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# 4. *Materials Ownership, Durable Goods Manufacturers*

The task that now confronts us is primarily descriptive. It is necessary to learn how the several sorts of materials stocks on hand and on order behave, and how that behavior relates to fluctuations in flows of goods or flows of orders for goods.

Of course, description has no place to start or stop unless it is related to a question. Two sorts of questions alternatively provide the frame of reference that makes description feasible. The first is, What does the behavior of the data suggest about possible causal interrelations? Second, How do the activities of stocks participate in economic instability? Efforts to answer these questions form the substance of Part III.

Here they provide the point of view which guides how the behavior of the various time series is explored. This and the following chapter each constitute an examination of some particular type of information, and focus on data on stocks and outstanding orders proper, expressed in dollars or as ratios to sales; durable goods manufacturers are examined here and department stores in Chapter 5. Chapter 6 looks at rates of change in stocks—inventory investment. Chapters 7 and 8 concentrate on the relation between adjacent flows and the stock pools that they feed or drain.

The impact of stocks and, with many qualifications, of unfilled orders on the flows of income and output in the economy is measured primarily by the amount that they increase or decrease, period by period; it is measured, in other words, by rates of change. However, the level of stocks and of unfilled orders constitutes a resource (and in some senses an obligation) both for the economy at large and for the individual company, and thus influences and reflects a wide variety of judgments. It is necessary therefore to acquire a firm understanding of characteristic movements of stocks and unfilled orders proper.

Accordingly, we examine, for manufacturers of durable goods, the levels and patterns of fluctuations, during postwar years, of materials on hand and on order. In the second section we review how these patterns relate to those of shipments of manufacturers to their customers.

## *THE LEVEL OF OWNERSHIP*

Manufacturers of durable goods carried "raw" materials on hand or on order, the book value of which averaged about $20 billion during the seventeen years 1946–62. Monthly sales (shipments) averaged about half that amount—about $10 billion; that is, the book value of stocks covered about two months' sales. However, direct comparison of the two figures is misleading. In durable goods industries, materials typically constitute about half of the value of final sales; the rest of the value accrues in the course of manufacturing.[1] Con-

[1] This estimate is based on the relation between costs of materials and value of shipments for about

sequently, materials stocks on hand and on order, carried on the books at $20 billion, might have represented on the average the material required for about four months' sales.

Of total goods on hand and on order, stocks of materials on hand constituted about a third; outstanding orders of materials represented the other two-thirds.[2]

## *CONFORMITY AND TIMING*

### *Business Cycles*

The level of ownership underwent strong cyclical fluctuations, as the top curve in Chart 1 shows. Comparison with the shaded areas, which mark periods designated as business recession according to the National Bureau's business cycle chronology, indicates that ownership tends to conform with general business conditions with a persistent lead at peaks. Table 1 sharpens the visual comparisons. The columns of section A show timing at each business cycle peak and trough; in the B and C sections, various summary measures are given. Typically, durable goods manufacturers ceased expanding their ownership of materials well before peaks in business activities occurred; the median lead[3] was four and a half months (line 1, column B4). During business cycle recessions, on the other hand, declining ownership continues just about up to the trough in business with a lead or a lag of no more than two months.

### *Extra Movements*

Line 2 of the table uses the "subcycle" reference scheme. It consists of the business cycle dates plus two additional movements found in many economic events. The first was part and parcel of the transition from a war to a peace economy. Recessions have notoriously followed wartime expansion. As some of the more drastic aspects of the adjustment subsided in late 1946, the usual postwar recession was thought by many to be due. Of the executives responding to a questionnaire distributed by *Fortune* magazine in May 1947, 74 per cent said that they expected conditions to worsen. Rendigs Fels in a study of "Recognition of Cyclical Turning Points" discusses this episode as one of the most blatant examples of "false declarations" of cyclical turns. He notes that:

> In May 1947, in separate statements, two professors from the same university used almost identical language, one saying, "The long expected and long advertised recession is here," the other saying, "Beyond question, the long advertised recession is here." A month later, a news magazine with a large circulation said, "The nation's bumper crop of economic forecasters could now relax, tuck their thumbs in their vests, and say, 'We told you so.' The recession had officially begun."

Also, there appears to have been confirmation as the year rolled on. Fels recounts that:

> The mean of the forecasts of industrial production made in September by the group of forecasters

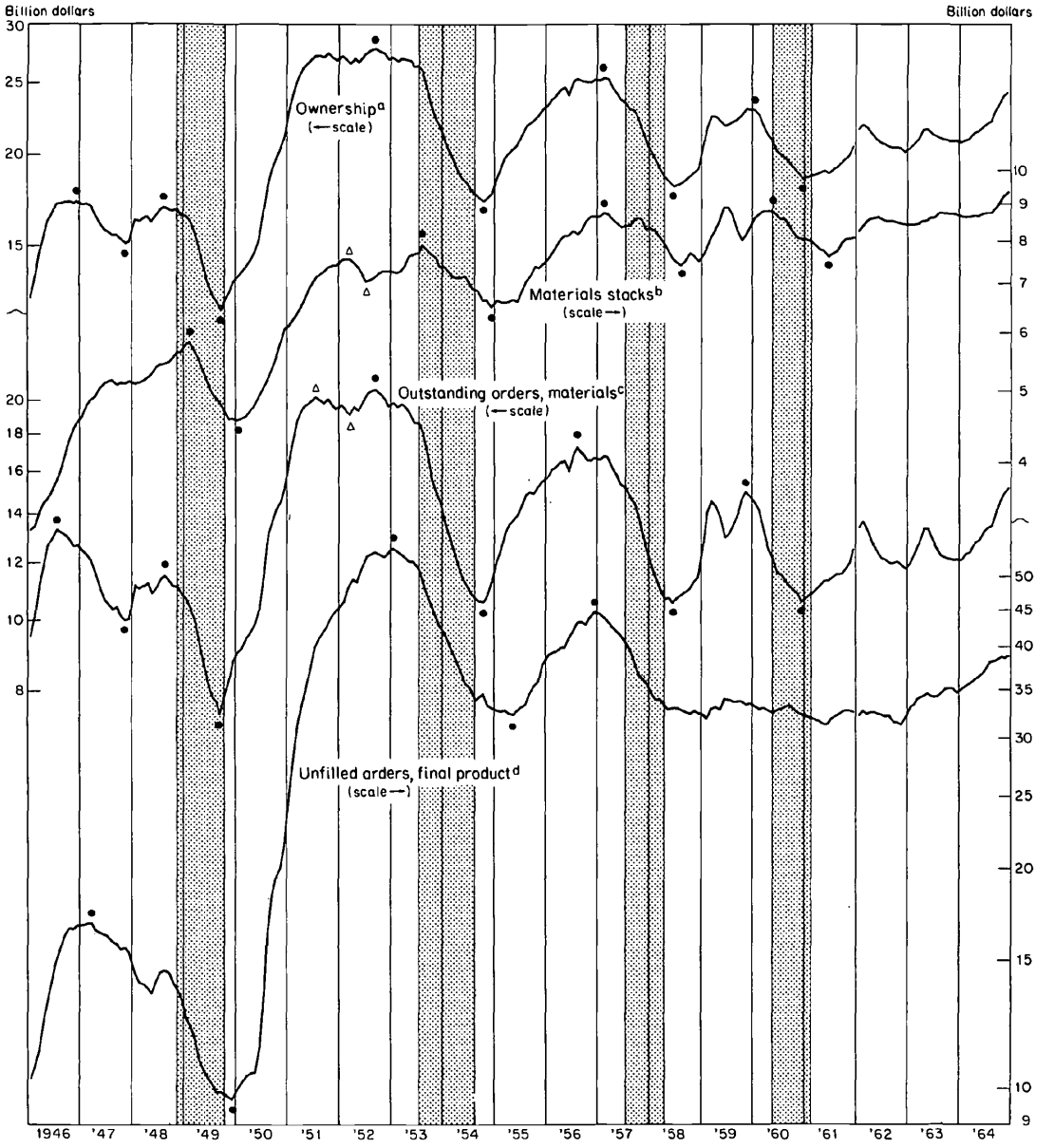
thirty-five of the larger industries covered in the durable goods field. The basic data were those of the 1958 *Census of Manufacturers,* Vol. 1, Table 3, pp. 1–6 ff. Value added is shipments minus cost of materials, which include also supplies, fuel, purchased electricity, and construction work. The median ratio for the various industries of value added to shipments fell in the upper portion of the .45–.49 size group. In view of the padded (for our purpose) definition of materials costs in the Census, the 50 per cent figure for values added is far more likely to be too low than too high. If so stocks represent a somewhat larger number of weeks' supply than the text suggests.

