11	+2	−6	0
Fabricated metal products	−3	+2	−10	+2	−15	+1	−5	0
Electrical machinery[b]	−22	−5	−6[c]	+5	−5	−3	−7	+4
Machinery exc. electrical[b]	−21	+2	−17	+3	−7	+3	−5	+3
Transport. equipment	−12	−2	−5[d]	−3	−10	n.t.	n.t.	n.t.
Other durable goods[e]	−7	−2	−4	0	−14	0	−10	0
Nondurable goods industries[f]	−18[a]	−4	[g]	−8	−20	−1	−4	−1

Notes to Table 11-13

n.a. = not available.

n.t. = no turn in unfilled orders.

Note: All measures in columns 4–8 and some in columns 1–3 are based on the new Census data (1963 revision) which begin in 1947 for the over-all aggregates and in 1953 for the component industries. Most of the measures in columns 1–3 are based on the older OBE data.

[a] See Charts 6-3 and 6-4 for the underlying series on backlogs of durable and nondurable goods. For total manufacturing and all durables, both the old data (Chart 6-3) and the new (Chart 6-4) show downward trends through 1947–48 and most of the 1949 recession. For nondurables, Chart 6-3 shows a peak in December 1947. Chart 6-4 shows one in May 1947, which is used here.

[b] The pre-1953 measures are based in part on unpublished data received from the Department of Commerce, Office of Business Economics.

[c] Minimum lead based on the Census series, which declines from its beginning in January 1953. Earlier OBE data show a mild increase between March and July 1953 and hence would indicate a different (coincident) timing of these backlogs.

[d] Timing difficult to establish as unfilled orders were slightly higher in June than in February of 1953, according to the new Census data; February is viewed as the peak date on the basis of the evidence of moving averages. Earlier OBE data point unequivocally to February.

[e] Includes professional and scientific instruments; lumber; furniture; stone, clay, and glass; and miscellaneous industries.

[f] Includes textiles, leather, paper, and printing and publishing.

[g] Not matched. Unfilled orders declined steeply after the March 1951 peak associated with Korean War developments, except for a small increase in November 1952–May 1953 (Chart 6-4).

duction-sustaining capacity of unfilled orders, one would expect it to show up directly in the comparisons involving the specific output or shipments series; its manifestations in the comparisons at turning points in general business activity are of the derived type and may therefore be weaker. Actually, the results of the two sets of measures for the 1948 and 1953 turning-point zones are about the same. However, those for the 1957 and 1960 zones show significant differences. Backlogs led at these recessions, even though they nearly coincided with, or even lagged behind, shipments. As noted before, downturns in manufacturing activity came early on these occasions, which accounts for these observations.

The tendency for the leads of backlogs to become shorter shows up strongly in the measures for the machinery industries as well (Table 11-13). No such indications, however, are obtained for the other major components of the durable goods sector and the nondurable goods industries.

In contrast to the long or intermediate leads at peaks, the timing of unfilled orders at the postwar troughs in economic activity was on the average coincident. Short leads were more frequent at the revivals of 1949 and 1954, intermediate or short lags at those of 1958 and 1961. The timing of order backlogs relative to the corresponding turns in shipments was on the whole very similar (cf. Tables 11-13 and 6-1, columns 2, 4, 6, and 8).

In sum, there were 35 leads and only 1 lag at business cycle downturns. The leads generally exceeded three months; the count includes only 2 rough coincidences. On the other hand, at business cycle upturns there were 12 leads, 9 exact coincidences, and 16 lags. Only seven of these observations were leads and lags exceeding three months and as many as 30 were rough coincidences.

For each of the industries, the average of the timing measures at peaks was a lead. These averaged from −6.8 months for primary metals to −14.0 months for the nondurables group; the figure for all durables is −11.8 months. Of the averages at troughs, seven were short lags and three were short leads; the former varied from +0.5 to +2.8, the latter from −0.5 to −3.5 months. The recession-revival contrast here is so systematic that no good purpose would be served in discussing the all-turns averages.[25]