[2] The analysis of the OBE data in the previous chapter makes it clear that there is a wide margin of error in these figures. Certainly any finding that is dependent on fairly close measurements ought to be rejected. Fortunately the evidence throughout is sufficiently gross to be most unlikely to be vulnerable to errors in the figures.

[3] The term median is used to apply to the average of the middle two or three observations.

CHART 1

*Ownership, Stocks, and Unfilled Orders, Durable Goods Manufacturers, 1946–64*




Note: Shaded areas represent business contractions. Specific cycle turns are marked by dots, additional minor turns by triangles.

[a] The sum of lines 2 and 3. [b] Purchased materials stocks for all durable goods industries. [c] Unfilled orders for fabricated metals, primary metals, and other durables. [d] Unfilled orders for machinery and transportation equipment.

TABLE 1

*Timing: Stocks on Hand and on Order, Durable Goods Manufacturers, 1946–62*

Section A: Months Lead (-) or Lag (+) for Matched Turns[a]

| Line | Reference Series[c] | Chronology[b] P (1/47) | T (7/47) | P 11/48 | T 10/49 | P (2/51) | T (6/52) | P 7/53 | T 8/54 | P 7/57 | T 4/58 | P 5/60 | T 2/61 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Specific Series: Ownership* | | | | | | | |
| 1 | Business cycles | | | -3 | -1 | | | -10 | +2 | -5 | +2 | -4 | -2 |
| 2 | Subcycles | -1 | +4 | -3 | -1 | ⊕ | ⊕ | -10 | +2 | -5 | +2 | -4 | -2 |
| 3 | Outstanding orders | +5 | 0 | 0 | 0 | ⊕ | ⊕ | 0 | 0 | +6 | 0 | +2 | 0 |
| 4 | Unfilled orders, final product | -3 | ⊕ | ⊕ | -3 | ⊙ | ⊙ | -4 | -7 | +2 | ☊ | ☊ | -5 |
| | | | | | | *Specific Series: Stocks of Materials* | | | | | | | |
| 5 | Business cycles | | | +3 | +3 | | | +1 | +4 | -5 | +4 | 0 | +4 |
| 6 | Subcycles | ⊕ | ⊕ | +3 | +3 | +13 | +1 | +1 | +4 | -5 | +4 | 0 | +4 |
| 7 | Ownership | ⊕ | ⊕ | +6 | +4 | ☊ | ☊ | +11 | +2 | 0 | +2 | +4 | +6 |
| 8 | Outstanding orders | ⊕ | ⊕ | +6 | +4 | +8 | +4 | +11 | +2 | +6 | +2 | +6 | +6 |
| 9 | Unfilled orders, final product | ⊙ | ⊙ | +23 | +1 | ⊕ | ⊕ | +7 | -5 | +2 | ⊕ | ⊕ | +1 |
| | | | | | | *Specific Series: Outstanding Orders* | | | | | | | |
| 10 | Business cycles | | | -3 | -1 | | | -10 | +2 | -11 | +2 | -6 | -2 |
| 11 | Subcycles | -6 | +4 | -3 | -1 | +5 | -3 | -10 | +2 | -11 | +2 | -6 | -2 |
| 12 | Unfilled orders, final product | -8 | ⊕ | ⊕ | -3 | ⊕ | ⊕ | -4 | -7 | -4 | ⊕ | ⊕ | -5 |
| | | | | | | *Specific Series: Unfilled Orders, Final Product* | | | | | | | |
| 13 | Business cycles | | | -20 | +2 | | | -6 | +9 | -7 | ⊕ | ⊕ | +3 |
| 14 | Subcycles | +2 | ⊕ | ⊕ | +2 | ⊕ | ⊕ | -6 | +9 | -7 | ⊕ | ⊕ | +3 |

(continued)

[a]Specific series are matched with the indicated reference series (see note c) in accordance with the standard NBER rules. A double relaxation of rules is marked r; it applies to cases for well-conforming series in which two like turns are matched, though an unlike turn lies between them. The figure is underlined when subcycle chronology is the reference series, a minor cycle in the specific series has entered a comparison; or, when two individual series are compared, a minor cycle in either series has entered a comparison. When the business cycle chronology provides the reference, minor specific cycle turns are ignored. The meaning of other symbols is:

⊕ = Turn in the reference series does not appear in the specific series.

☊ = Turn in the specific series does not appear in the reference series.

⊙ = There is no turn in either series in the neighborhood of the chronology date.

[b]Chronology dates are business cycle reference dates. In addition, four minor subcycle dates, enclosed in parentheses, are added to form a subcycle chronology.

[c]Reference series are of three sorts: (1) the business cycle chronology as shown in column heads, excluding the dates in parentheses; (2) the

TABLE 1 (concluded)

| Line | Reference Series[c] | Section B: Average Timing of Turns — Number Matched | | | Median[e] | | | Average Deviation[f] | | | | Section C: Per Cent of Months in Like Phase[d] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | All Turns | | | |
| | | − | + | 0 | P | T | All | P | T | | Wt'd | Timing Adjustment[g] | % Mos. 7/46–12/61 |
| | *Specific Series: Ownership* | | | | | | | | | | | | |
| 1 | Business cycles | 6 | 2 | 0 | −4.5 | +0.5 | −2.5 | 2.0 | 1.8 | 1.9 | 1.9 | −2,−3 | 82 |
| 2 | Subcycles | 7 | 3 | 0 | −4.0 | +1.0 | −1.5 | 2.2 | 1.8 | 3.0 | 2.1 | −1,−2 | 75 |
| 3 | Outstanding orders | 0 | 3 | 7 | +2.3 | 0 | 0 | 2.3 | 0 | 1.4 | 1.1 | 0 | 89 |
| 4 | Unfilled orders, final product | 5 | 1 | 0 | −1.7 | −5.0 | −3.5 | 2.4 | 1.3 | 2.0 | 1.9 | −3 | 78 |
| | *Specific Series: Stocks of Materials* | | | | | | | | | | | | |
| 5 | Business cycles | 1 | 6 | 1 | +0.5 | +4.0 | +3.0 | 2.2 | 0.2 | 2.0 | 1.3 | +3 | 89 |
| 6 | Subcycles | 1 | 8 | 1 | +1.3 | +3.7 | +3.0 | 4.3 | 0.9 | 2.8 | 2.6 | +3 | 82 |
| 7 | Ownership | 0 | 7 | 1 | +5.0 | +3.0 | +4.0 | 3.2 | 1.5 | 2.4 | 2.4 | +4 | 82 |
| 8 | Outstanding orders | 0 | 10 | 0 | +6.7 | +3.3 | +6.0 | 1.5 | 1.3 | 1.9 | 1.4 | +6 | 81 |
| 9 | Unfilled orders, final product | 1 | 5 | 0 | +10.7 | −1.0 | +1.5 | 8.2 | 2.7 | 5.8 | 5.4 | +1,+2 | 70 |
| | *Specific Series: Outstanding Orders* | | | | | | | | | | | | |
| 10 | Business cycles | 6 | 2 | 0 | −8.0 | +0.5 | −2.5 | 3.0 | 1.8 | 3.9 | 2.4 | −2,−3 | 70 |
| 11 | Subcycles | 8 | 4 | 0 | −6.0 | +0.5 | −2.5 | 3.8 | 2.3 | 4.1 | 3.1 | −2,−3 | 74 |
| 12 | Unfilled orders, final product | 6 | 0 | 0 | −5.3 | −5.0 | −4.5 | 1.8 | 1.3 | 1.5 | 1.5 | −4,−5 | 77 |
| | *Specific Series: Unfilled Orders, Final Product* | | | | | | | | | | | | |
| 13 | Business cycles | 3 | 3 | 0 | −11.0 | +4.7 | −2.0 | 6.0 | 2.9 | 7.8 | 4.4 | +2,−2 to −6 | 61 |
| 14 | Subcycles | 2 | 4 | 0 | −3.7 | +4.7 | +2.0 | 3.8 | 2.9 | 4.2 | 3.3 | +2 | 56 |

subcycle chronology as shown in all column heads; (3) particular series whose specific cycles and minor cycles constitute the reference dates for comparison.

[d]The number of months during which the specific series is in like phase with the reference series is expressed as a percentage of the total number of months covered between dates as given.

[e]Median is the average timing of the center two or three turns.

[f]Average deviation from the median. The "weighted" (wt'd) average is the deviation from the median for peaks and for troughs separately, weighted by the number of turns.

[g]In determining months in like phase a timing adjustment is made which maximizes confluence. Before counting the months in phase, the specific series is in effect moved to the right to allow for a lead and to the left to allow for a lag if by so doing the percentage of months in like phase (as rounded) is increased. If the months in phase are as large or larger without an adjustment, this is indicated by a "timing adjustment" of 0.

In some cases we wish to know the percentage of months in phase on a synchronous basis, regardless of whether the percentage in phase is thereby maximized. If so, the "timing adjustment" is given as "none."

referred to as Set A in this investigation predicted a decline from a high in the first half of the year, the decline to continue for the year and a half covered by the prediction and to aggregate more than 10 per cent—clearly an amplitude of cyclical proportions. What is worse, every single forecaster in the group predicted a decline in industrial production.[4]

In view of the customary lag in forecasts relative to actual turns,[5] it is not surprising that a wide variety of time series showed a downturn which seemed to center in January. I had dated the upturn in July.[6]

The second episode was associated with the Korean War, which occasioned a burst of business activity in the second half of 1950. It culminated early in 1951; February was selected as the most representative month. Troughs in many sorts of activities occurred in June of 1952, though a number, particularly in nondurable goods industries, started to recover almost a year earlier.[7]

The large majority of the economic time series with which this monograph is concerned had specific cycle turns which appeared to be associated with the Korean episode and a number also with the postwar phantom recession.[8] Occasionally, movements in individual series at these or other times do not qualify as specific cycle turns according to National Bureau rules, yet do seem clear interruptions of the current cyclical phase. It has seemed unwise to lose sight of such movements for the purpose of describing the basic behavior of the times series during business cycles or for comparing one series with another. Accordingly, additional "minor specific subcycle" turns have occasionally been selected; they are shown on the charts by triangles.[9]

### *Subcyclical Timing*

Timing at subcycles, as line 2 of Table 1 indicates, includes behavior at both *business cycle and the two minor subcycle* turns. Ownership as a whole conformed to the first of the extra (minor) movements largely because of the strong drop in outstandings after the abnormalities of wartime expansion receded. But in the later phases of the Korean War, ownership leveled rather than dipped. The timing of ownership with respect to the reference subcycle chronology was virtually the same as previously described for business cycles only—a clear lead at all peaks, and mixed and therefore average synchronous behavior at troughs.

Characteristically, the two parts of ownership, stocks and outstandings, turn at different times. Stocks tend to lag the subcycle or cycle chronology, and by more at troughs than at peaks (median lags of four and one months,

[4] Rendigs Fels, "Recognition of Cyclical Turning Points," unpublished paper, National Bureau of Economic Research, 1963, p. 32.

[5] Fels found it typically to be between three and six months (*ibid.*, p. 32).

[6] Ruth P. Mack, "Notes on Subcycles in Theory and Practice," *American Economic Review, Proceedings,* May 1957, pp. 164–167; also, NBER, Annual Report, May 1957, pp. 53–56.

[7] *Ibid.*

[8] Turns in individual series selected by the National Bureau in accordance with standard procedures are referred to here as elsewhere as "specific cycle turns." They are marked on all charts by crosses placed above (peaks) or below (troughs) the curve.

[9] Note that selection of these minor movements, like the selection of specific cycles themselves, is constantly confronting marginal decisions. For example, the 1949-53 expansions in stocks of materials and outstanding orders, the second and third curves on Chart 1, were interrupted by a brief contraction early in 1951 or 1952 which was marked as a subcycle. For outstanding orders, the decision teetered on the margin, but the turns were marked. Ownership (top curve) had a slightly less clearly delineated hesitation at that time, and this was not marked. The marginal character of the selection of specific cycles is also evident when, for example, the extra movements in outstanding orders or ownership associated with troughs in 1947 are compared with other specific cycles in the same series or with the minor subcycles marked in material stocks in 1950–51.

The decision not to mark a movement can also be based on reasons other than that it is too mild. A strike affects stocks outstanding, orders, and sales, yet the phenomenon as a whole has a number of highly particular characteristics. For this reason I have consistently not marked the interruptions of expansion in 1959 associated with the steel strike; these occurred in many series.

respectively, line 6). Outstandings lead strongly at peaks (median lead of six months, line 11) and virtually synchronize at troughs. They share the business cycle pattern previously described for ownership. Direct comparisons between stocks and outstandings confirm the character of the difference. Line 8 of the table indicates the lead or lag of stocks at each turn in outstandings. The median lag is seven months at peak and three at troughs. And a lag of six months is the median for all turns.

Moreover, the relationship is reasonably systematic. The average deviation from the median for all turns is only 1.9 months—1.4 months if the average deviation for peaks and troughs is computed separately and then averaged (line 8, last column of section B). The chart also suggests substantial parallelism in the two series once the inflated unfilled orders of the immediate postwar years had been somewhat reduced and stocks correspondingly increased. (This counterpoised behavior appears again in 1952 and during the protracted steel strike in 1959.) Section C of the table indicates that from mid-1946 through 1961 the two series are in like specific cycle phase for 81 per cent of the months, after allowing for the average tendency for orders to lead by half a year. If comparisons are confined to 1948 and thereafter, 88 per cent of the months are in like phase. Apparently, then, outstandings exhibit substantial parallelism to materials stocks and lead them by a considerable interval, particularly at peaks.

A further indication of correlation appears in the impression that matched episodes in the two series seem to have about the same rank order with respect to their severity. The episodes to be compared can be selected by turning to Chart 1 and selecting matching expansion phases in materials stocks on the one hand and outstanding orders for materials on the other. They are the rises starting in late 1949 or early 1950, in late 1954, and in 1958; the first lap of the post 1961 expansion can also be included by selecting the top of the first rise in 1962 (which, however, has not been considered as a candidate for a specific peak because of the discontinuity of the data discussed in Chapter 3, page 64).

For both stocks and outstandings the specific cycle amplitude of the four expansions grew successively less. Also, in each case the amplitude for stocks was small relative to outstandings—between a quarter and a third the size; the average ratio was 29.8. This relationship remained remarkably stable. If this figure is used to estimate the rise in stocks by applying it to the rise in outstandings for each episode, the estimates on the average are within ±9 per cent of the actual figure.[10]

The long lead and considerable parallelism of the two series have interesting implications. The parallelism seems to support the suggestion to which the analysis of business problems pointed—that outstandings and stocks on hand had an intimate dynamic interrelationship. However, the length of the lead of outstandings is puzzling. The average number of months' supply held as stocks on order has probably not exceeded four months since 1947, or two and a half since 1953.[11] If this average tenancy period is the critical figure, it would seem that a decline or rise in outstandings would be transmitted to materials stocks via the inverse vestibule effects in far less time than leads at peaks ranging from six to eleven months imply. It will be useful to keep this puzzle in mind in the hope that additional information bearing on it will be uncovered.

[10] The ratios of the specific rise in stocks to those of outstandings during four matched episodes were 24.9, 33.2, 31.2, and 29.0. The average of these figures is 29.8. For each episode the rise in outstandings in dollars was multiplied by 29.8 to estimate the rise in stock for the corresponding periods. The estimated rise was divided by the actual rise and subtracted from 100 to get the percentage error or estimate. The errors for the four episodes were +19.4, −10.2, −4.0, +2.6.

[11] The estimates are based on doubling the ratio of unfilled orders to sales on the assumption that materials represent about half the value of final product and value added the other half.