The aggregative backlog series covered in Table 11-13 missed business cycle turns in as few as 4 instances out of the 77 opportunities to do so in the years 1948–61. They also had very few extra turns in this period so that their cyclical conformity, allowing for timing differences, was very good. Furthermore, the general smoothness of these series enhances the reliability of this record. However, short but sharp declines in unfilled orders of several industries occurred in 1962, and again in 1966–67, years that witnessed slowdowns in economic activity. Scattered countercyclical movements occurred at other times, notably in primary metals during the 1963–65 period, but these fluctuations have generally been shorter than the movements recognized as specific cycles in the National Bureau studies. The most recent high point in manufacturers' unfilled orders occurred in May 1969, about

[25] The long leads at the early postwar peaks result in large average deviations of the corresponding timing measures. The peak-trough differences could be exaggerated by a few extreme observations with opposite signs. However, this actually does not happen. Medians, which are not affected by extreme items, show much the same type of timing relations as the means, which are so affected.

six months before what now seems a likely date of another business cycle peak.

Again, the patterns observed for the comprehensive series in the current Census compilation are confirmed by the record of the pre-1963 OBE data for the more narrowly defined industrial subdivisions. This supporting evidence is presented in Appendix E, part III.

Market Categories

Table 11-14 shows the timing of unfilled orders for six market categories at each successive business cycle turn during 1954–61.[26] These series begin in 1953 and their timing at the mid-year downturn in business activity is uncertain. Typically, these series were at their highest levels near the beginning of the year. They then declined through the 1953–54 recession, indicating leads of at least five to six months. Information suggests that some of these leads were probably a good deal longer.[27]

Unfilled orders for all categories of nonmilitary items show basically conforming behavior in that their peaks and troughs can be matched with business recessions and revivals, respectively. Extra declines in these series occurred in 1962, but they were relatively mild, except for the backlogs of consumer goods orders. The latter category (home goods, apparel, and consumer staples) also shows a small and hesitant but rather long decline in 1964 and the first half of 1965.

Unfilled orders for defense products, on the other hand, show a rather different time path, with fewer and weaker links to the cyclical movements of the economy. Their highest level in 1953 was reached in June, one month before the reference peak; and their subsequent decline was not reversed until mid-1955. There followed a rise to a high plateau in the fall and winter of 1956–57, then a protracted, gradual decline through 1962, and afterward another upward movement which intensified beginning early in 1965.

All observations at the 1957 and 1960 recessions are leads of backlogs. These vary from three to eleven months, but most fall in the intermediate range of five to eight months (Table 11-14, columns 2 and

[26] The data are from the current Census compilation, first published in 1963. They are described in Chapter 6 and shown in Chart 6-6.

[27] Note (Table 11-13, column 3) the ten-month leads of the first two comprehensive backlog series at the July 1953 peak.

Table 11-14
Timing of Value of Unfilled Orders at Each Business Cycle Turn, Six Market Categories, 1954–61

Market Category [a]	Lead (−) or Lag (+), in Months, of Unfilled Orders at Business Cycle Turns					Av. Lead (−) or Lag (+), in Months	
	Trough Aug. 1954 (1)	Peak July 1957 (2)	Trough April 1958 (3)	Peak May 1960 (4)	Trough Feb. 1961 (5)	Peaks (6)	Troughs (7)
Home goods, apparel, and consumer staples	0	−7 [b]	−1	−5	+1	−6.0	0
Equipment and defense products, incl. automotive	+4	−5	+4	−11 [c]	n.m.	−8.0	+4.0
Defense products	+10	−10	n.m.	n.m.	n.m.	[d]	[d]
Machinery and equipment industries	+4	−5	+4	−5	−3	−5.0	+1.7
Construction materials, supplies, and intermediate products	+1	−5 [e]	+1	−3	0	−4.0	+0.7
Other materials, supplies, and intermediate products	0	−8	+2	−6	+1	−7.0	+1.0

n.m. = not matched.

[a] For composition of these categories, see Chapter 3.

[b] Based on the secondary peak of unfilled orders in December 1956. The series reached a primary peak in October 1955, after which it slightly declined in the first and rose in the second half of 1956.

[c] Based on the peak in June 1959, which terminated a distinct but small rise that began in August 1958.

[d] Only one observation is available.

[e] Based on the peak in February 1957. The isolated high values of this series in April–May 1956 are disregarded.

4). Among the timing measures at the 1954, 1958, and 1961 revivals, short lags of one to four months prevail over short leads and coincidences (columns 1, 3, and 5). About all that can be inferred from this limited information is that these patterns are consistent with those observed generally in the industry series.