*Unfilled Sales Orders*

By way of digression, it is interesting to compare unfilled orders for final products (the unfilled sales orders of the transportation equipment and machinery industries) with the outstanding orders placed by these companies for materials (goods produced by the fabricated metals, primary metals, and "other durables" industries). Total unfilled orders for the durable goods industries is the sum of those for the two groups. As the two lower curves on the chart suggest, the book value of unfilled orders for final products since 1951 averaged about twice that of the materials.

A comparison of the two curves throws light on the relation between unfilled orders for the product a company sells (often referred to as "back orders" or backlogs of unfilled orders in management literature) and unfilled orders for the materials a company buys (called materials orders outstanding, outstandings, or stock on order). The latter are, of course, "back orders" of producers of materials.

The two groups of unfilled orders behaved very differently. The decline in backlogs that followed the buildup of World War II was interrupted in 1948 for materials, but not appreciably for final products. There is another sharp contrast after the Korean War, when the continued upward movement of orders for final products indicated that production did not catch up with shipments of machinery and transportation equipment (including automobiles) for almost two years after balance had been restored in orders and shipments of materials. The huge backlogs of orders for durable equipment must certainly have tended to cushion the jar to economic expansion created by the post-Korean declines in many other lines. The 1954–58 movement was found in both series, but this time the percentage movement of final products was weaker than that of materials. From 1958 through 1962, unfilled orders for final products remained virtually constant, while those for materials moved in conformity with the cyclical tides of the period as well as with the temporary dip of early 1962. In general, it is clear that outstanding orders for materials respond sensitively to even minor business fluctuations, whereas those for finished machinery and transportation equipment take much more to set them in motion. As a result, many of the movements in outstanding orders for materials are unmatched by similar ones for final products. Line 12 of Table 1 shows that only six turns could be matched.

These facts about behavior do not seem out of line with the firm's-eye view. The size of back orders for the product a company sells affects the risk involved in advance orders for materials. Consequently it is reasonable to find that the former never fluctuated without corresponding fluctuations in the latter. However, since the presence of sizable back orders is only one of the things influencing ordering policy for materials, there is no reason why materials buying cannot undergo fluctuations, manifested in changing outstanding orders, at times when back orders for final product are level.

Perhaps also reflecting the variety of influences that shape the course of materials outstanding, turns in outstandings always preceded those in unfilled orders whenever they occurred. The median lead was five months (Table 1, line 12). Thus backlogs of sales orders were still increasing when purchased materials outstanding had already started to decline; similarly, backlogs were still falling when outstandings had started to rise.

These facts seem to support the general notion that it is useful to separate unfilled orders for final products and for intermediate products, at least until the character and cause of their heterogeneity is more adequately understood.

TABLE 2

*Reference Cycle Amplitude of Stocks and Outstanding Materials Orders, Durable Goods Manufacturers,[a] 1946–62*
(billion dollars)

| | A: Rise or Fall (-) During Reference Phases | | | | | | |
|---|---|---|---|---|---|---|---|
| | Contraction 11/48–10/49 | Expansion 10/49–7/53 | Contraction 7/53–8/54 | Expansion 8/54–7/57 | Contraction 7/57–4/58 | Expansion 4/58–5/60 | Contraction 5/60–2/61 |
| 1. Ownership | -4.09 | 13.61 | -8.59 | 5.83 | -4.70 | 2.10 | -2.04 |
| 2. Materials stocks | -.91 | 3.04 | -.86 | 1.47 | -.43 | .81 | -.78 |
| 3. Outstanding orders | -3.18 | 10.57 | -7.73 | 4.36 | -4.28 | 1.29 | -1.26 |
| 4. All stocks | -1.48 | 11.98 | -2.29 | 7.77 | -2.20 | 2.65 | -1.50 |

| | B: Average Rise or Fall (-) During Reference Phases | | | | | Amplitude as % of Amplitude of Materials Stocks[b] | | |
|---|---|---|---|---|---|---|---|---|
| | Per Phase | | Per Month[a] | | | | | |
| | Expansion (1) | Contraction (2) | Expansion (3) | Contraction (4) | All Phases (5) | Expansion (6) | Contraction (7) | All Phases (8) |
| 1. Ownership | 7.18 | -4.86 | .205 | -.462 | .219 | 402 | 651 | 390 |
| 2. Materials stocks | 1.77 | -.75 | .051 | -.071 | .056 | 100 | 100 | 100 |
| 3. Outstanding orders | 5.40 | -4.11 | .154 | -.392 | .222 | 302 | 552 | 396 |
| 4. All stocks | 7.47 | -1.87 | .213 | -.178 | .204 | 417 | 250 | 364 |

Note: The measures are those of standard NBER business cycle analysis.

[a]Per month amplitude measures are the sum of the rises divided by the total number of months of cyclical expansion and analogously for contractions. For the total, falls (carrying a negative sign) are subtracted from total rises and divided by the number of months between first and last peak or trough.

[b]Per month amplitude of each series as a percentage of the corresponding figure for materials stocks.

## *AMPLITUDE*

Ownership and each of its components underwent substantial cyclical fluctuation. Stock on order had a far wider amplitude of movement than did stocks on hand. During the three reference cycle expansions occurring between 1948 and 1962, the book value of stocks on order increased on the average by $5.4 billion (Table 2, column B1) and during the four reference cycle contractions fell on the average by $4.1 billion. The corresponding figures for materials stocks on hand were $1.8 and $.8 billion respectively. Thus the cyclical rise in outstandings was, on the average, about three times that of materials stocks and the fall

TABLE 3

*Average Specific Cycle Amplitude Per Month of Materials Stocks on Hand and on Order, Durable Goods Manufacturers, 1946-62*

| | Date of First and Last Peak or Trough (1) | No. of Cycles (2) | Amplitude Per Month ($ billion)[a] Expansions (3) | Contractions (4) | All Phases (5) | Amplitude as % of Amplitude of Materials Stocks Expansions (6) | Contractions (7) | All Phases (8) |
|---|---|---|---|---|---|---|---|---|
| 1. Ownership | P 12/46 to P 2/62 | 5 | .308 | -.367 | .333 | 417 | 456 | 436 |
| 2. Materials stocks | P 2/49 to P 5/62 | 4 | .074 | -.080 | .076 | 100 | 100 | 100 |
| 3. Outstanding orders | P 7/46 to P 2/62 | 5 | .280 | -.304 | .291 | | | |
| | P 8/48 to P 2/62[b] | 4 | .293 | -.328 | .309 | 396 | 408 | 404 |
| 4. All stocks | T 1/46 to T 5/61 | 4 | .233 | -.225 | .231 | 315 | 279 | 302 |
| | | | | | | 120[c] | 135[c] | 126[c] |

[a]Amplitude measures are the sum of the rises minus the sum of the falls divided by the number of months between the first and last peak or trough. Thus the rise and fall during each specific cycle (carrying a negative sign) are weighted by its duration.

[b]The amplitude of outstandings beginning 8/48 is compared with that of materials stocks in order to match the time periods as nearly as possible.

[c]Amplitude for outstandings as percentage of all stocks.

about five times (columns B6 and 7).[12] The level of outstandings proper, it will be recalled, was only about twice that of materials stocks. The first part of Table 2 gives the phase-by-phase figures.

Even compared with total stocks of durable goods manufacturers, outstandings show striking fluctuations. Comparison of the last two lines in the table indicates that during contractions (column B7) the cyclical amplitude of the average book value of outstanding orders for durable materials was over twice that of total stocks of the durable goods industries (stocks of finished and in-process goods and materials) and about three quarters of it during expansions. If these book-value figures were converted to months of supply (a conversion that would raise the weight of raw and in-process materials relative to finished goods), the ratios would be substantially higher.[13]

Reference cycle amplitudes are influenced by the degree to which each series conforms to business cycles. This element can be removed by comparing amplitude during cycles specific to each series. Table 3 gives the figures. Comparison of column 5 in the two tables shows that a substantial portion—between two-

[12] The difference in the relationship for rises and falls was partly due to the fact that there was little trend rise in book value of outstandings and a substantial one in stocks.

[13] Also, it will be recalled that the series excludes materials bought from dealers or other nonmanufacturers.

thirds and three-quarters—of the total specific fluctuation in these several stockpiles occurred during the times of general economic fluctuation as designated by the reference subcycle chronology. The tables also show that the relative instability of outstandings compared with stocks is somewhat greater when the full specific rises and falls of each aggregate are taken into account than when the reference framework is used (compare column 8 in the two tables). Apparently, if outstandings have the capacity to influence economic events, their influence will tend to reinforce the business tides.