Individual Industries or Products

Table 11-15 summarizes the record of cyclical performance for sixteen series on unfilled orders. When no allowance is made for differences between the periods they cover, these series are found to vary greatly in their timing. The averages at peaks range from long leads (eighteen months for machine tools) to intermediate lags (five months for foundry equipment). At troughs the variation is less, most series being on the average roughly coincident; the range of the means is here from a lead of four to a lag of seven months. Moreover, the timing of the series often varies considerably from one recession or revival to another.

Another way of describing the situation is to note that as many as 47 observations at peaks, or 72 per cent, are leads, while the lags number 15, or 23 per cent. At troughs, there are almost as many lags as leads, and most of the recorded timing intervals are short, i.e., "rough coincidences" (see the distributions of leads and lags in columns 4–7, particularly the summary in the last three lines).

These over-all measures, however, include the interwar period, when unfilled orders were on the whole small and roughly coincident with production, as well as the recent war and postwar years, when unfilled orders were large and led production at peaks by long intervals. When the pre-1945 observations used in Table 11-15 are separated from the post-1945 ones, a marked contrast is found between the results of the two sets, and it is in the expected direction. For the eleven pre-World War II series,[28] the timing average was −2.1 at recessions and (nearly) coincident at revivals. For all sixteen series covered in Table 11-15, the corresponding averages were −2.2 and +0.2 months in the period before 1945, and −15.8 and −2.5 months in the period after 1945. These figures again demonstrate the prevalence of very long leads of unfilled orders at the postwar recessions compared to

[28] See Table 11-15 for their identification and timing records. The five postwar series are machine tools, paperboard, oil burners, railroad freight cars, and oak flooring.

Table 11-15
Summary Measures of Timing of Unfilled Orders at Business Cycle Peaks and Troughs, Sixteen Industries or Products,[a] Various Periods, 1904–61

Period Covered[b] (1)	No. of Observations[c] (2)	Bus. Cycle Turns Skipped[d] (3)	Extra Spec. Cycle Turns[e] (4)	No. of Timing Observations at Peaks or Troughs That Are: Leads (5)	Exact Coincidences (6)	Lags (7)	Rough Coincidences[f] (8)	Av. Lead (−) or Lag (+) (months): Peaks or Troughs (9)	All Turns (10)
MACHINE TOOLS[g]									
1948–61	4	0	1	4	0	0	0	−18.0	−9.5
	4	0	1	2	0	2	3	−1.0	
PAPERBOARD[h]									
1926–57	6	1	3	6	0	0	2	−13.2	−9.0
	5	1	3	4	0	1	2	−4.0	
OIL BURNERS[i]									
1933–49	2	1	4	2	0	0	0	−12.5	−7.0
	3	1	4	2	1	0	2	−3.3	
TEXTILES[j]									
1923–33	3	0	1	3	0	0	0	−9.0	−4.8
	3	0	1	1	0	2	1	−0.7	
FURNITURE AND FLOORING[j]									
1921–33	3	0	0	3	0	0	1	−5.3	−4.4
	4	0	0	3	0	1	2	−3.8	
UNITED STATES STEEL CORPORATION[h]									
1904–33	8	0	0	6	1	1	4	−3.9	−2.7
	9	0	0	4	2	3	4	−1.7	
RAILROAD FREIGHT CARS[i]									
1927–57	5	1	2	4	0	1	1	−8.6	−2.1
	5	1	2	1	0	4	3	+4.4	

OAK FLOORING [k]									
1920–57	9	0	2	6	0	3	4	−4.0	−2.1
	8	0	2	5	0	3	2	0.0	
BRICK AND GLASS [j]									
1920–33	2	2	0	1	0	1	2	−0.5	−2.0
	2	2	0	2	0	0	1	−3.5	
WOODWORKING MACHINERY [g]									
1921–38	4	0	1	4	0	0	3	−4.0	−1.6
	5	0	1	4	0	1	4	+0.4	
IRON AND STEEL [j]									
1920–33	4	0	0	3	0	1	2	−2.8	−1.1
	4	0	0	1	2	1	2	+0.5	
FURNITURE [l]									
1924–38	3	0	1	2	1	0	2	−2.7	−0.4
	4	0	1	2	0	2	3	+1.2	
STEEL SHEETS [h]									
1919–33	4	0	0	2	1	1	3	+0.2	+0.4
	5	0	0	2	2	1	4	+0.6	
FOUNDRY EQUIPMENT [g]									
1926–38	3	0	0	0	0	3	1	+4.7	+3.2
	3	0	0	1	0	2	2	+1.7	
ELECTRIC OVERHEAD CRANES [g]									
1927–38	2	0	1	0	0	2	0	+4.5	+3.8
	3	0	1	0	0	3	2	+3.3	
TRANSPORTATION EQUIPMENT [j]									
1920–33	3	1	0	1	0	2	1	+2.0	+4.5
	3	1	0	0	0	3	1	+7.0	
Total									
Peaks	65	6	16	47	3	15	26		
Troughs	70	6	16	34	7	29	38		
All turns	135	12	32	81	10	44	64		

Notes to Table 11-15

Note: For each series, the entries on the first line in columns 2–9 are for peaks; the entries on the second line, for troughs.

[a] Ranked by the length of the average lead, all turns (column 10), from longest to shortest.

[b] Identifies the first and last reference turn that could be matched by the given series.

[c] Number of recorded timing comparisons (leads, lags, and coincidences) at business cycle peaks and troughs.

[d] Number of business cycle peaks and troughs that are not matched by cyclical turns in the given series. Corresponding entries in columns 2 and 3 add up to the number of business cycle peaks or troughs covered.

[e] Number of specific-cycle peaks or troughs in the given series that do not match business cycle peaks or troughs. Corresponding entries in columns 2 and 4 add up to the number of new-order peaks or troughs covered.

[f] Includes exact coincidences and leads and lags of one, two, and three months.

[g] In current dollars.

[h] In tons.

[i] Number.

[j] Components of an index, 1923–25 = 100, based on data in physical units.

[k] In board feet.

[l] Number of production days; based on data in value terms.

short leads at the interwar recessions. At revivals, short leads dominate in the postwar period and short lags or coincidences in the interwar period.

All but five of the sixteen series had a downturn (upturn) at each business cycle peak (trough) covered. It appears that unfilled orders for a variety of products rarely fail to participate in a general recession or revival. Some of the series show relatively frequent "extra" turns that imply additional movements shorter than the phases of the business cycle and in opposite direction. These episodes are concentrated in periods of widespread acceleration and retardation of economic activities, during which many different series had extra movements.[29] The average percentage of business cycle turns matched is 92; that of the specific-cycle turns matched is 81. According to these measures, no significant differences seem to exist between peaks and troughs; all but three of the series can be said to have had a good conformity record at either turn.

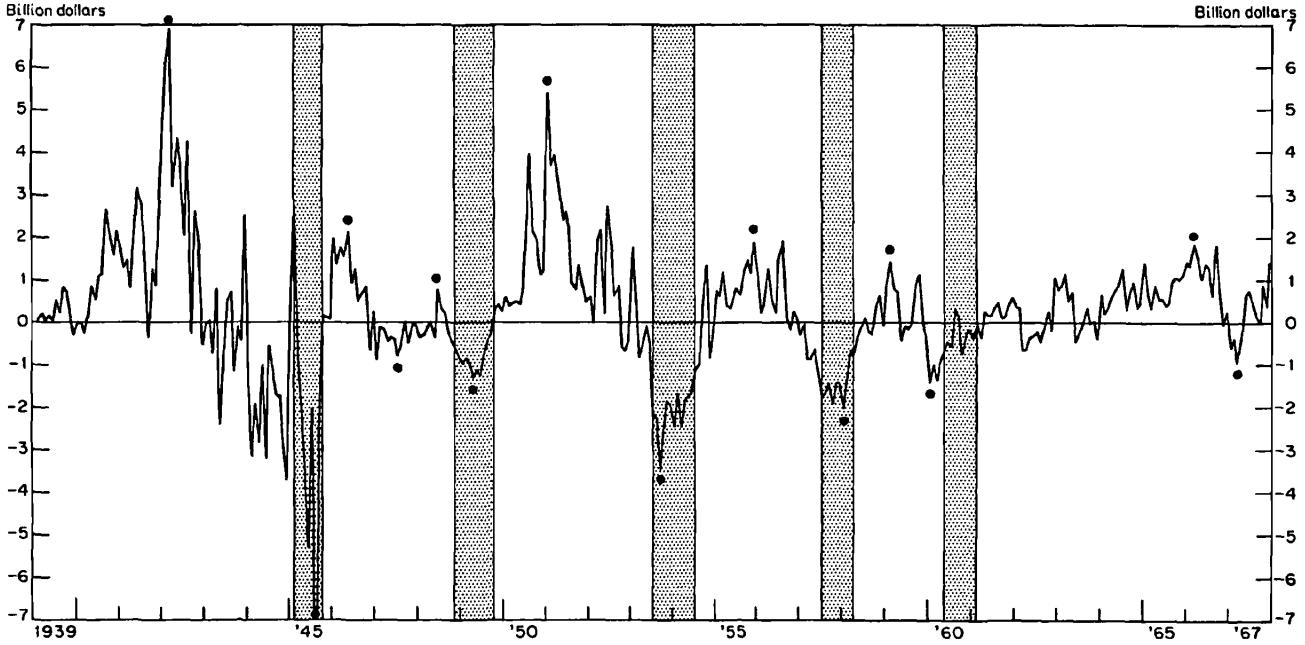
[29] Extra peaks occurred mainly in 1933–34, 1941–42, and 1950–51; extra troughs, in 1934–35, 1942–44, and 1951. These periods include the "double-bottom" configuration of the early thirties, some particular developments during World War II, and the mild "Korean cycle."