## *FIRST THRUST OF EXPANSIONS*

Outstanding orders seem to share the characteristics often observed in stocks—they fall at a faster rate during business contractions than they rise during expansions, thereby suggesting that they push things down with more force than they lift them up. The average monthly rate of rise of outstanding orders during the expansion phases of business cycles (beginning with the 1949 troughs) was $160 million per month; during contractions the monthly rate of fall averaged $400 million.[14]

But further examination reveals an interesting variation on this usual theme: outstanding orders rise with far more vigor in the early months of expansion than in the later ones. This impression is also conveyed by Chart 1.

Table 4 formalizes the comparisons by using a three-part reference framework. Business cycle expansions are divided into two pieces and contractions are treated in the conventional way. The first sections of expansions are delineated by the additional minor peaks that were mentioned earlier—January 1947 and February 1951. We also select two further dates. The first, December 1955, was a candidate subcycle peak which was considered in the course of the work on subcycles, but it was rejected because the break in expansion was not sufficiently diffused among different sorts of economic activity. However, many series appeared to reach temporary peaks in their expansion at about that time. The second date, March 1959, marks the time when the anticipatory action associated with the steel strike a few months later seemed to reach its zenith. Note that these four peak dates occurred fifteen, sixteen, sixteen, and eleven months after the previous business cycle reference troughs marked in 1945, 1949, 1954, and 1958 respectively. It is interesting, incidentally, that these periods are quite uniform in length and also typically a bit longer than postwar contractions (compare columns 5 and 15). Table 4 indicates that in three of the four episodes the total cyclical rise in outstandings had been effected during these first periods—the standing at subpeaks is usually higher than at subsequent peaks (columns 7 and 8). For all of them, the average monthly rate of expansion was entirely comparable to that of contractions (bottom two lines, columns 12 and 19).

The large proportion of the rise that occurred in the first phase of expansion could be due in part to the strong tendency for outstandings to experience peaks ahead of the business cycle high points. Table 5, therefore, converts the comparisons to a specific cycle basis. The specific cycle peaks or troughs in outstandings that are matched with business cycle peaks or troughs provide the dates for columns 1, 2, 10, and 11. The first period of thrusts is selected as the months when, in the course of its first specific cycle rise in reference expansion, the rate of rise in outstandings has reached its maximum and declined to the halfway mark between its maxi-

[14] The figures are based on standings for the single month of peaks and troughs and are rounded to tens of millions of dollars. They are therefore not identical to those in Table 2, line 3, columns 3 and 4.

TABLE 4

*Amplitude of Outstanding Materials Orders During Reference Cycle Phases and First Subcycle Expansion,[a] Durable Goods Manufacturers, 1946-62*

| Reference Dates | | | Interval (months) Trough to: | | Standings ($ billion)[b] | | | Rise ($ billion) Total | | Rise ($ billion) Per Month | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Trough | Peak | Sub Peak[a] | Peak | Sub Peak | Trough | Peak | Sub Peak | Cycle | Sub C. | Cycle | Sub C. |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| *Expansions* | | | | | | | | | | | |
| 1/46[c] | 11/48 | 1/47 | 34 | (12)[d] | 9.5 | 11.1 | 12.5 | 1.6 | 3.0 | 0.05 | 0.25 |
| 10/49 | 7/53 | 2/51 | 45 | 16 | 7.9 | 18.6 | 17.9 | 10.7 | 10.0 | 0.24 | 0.62 |
| 8/54 | 7/57 | 12/55 | 35 | 16 | 10.7 | 15.2 | 15.5 | 4.5 | 4.8 | 0.13 | 0.30 |
| 4/58 | 5/60 | 3/59 | 25 | 11 | 10.7 | 12.2 | 14.5 | 1.5 | 3.8 | 0.06 | 0.35 |
| Average, 1/46 to 2/61 | | | 34.8 | | | | | 4.6 | 5.3 | .13[e] | .39[e] |
| Average, 11/48 to 2/61 | | | 35.0 | 14.3 | | | | 5.6 | 6.2 | .16[e] | .43[e] |

| Reference Dates | | Interval (months) | Standings[b] ($ billion) | | Fall ($ billion) | |
|---|---|---|---|---|---|---|
| Peak | Trough | | Peak | Trough | Total | Per Month |
| (13) | (14) | (15) | (16) | (17) | (18) | (19) |
| *Contractions* | | | | | | |
| 11/48 | 10/49 | 11 | 11.1 | 7.9 | -3.2 | -0.29 |
| 7/53 | 8/54 | 13 | 8.6 | 10.7 | -7.9 | -0.61 |
| 7/57 | 4/58 | 9 | 15.2 | 10.7 | -4.5 | -0.50 |
| 5/60 | 2/61 | 9 | 12.2 | 10.8 | -1.4 | -0.16 |
| Average, 1/46 to 2/61 | | | | | -4.2 | -.40[e] |
| Average, 11/48 to 2/61 | | 10.5 | 11.8 | 10.2 | -4.2 | -.40[e] |

[a]Two of the dates are part of a previously selected subcycle chronology; two are otherwise chosen.

[b]Standings are for the single month of peak or trough. Therefore figures may differ slightly from those of Table 2, where standings are three-month averages.

[c]First month for which data are available.

[d]The interval from the business cycle trough in October 1945 was fifteen months.

[e]Sum of the rises (falls) divided by the total number of months of expansion (contraction) covered.

TABLE 5

*Amplitude of Outstanding Materials Orders During Selected Specific Cycles and First Period of Rapid Thrust[a], Durable Goods Manufacturers, 1946-62*

| *Expansions* | | | | | | | | | *Contractions* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Specific Dates | | | Interval (mos.) from Trough to: | | Rise ($ billion)[b] | | | | Specific Dates | | Interval | Fall ($billions)[b] | |
| | | | | | Total | | Per Month | | | | | | |
| Trough | Peak | Top of Thrust[a] | Peak | Top of Thrust | Cycle Expansion | Thrust | Cycle Expansion (6÷4)[c] | Thrust (7÷5) | Peak | Trough | (mos.) | Total | Per Mo. |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) |
| 1/46[c] | 8/48 | 6/46 | 31 | (5)[d] | 2.0 | 3.4 | 0.06 | 0.68 | | | | | |
| | | | | | | | | | 8/48 | 9/49 | 13 | -4.1 | -0.32 |
| 9/49 | 9/52 | 4/51 | 36 | 19 | 13.2 | 12.1 | 0.37 | 0.64 | | | | | |
| | | | | | | | | | 9/52 | 10/54 | 25 | -10.0 | -0.40 |
| 10/54 | 8/56 | 6/55 | 22 | 8 | 6.6 | 3.3 | 0.30 | 0.41 | | | | | |
| | | | | | | | | | 8/56 | 6/58 | 22 | -6.6 | -0.30 |
| 6/58 | 11/59 | 3/59 | 17 | 9 | 4.4 | 3.9 | 0.26 | 0.43 | | | | | |
| | | | | | | | | | 11/59 | 12/60 | 13 | -4.4 | -0.34 |
| 1/46 to 12/60 | | | 106 | 41 | 26.2 | 21.7 | .25 | .53 | | | | | |
| 9/49 to 12/60 | | | 75 | 36 | 24.2 | 19.3 | .32 | .54 | | | 73 | 25.1 | .34 |

[a]Only those specific cycles are included whose troughs are matched with business cycle reference troughs. The first period of thrust starts at the specific trough and ends at the month when, in the course of its first specific cycle rise of reference expansion, the rate of rise (as measured by a five-month centered average of month-to-month change) has reached its maximum and declined to halfway between its maximum and zero. Failing the necessary information for the first period, the peak date of the first specific cycle was used.

[b]Based on standings for the month of peak or trough only.

[c]First month when data are available.

[d]Period from beginning of the data, not from the previous trough.