First-Difference Series

While the monthly series of order backlogs for various manufacturing industries are on the whole remarkably smooth, differencing transforms them into series of monthly changes that are typically very erratic. However, longer movements of the specific-cycle type are also definitely recognizable in several of these backlog-change series, even though they are overlaid and somewhat obscured by the short, irregular oscillations (which probably reflect mainly errors of measurement that are brought into sharp focus through the differencing procedure). The largest movements occurred during World War II and the Korean War, with sharp peaks in 1942 and 1951 (Chart 11-2). Smaller cycles appear in the series for all manufacturing and all durable goods industries in 1945–47, 1947–49, 1953–58, 1958–60, and 1960–67. Allowing for the pronounced tendency of the series to lead, all business cycle peaks and troughs in this period are matched by the like turns in these fluctuations. In addition, there are "extra" specific-cycle movements and turns in these series, associated with the business retardations of 1947 and 1966–67. Only in the early sixties did the changes in order backlogs show a prolonged hesitancy, in the form of very slow drifts from small negative to small positive values.

The first-difference series for the major component industries of the durable goods sector disclose similar cyclical patterns in the first decade covered (beginning in 1948). Negative values of ΔU prevail in each of the recessions, 1948–49, 1953–54, and 1957–58. Sharp peaks on the positive side show up during the Korean War period in 1950–51 and are followed by steep declines interrupted by small secondary rises in the first half of 1952. Generally lower positive values are observed at the height of the next expansion, in 1955–56, reflecting the prevalence of downward trends in backlogs during the 1950's. In particular, fabricated metal products and the group of other durables show only small and sporadic positive values of ΔU during the 1955–56 boom. The short and rather weak rise of business activity in 1958–60 leaves less of an imprint on these series, except for sharp fluctuations in primary metals due to the anticipations and effects of the 1959 steel strike. Several of the ΔU series in the early sixties look just like predominantly random short oscillations about the zero level with varying amplitudes. The declines in 1966 and again in 1969–70 (which

Chart 11-2
Month-to-month Change in Manufacturers' Unfilled Orders, Durable Goods Industries, 1939–67



Note: Shaded areas represent business cycle contractions; unshaded areas, expansions. Dots identify peaks and troughs of specific cycles.

began in the last quarter of 1968) are definitely cyclical in most of these series.

It appears that systematic elements are apparently most difficult to discern in the ΔU of those industries which produce mostly to stock and have, therefore, relatively small backlogs. These include the lumber products and the stone, clay, and glass products industries in the "other durables" group and also the nondurable goods industries reporting unfilled orders (textiles, leather, paper, and printing and publishing).

As long as new orders rise more rapidly than shipments, the rate of change in the backlog of unfilled orders (ΔU) will be increasing. But before turning down, new orders are likely to show an increase slower than that of shipments (whose expansion is not as yet so advanced). When this happens, ΔU will be at its peak. This suggests a lead of ΔU relative to N, and therefore often a long lead of ΔU at business cycle peaks. Moreover, another influential factor that can work in the same direction is the size of the total backlog. If unfilled orders have accumulated to large volumes in the expansion, they can sustain a rise in production even after a downturn in currently received orders. Hence, their lead relative to output and shipments is likely to be long. In such cases, then, the lead of ΔU will be long a fortiori.

Confirming evidence is provided below by the timing measures for the change in backlogs of durable goods orders (OBE-Census). These

Reference Peak	*Lead (−) of* ΔU *(mos.)*	*Reference Trough*	*Lead (−) of* ΔU *(mos.)*
Feb. 1945	−35	Oct. 1945	−2
Nov. 1948	−5	Oct. 1949	−6
July 1953	−30	Aug. 1954	−11
July 1957	−19	Apr. 1958	−3
May 1960	−15	Feb. 1961	−13
Av.	−20.8	Av.	−7.0
Av. dev.	9.4	Av. dev.	4.0

leads are much longer than those of new orders.[30] There is some indication that the peak leads have, here too, undergone some reduction in

[30] The corresponding averages for peaks (1948–60) are −10.2 for N and −17.2 for U. The averages for N and U at troughs (1949–61) are −4.8 and −8.2.

the recent years.[31] The results for total manufacturing are similar. Further documentation, consistent with the same general conclusions, is given in Table 11-16, which shows estimates of the timing of ΔU based on the current Census data for major durable goods industries. Finally, considerable support for our expectations concerning the cyclical timing of ΔU comes from the historical data on order backlogs of the U.S. Steel Corporation (first introduced in Chapter 6). Chart 11-3 presents quarterly first differences in this series (the data were reported quarterly during 1902–10 and monthly during 1911–33). As would be expected, the series (particularly in monthly terms) has a large irregular component, yet it has clearly undergone several longer cyclical movements. Measured trough to trough, six of these major fluctuations stand out. The last of these waves can be divided into two parts (1923–27 and 1927–33), though with some uncertainty since these movements are shallow and obscured by the short, small oscillations around the zero level that dominate this segment of the series.[32]

There is no doubt about the tendency of ΔU for steel products to lead at both the peaks and the troughs of business cycles. The leads are on the average long, even at troughs.[33] They vary greatly, from some in the range of rough coincidences to several exceeding a year or even two. The longest ones, of 27 and 33 months, are associated with the downturns of 1907 and 1918, which terminated the two longest business expansions in the period here covered. On both occasions, large backlog accumulations accompanied major upswings in the economy. In 1917–18 high wartime demand for steel had apparently caused an early downturn and a substantial depletion of the backlogs despite persistently high levels of steel output (Chart 6-1).

[31] The short lead at the November 1948 peak may appear surprising, but it is based on a secondary downturn in ΔU, terminating a mild rise in this series between mid-1947 and mid-1948; the basic trend in ΔU has been downward since 1946. The major peak in 1946 preceded the 1948 recession by 30 months.

The long lead at the July 1953 peak, on the other hand, can be questioned because it covers the entire decline in ΔU after the huge backlog accumulation during the first three quarters of the Korean War. This decline was interrupted by secondary gains in ΔU during the first half of 1952. Using the high value of ΔU in June 1952 to match the 1953 reference date would result in a lead of 13 months (see Chart 11-2).

[32] The series of backlog *levels* (Chart 6-1) has unmistakably passed through two specific cycles in the same years, but these movements were relatively small (except for the decline in 1930–31). It should be recalled that unfilled orders declined substantially and were generally rather small relative to production in the middle and late twenties.

[33] The mean of the leads of ΔU at the eight recessions of 1907–29 is −12.5 months. Omitting the last two observations, which are relatively uncertain, leaves the average unchanged. The mean of the leads at the nine revivals of 1904–33 is −10.3; excluding the last two observations again makes little difference (it reduces the average slightly, to −9.7).