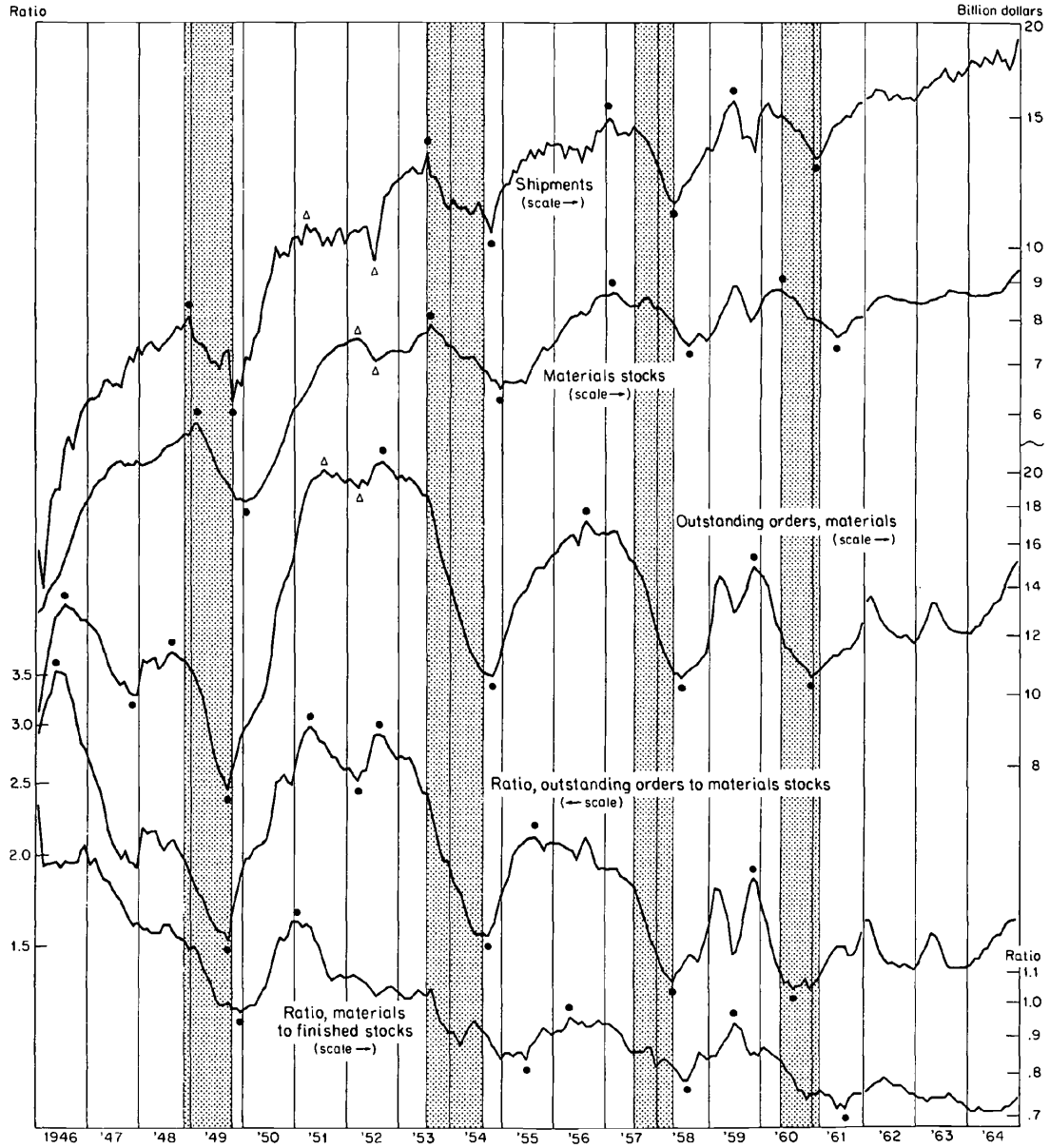
mum and zero.[15] The intervals ranged from eight to nineteen months, and the shorter figure seems more typical. Comparison of columns 9 and 14 of Table 5 shows that the monthly rates of rise during these periods of first thrust are stronger than during contraction. A large part of specific cycle expansion usually occurred during these first episodes (compare columns 6 and 7).

After the first two thrusts, outstandings declined for a while and then rose again, thus producing extra movements which, as mentioned previously, were also found in many other economic areas. In 1959, too, the thrust was followed by a temporary decline, but its

[15] The selection was made on the basis of a five-month moving average of month-to-month change as shown in Chart 6, below. Some time after outstandings proper have reached their specific cycle trough associated with the reference cycle trough, the rate of rise in outstandings reaches a peak. Some months later outstandings cease to rise. (The five-month average crosses the zero line on its way down.) The month when the five-month average has declined to a figure closest to one-half its peak level marks the termination of the first specific cycle thrust.

CHART 2

*Relations Among Outstanding Orders, Stocks, and Shipments, Durable Goods Manufacturers, 1946–64*




Note: Shaded areas represent business contractions. Specific cycle turns are marked by dots, additional minor turns by triangles.

short duration and close association with the extended steel strike gives it a somewhat colloquial interest. The movement that ended in 1955 resulted in a flattening rather than an actual downturn.

In general the figures suggest that insofar as an increase of materials on order tends to stimulate more ordering than would otherwise take place (and consequently more business activity), the chief impact of stimulation occurs in the first year or year and a half of expansion.

Though stocks of materials on hand also tend to flatten by the middle of expansion, the strong early upward surge of materials on its way to factory floors concentrates particularly in the most responsive portion of ownership—outstanding orders. The proportion of total ownership that consists of outstanding orders rises to a peak early in expansion and then flips downward. This can be seen in the next to the last curve in Chart 2, the ratio of outstanding orders to stocks of materials. The bottom line in the chart suggests that a similar pattern characterizes the relation of materials to finished stocks. Taken together, the curves seem to depict a moving bulge in the pipelines of materials; it starts in the first section, the outstanding orders for materials, and slips toward later sections as expansion continues. During contraction it moves much farther in that direction.

## *RELATION BETWEEN SALES AND STOCKS*

The economic meaning of the size of a stock reservoir depends in part on its relation to the flow of goods or services to which it is linked.

Any business must, of course, maintain some sort of positive association between the volume of stocks and sales. But the analysis of Chapter 2 suggests that it is not at all clear what that association is likely to be. It is the joint result of the physical necessities of servicing sales (and the sales relation alone is most efficiently handled by a less than proportionate change in stock), changes in opportunity costs which may or may not parallel sales, changes in expectations about market conditions, and errors which it is not worthwhile to reverse immediately. Obviously, then, it is pertinent to ask how these ratios actually behave. Do stocks tend to maintain a systematic relation to sales or shipments and, if so, is it a constant one or one that is positively or negatively associated with shipments? How about these relations for outstanding purchase orders or ownership as a whole? What is the meaning, in terms of business problems and practices, of such relationships as the time series show? In this section some gross behavioral characteristics are exhibited. In Chapter 9 we explore the question of "why."

### *Parallelism in Sales and Stocks*

The behavior of shipments and of stocks both on hand and on order in durable goods manufacturing are compared in the first three lines in Chart 2 and detailed timing comparisons appear in Table 6.