Table 11-16
Timing of Changes in Unfilled Orders at Each Business Cycle Turn, Seven Major Durable Goods Industries, 1954–61

Industry	Lead (–) or Lag (+), in Months, of Backlog Change at Business Cycle Turn					Av. Lead (–) or Lag (+), in Months	
	Trough Aug. 1954	Peak July 1957	Trough Apr. 1958	Peak May 1960	Trough Feb. 1961	Peaks	Troughs
Primary metals	–10	–28 [a]	–3	–7	–11	–17.5	–8.0
Blast furnaces, steel mills	–10	–28 [a]	–4	–7	–11	–17.5	–8.3
Fabricated metal products	–14	–21 [a]	–5	–6 [b]	–8 [b]	–13.5	–9.0
Electrical machinery	–5	–28	–8	–11 [b]	–13 [b]	–19.5	–8.7
Machinery except electrical	–6	–20	–4	–14	–7	–17.0	–5.7
Transportation equipment	–11	–19 [a]	–6	n.t.	n.t.	[c]	–8.5
Other durable goods	–9	–23	–3	–16 [b]	–10 [b]	–19.5	–7.3

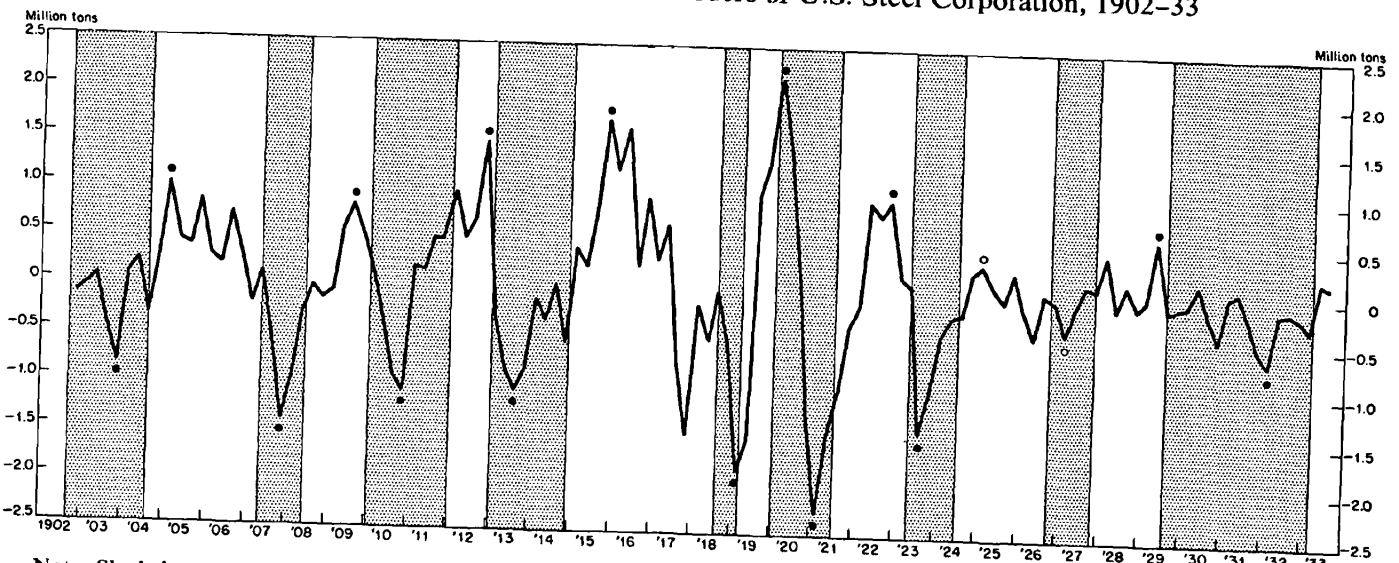
n.t. = no turn.

[a] Based on specific-cycle peaks in 1955. Sharp but isolated peaks in mid-1956, due to large orders for defense products, are disregarded.

[b] Timing particularly uncertain and difficult to establish.

[c] Only one observation is available.

Chart 11-3
Quarter-to-quarter Change in Unfilled Orders of U.S. Steel Corporation, 1902–33



Note: Shaded areas represent business cycle contractions; unshaded areas, expansions. Dots represent specific cycle turns; circles, minor turns.

In other business expansions that also rank high in relative magnitude, 1908–10 and 1921–23,[34] unfilled orders for steel products show smaller rises and the leads of ΔU at peaks are not very long. Steel production increased at particularly high rates in each of these periods, which probably provides a part of the explanation. These were short but vigorous upswings that followed upon fairly severe contractions during which backlogs fell to low levels. It may be helpful to recall that the amplitudes of business expansions are positively correlated with the amplitudes of the preceding (but not of the following) contractions.[35]

Summary

Comprehensive series show that new orders received by durable goods manufacturers led at each business cycle turn of the period 1921–70. Total advance orders (excluding those industries for which order backlogs are not reported) behaved similarly. The leads were, on the average, shorter at the troughs than at the peaks of the cycle—about five and eight months, respectively.