The chart reveals a family resemblance between shipments and stocks of materials on hand and on order. But it certainly suggests that stocks on hand follow shipments more closely than do stocks on order. The latter, as the analysis of earlier chapters suggests, are likely to reflect, among other things, conditions, or expectations about conditions, in the markets in which materials are bought and sold. The eye picks up notable differences in the contours of the waves in outstandings and shipments (curves 3 and 1), whereas stocks on hand move more similarly to shipments (curves 2 and 1). Table 6 supports these impressions. In line 4 of section C we see that during 84 per cent of the months from mid-

TABLE 6

*Timing: Shipments, Durable Goods Manufacturers, 1946–62*

| Line | Reference Series[c] | Section A: Months Lead (-) or Lag (+) for Matched Turns[a] — Chronology[b] P (1/47) | T (7/47) | P 11/48 | T 10/49 | P (2/51) | T (6/52) | P 7/53 | T 8/54 | P 7/57 | T 4/58 | P 5/60 | T 2/61 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Specific Series: Shipments* | | | | | | | | | | | |
| 1 | Business cycles | | | +1 | 0 | | | 0 | +2 | -6 | 0 | -11 | -1 |
| 2 | Subcycles | ⊕ | ⊕ | +1 | 0 | +1 | +1 | 0 | +2 | -6 | 0 | -11 | -1 |
| | | *Specific Series: Ownership* | | | | | | | | | | | |
| 3 | Shipments | ⊗ | ⊗ | -4 | -1 | ⊕ | ⊕ | -10 | 0 | +1 | +2 | +7 | -1 |
| | | *Specific Series: Stocks of Materials* | | | | | | | | | | | |
| 4 | Shipments | ⊕ | ⊕ | +2 | +3 | +12 | 0 | +1 | +2 | +1 | +4 | +11 | +5 |
| | | *Specific Series: Outstanding Orders* | | | | | | | | | | | |
| 5 | Shipments | ⊗ | ⊗ | -4 | -1 | +4 | -4 | -10 | 0 | -5 | +2 | +5 | -1 |
| | | *Specific Series: Unfilled Orders, Final Product* | | | | | | | | | | | |
| 6 | Shipments | ⊕ | ⊕ | -21 | +2 | ⊕ | ⊕ | -6 | +7 | -1 | ⊕ | ⊕ | +4 |

| Line | Reference Series[c] | Section B: Average Timing of Turns — Number Matched - | + | 0 | Median[e] P | T | All | Average Deviation[f] P | T | All Turns Wt'd | | Section C: Percentage of Months in Like Phase[d] — Timing Adjustment[g] | % Mos. 7/46–12/61 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Specific Series: Shipments* | | | | | | | | | | | |
| 1 | Business cycles | 3 | 2 | 3 | -3.0 | 0 | 0 | 4.5 | 0.8 | 2.6 | 2.6 | 0 | 80 |
| 2 | Subcycles | 3 | 4 | 3 | -1.7 | +0.3 | 0 | 4.1 | 0.9 | 2.3 | 2.5 | 0 | 84 |
| | | *Specific Series: Ownership* | | | | | | | | | | | |
| 3 | Shipments | 4 | 3 | 1 | -1.5 | -0.5 | -0.5 | 5.5 | 1.0 | 3.2 | 3.2 | -1,0 | 72 |
| | | *Specific Series: Stocks of Materials* | | | | | | | | | | | |
| 4 | Shipments | 0 | 9 | 1 | +4.7 | +3.0 | +2.5 | 4.7 | 1.4 | 2.9 | 3.1 | +2,+3 | 84 |
| | | *Specific Series: Outstanding Orders* | | | | | | | | | | | |
| 5 | Shipments | 6 | 3 | 1 | -1.7 | -0.7 | -1.0 | 5.3 | 1.5 | 3.4 | 3.4 | -1 | 73 |
| | | *Specific Series: Unfilled Orders, Final Product* | | | | | | | | | | | |
| 6 | Shipments | 2 | 2 | 0 | -9.3 | +4.5 | -1.7 | 7.8 | 2.5 | 7.3 | 5.6 | -1 | 62 |

For notes see Table 1.

1946 to the end of 1961, shipments and materials stocks are in like phase after allowing for a lag of either two or three months. For both ownership and outstanding orders, the association with shipments is nearly synchronous on the average (or leading slightly for outstandings), and this is an interesting fact. However, the months in like phase are low (72 or 73 per cent). For all these data, troughs behave systematically; average deviations in the timing of shipments and the stock or outstandings series are very small (column B8). It will be recalled that this was also characteristic of the association of materials stocks (and, to a lesser extent, the other stock data too) with troughs in business cycles, and the statistical reason is simply that it is also true of troughs in shipments. The economic meaning, on the other hand, is equivocal since the reversal in the stock aggregates could very well be causally associated with change in sales *or* in the business climate, or both.

### *Stock-Sales Ratios, Trend and Fluctuations*

In any event, it is certainly no surprise to see manufacturers increasing their raw materials on hand and on order when their shipments to customers rise, and decreasing them as they fall off. But how about the particular character of the association? Chart 3 adratios of end-of-month stocks to shipments durdresses itself to this question by depicting the ing the month. The shaded areas show the periods when business cycles were in falling phase. These curves tell, I think, a very interesting story.

First, a word concerning their level and trend. One would like to gauge the size of stocks in terms of the number of months' sales for which they provide. But this is not shown by the ratio because, as suggested earlier, stocks are measured in terms of the value of "raw materials" and shipments in terms of the value of finished goods, and consequently, to make a unit-for-unit comparison, the value of materials must at least be doubled.[16] Thus the scale for the center three lines should be multiplied by two to indicate approximately the number of months' sales for which provisions have been made. So viewed, materials stocks on hand typically constitute about five weeks' sales (stock-sales ratio of .6 in the chart) for the period as a whole. But the trend has been downward, and this is not merely a reflection of early adjustments to peacetime conditions. Though there may have been some stabilization in the fifties, the last several years have seen a further decline to about one month's provisions (ratio of .5).

Materials on order were, for the period as a whole, substantially larger than those on hand; they averaged just short of two and a half months' sales, and, as the discussions at the end of Chapter 3 indicate, this must be regarded as a rough approximation. They shared the downward trend relative to sales, but to a more marked degree.

In view of the relative decline in both stocks of materials on hand and on order, the constant relation of total stocks to shipments may seem surprising (bottom curve). Yet actually it probably is more of an explanation than a contradiction. Stock in process kept a relatively steady relation to shipments. The increase in finished stocks relative to stocks of materials—and relative also, and particularly so, to outstanding orders for materials—can be interpreted as reflecting a long-term shift from a seller's to a buyer's market.

Turn now to the cyclical patterns of the stock-shipments ratio, which, if my interpretation is correct, may also have some bearing on their trends. A swift glance at Chart 3 answers one question of some general import. Ignoring trends, are stocks-sales ratios approximately constant? They are not. The vertical scale of the chart is proportional and has the

[16] The reason, to repeat, is that an examination of census data for a number of major durable goods industries suggests that, very typically in durable goods manufacture, the value added by manufacture is about equal to the cost of the materials and fuels.

same dimensions as that used for the previous charts. Accordingly, the picture suggests that the magnitude of fluctuation in the ratios is substantial. (Compare it with that of the data proper in Chart 1.) Table 7, lines 1, 4, and 7, shows the average standing of the ratios, converted to estimated weeks' supply, at their specific peaks and troughs, 1948 through 1961.[17]

On the average, materials represented one more week's supply at peaks than at troughs in the ratio (column 3), about one-fifth more than the five-week supply typical at troughs (column 4). For ownership and outstandings, an additional four weeks' supply was usual, and this constituted about one-third more for ownership and one-half more for outstandings than the average position at troughs. Clearly, then, if manufacturers were trying to achieve a constant relation between sales and any of the three stock aggregates, they were not succeeding. Moreover, there is no reason to suppose that they could not do so if the objective carried a sufficient priority. For ownership, adjustment to a desired figure could be achieved almost immediately by appropriate changes in new orders; even for stock of materials on hand, foreknowledge of demand, often supplied by advance sales and orders, would make it possible to gauge materials buying so as to validate a stock objective if it were worth the cost.

### *Relationship of Ratios to Shipments*

But granted that the figures suggest that a constant sales-stock ratio is not a high-priority management objective, what are the characteristics of the relation that actually does obtain? Is it, for example, the inverse relation of the ratio to the level of sales which would be produced if the single factor influencing stocks were an efficient link to sales, other things the same? Here again, the answer is no.

Study of Chart 3 makes it clear that the ratio of materials stocks to shipments is increasing during substantial periods when shipments are increasing too. These are certainly periods when stocks could be cut down if it were clearly desirable to do so. A similar remark applies to the ratios for ownership and stocks on order. Column 5 of Table 7 shows that the three ratios (for stocks, outstandings, and ownership) are in rising specific cycle phase during 44, 47, and 37 per cent respectively of the months when shipments are in rising specific cycle phase. Column 4 indicates, in lines 2, 5, and 8, that the range between the high and the lows in the ratio, which are reached when sales are rising, is, of course, less than their total specific cycle range (lines 1, 4, and 7), but nevertheless not insignificant; the high is 110 to 146 per cent of the low.