The tendency to anticipate business cycle turns with substantial regularity is shown by the less aggregative series on new orders of the component manufacturing industries. However, the leads of these series varied substantially from turn to turn. They were generally rather long at the recessions of 1957 and 1960 and at the revival of 1954, but tended to be short at the other revivals and at the recessions of 1948 and 1953 (according to preliminary results, probably also at the tentatively dated peak of 1970). For each major industry and for a large majority of the subdivisions, the average lead of new orders was longer at business cycle peaks than at troughs in the postwar periods for which such records can be established.

The new data for market categories confirm the leads of new orders, but they also reveal some rather marked differences in cyclical con-

[34] For a ranking of business expansions and contractions according to relative magnitude, based on the average rise and fall in three indexes of business activity, see "Leading and Confirming Indicators of General Business Changes," in Moore, ed., *Business Cycle Indicators*, Vol. I, pp. 91 and 104.

[35] See *ibid.*, pp. 86–93. Another episode that obviously illustrates the same correlation is the sequence of a mild contraction and moderate recovery in 1926–29. Both output and unfilled orders for steel had weak declines followed by weak rises in this period.

formities. The series for machinery and equipment and for materials, supplies, and intermediate products score high on conformity. Very low scores go to nondurable consumer goods, primarily staples made to stock. Automotive orders (differing little from shipments) show turning points that correspond to business cycle peaks and troughs but also marked extra movements. Defense orders are the most erratic, with large autonomous fluctuations.

The early cyclical movements of new orders are still more widely diffused than these series for major industries and their main components would suggest. Leads prevail over lags and coincidences for each item in a fairly large and varied collection of series for individual industries and products. These series cover different periods between 1937 and 1957 but give the best representation to the interwar years. Most of the average leads of new orders fall in the range of three to nine months, according to these data. The leads are in most cases longer at business peaks than at troughs. Their frequencies are generally too high to be attributable to change. Leads at business cycle turns are characteristic of both new orders and shipments (N and S) in some industries that customarily fill their orders on receipt or on short notice.

For these individual series of new orders, too, the over-all degree of conformity to business cycles is high. The series have rarely "skipped" business cycle turns by failing to reverse their own movement in correspondence with a general revival or recession. More frequently they (like the more aggregative series) show "extra" turns, which mark sizable movements that do not match business expansions or contractions. But again, the frequencies of conforming movements are, with few exceptions, too high to be attributable to chance.

For any period, the cyclical timing of S is determined by the cyclical timing of N and the delivery lag (of S behind N). Cyclical fluctuations in aggregate demand may impart considerable similarity to the timing of major turns in many new-order series. The dispersion of cyclical turning points could well be greater for the corresponding series on production and shipments because of the variation in delivery periods among different industries and products. However, convergent and approximately correct anticipations of buyers would work in the opposite direction; e.g., expectations of a recession may cause purchasers of

items with long (short) delivery periods to curtail their orders early (late).

Timing dispersion was measured at each of the recessions and revivals covered, for all available sets of paired series on *N* and *S*. The evidence for the more aggregative data (several industry and market-group classifications) does not refute the hypothesis that the turning points in new orders are usually more concentrated in time than those of shipments. However, the results here are fairly weak, mainly because the corresponding dispersion figures are often large and not significantly different for *N* and *S*. The evidence for the individual series, on the other hand, supports the hypothesis rather strongly, since the dispersion of leads and lags for these was greater for *S* than for *N* at nine of the eleven business cycle turns of the interwar period.

Unfilled orders were generally small and their cyclical timing was roughly coincident during the interwar period, judging from a sample of series for individual industries. Subsequently, as shown both by these data and the major-industry aggregates, manufacturers' backlogs of orders grew large and led by long intervals at business cycle peaks, while continuing to be approximately coincident at troughs. The leads were exceedingly long at the recessions of the forties, but were much shorter at the more recent business downturns, from 1953 or 1957 on. These results recall the timing comparisons of unfilled orders with shipments and can be similarly interpreted.

Series on the change in backlogs anticipate both peaks and troughs of the cycle. These leads are often very long, particularly in the late stages of major business expansions, when they signal slowdowns in the rise of new orders that occur well in advance of any slowdowns in the rise of production.