The particular times in the cycles in shipments when the ratios rise and fall are worth some attention, and Table 8 gives the figures. The specific cycle lows in the stock-shipment ratio occurred after shipments had started to rise, indeed never less than seven nor more than twelve months thereafter (Table 8, line 7). Typically, the last few months' fall in the ratio was due to the fact that though stocks were rising, shipments were rising faster. But it is noteworthy that this situation did not last for long: within the first year of the expansion in shipments, stocks started to rise faster than shipments (the ratio began to rise). An exception, however, was the phase starting in 1961, when the ratio flattened for a while and then continued to fall.

The ratio was usually still rising—that is, the number of months' supply held in stock was increasing—when shipments reached their peak and started to decline. But since stocks themselves reversed very promptly, the continued rise of the ratio was due to the fact that stocks did not fall *as fast* as shipments. Again, the last complete expansion phase, the one with a peak in 1959, was an exception.

[17] I use the assumptions that materials constitute half of the price of finished goods and that there are four and a third weeks to the average month. Accordingly, the monthly book-value figures are multiplied by 8.67.

TABLE 7

*Average Amplitude and Conformity of Stock-Shipment Ratios During Expansion Phases Variously Defined, Durable Goods Manufacturers, 1948–61*

| Line | Ratio to Shipments | Reference for Expansion Phase In Ratio | Standing of Ratios, Weeks[a] | | | | % Months When Ratio Was in Rising Specific Phase During Expansion Phases of:[b] | |
|---|---|---|---|---|---|---|---|---|
| | | | Standing at | | Peaks Minus | Peaks as % of | | |
| | | | Troughs (1) | Peaks (2) | Troughs[c] (3) | Troughs[c] (4) | Shipments (5) | Business Cycles (6) |
| | *Materials Stock* | | | | | | | |
| 1 | | Ratio[d] | 5.0 | 6.0 | 1.0 | 121 | | |
| 2 | | Shipments[e] | 5.0 | 5.5 | .5 | 110 | 44 | |
| 3 | | Business cycle[f] | 5.0 | 5.9 | .9 | 119 | | 52 |
| | *Outstandings* | | | | | | | |
| 4 | | Ratio[d] | 8.2 | 12.5 | 4.3 | 152 | | |
| 5 | | Shipments[e] | 8.2 | 10.6 | 2.4 | 146 | 47 | |
| 6 | | Business cycle[f] | 8.2 | 12.5 | 4.3 | 152 | | 44 |
| | *Ownership* | | | | | | | |
| 7 | | Ratio[d] | 13.5 | 17.9 | 4.4 | 133 | | |
| 8 | | Shipments[e] | 13.5 | 16.9 | 3.4 | 125 | 37 | |
| 9 | | Business cycle[f] | 13.5 | 17.9 | 4.4 | 133 | | 34 |

[a]The individual standings are two-month averages of monthly data for peak (trough) month and the higher (lower) of the two adjacent months. If the peak (trough) was erratically high (low), a three-month centered average was used. Monthly data were converted to weeks by assuming that there are 4.5 weeks per month. The figures average the individual standings for the fourteen years from the beginning of 1948 to the end of 1961.

[b]These are the same measures as those appearing in section C of the timing tables except that they are confined to the periods when the reference scheme (specific cycles in sales for column 5 and business cycle chronology in column 6) is in rising phase. Comparisons are made without a timing adjustment.

[c]Based on average standings (not on standing for each phase averaged).

[d]Standings are taken at specific cycle peaks and troughs in the ratio.

[e]The peak standing is that of the high reached in the ratio during each specific cycle in shipments. Trough standing is that of the specific cycle trough in the ratio that is matched with each specific cycle trough in shipments.

[f]The peak standing is that of the high reached in the ratio during each business cycle expansion. Trough standing is that of the specific cycle trough in the ratio that is matched with each reference trough.

TABLE 8

*Timing: Stock-Shipments Ratios, Durable Goods Manufacturers, 1946–62*

| Line | Reference Series[c] | Section A: Months Lead (-) or Lag (+) for Matched Turns[a] Chronology[b] P (1/47) | T (7/47) | P 11/48 | T 10/49 | P (2/51) | T (6/52) | P 7/53 | T 8/54 | P 7/57 | T 4/58 | P 5/60 | T 2/61 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Specific Series: Ratio of Ownership to Shipments* | | | | | | | | | | | | |
| 1 | Business cycles | | | ⊕ | +8 | | | -24 | +4 | -12 | +8 | -6 | ⊕ |
| 2 | Subcycles | ⊕ | ⊕ | ⊕ | +8 | +5 | ⊕ | ⊕ | +4 | -12 | +8 | -6 | ⊕ |
| 3 | Shipments, all durables | ⊙ | ⊙ | ⊕ | +8 | +4 | ⊕ | ⊕ | +2 | -6 | +8 | +5 | ⊕ |
| 4 | Ownership | ⊕ | ⊕ | ⊕ | +9 | -14 | ⊙ | ⊙ | +2 | -7 | +6 | -2 | ⊕ |
| | *Specific Series: Ratio of Purchased Materials Stocks to Shipments* | | | | | | | | | | | | |
| 5 | Business cycles | | | +3 | +10 | | | +4 | +11 | +8 | +12 | +8 | ⊕ |
| 6 | Subcycles | +7[r] | +8[r] | +3 | +10 | +10 | +8 | +4 | +11 | +8 | +12 | +8 | ⊕ |
| 7 | Shipments, all durables | ☊ | ☊ | +2 | +10 | +9 | +7 | +4 | +9 | +14 | +12 | +19[r] | ⊕ |
| 8 | Stocks | ☊ | ☊ | 0 | +7 | -3 | +7 | +3 | +7 | +13 | +8 | +8 | ⊕ |
| 9 | R:ownership to shipments | ⊕ | ⊕ | +3 | +2 | +5 | ⊕ | ⊕ | +7 | +20 | +4 | +4 | ⊙ |
| 10 | R:outstanding to shipments | ⊕ | ⊕ | ⊕ | +11 | +5 | ⊕ | ⊕ | +12 | +20 | +4 | +14 | ⊙ |
| | *Specific Series: Ratio of Outstanding Orders to Shipments* | | | | | | | | | | | | |
| 11 | Business cycles | | | ⊕ | -1 | | | -24 | -1 | -12 | +8 | -6 | ⊕ |
| 12 | Subcycles | ⊕ | ⊕ | ⊕ | -1 | +5 | ⊕ | ⊕ | -1 | -12 | +8 | -6 | ⊕ |
| 13 | Shipments, all durables | ⊙ | ⊙ | ⊕ | -1 | +4 | ⊕ | ⊕ | -3 | -6 | +8 | +5 | ⊕ |
| 14 | Outstandings | ⊙ | ⊕ | ⊕ | 0 | 0 | ⊕ | ⊕ | -3 | -1 | +6 | 0 | ⊕ |
| 15 | R:materials stocks to shipments | ⊙ | ☊ | ☊ | -11 | -5 | ⊕ | ⊕ | -12 | -20 | -4 | -14 | ⊙ |

(continued)

TABLE 8 (concluded)

| Line | Reference Series[c] | Section B: Average Timing of Turns — Number Matched (- + 0) | Median[e] P | Median[e] T | Median[e] All | Average Deviation[f] P | Average Deviation[f] T | Average Deviation[f] All Turns Wt'd | Section C: Percentage of Months in Like Phase[d] — Timing Adjustment[g] | % Mos. 1/48–12/61 |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Specific Series: Ratio of Ownership to Shipments* | | | | | | | | | |
| 1 | Business cycles | 3 3 0 | -14.0 | +6.7 | -1.0 | 6.7 | 1.8 | 10.3 4.2 | None | 51 |
| 2 | Subcycles | 2 4 0 | -4.3 | +6.7 | +4.5 | 6.2 | 1.8 | 5.8 4.0 | None | 54 |
| 3 | Shipments, all durables | 1 5 0 | +1.0 | +6.0 | +4.5 | 4.7 | 2.7 | 3.5 3.7 | None | 60[h] |
| 4 | Ownership | 3 3 0 | -7.7 | +5.7 | 0 | 4.2 | 2.4 | 6.7 3.3 | 0 | 64 |
| | *Specific Series: Ratio of Purchased Materials Stocks to Shipments* | | | | | | | | | |
| 5 | Business cycles | 0 7 0 | +6.0 | +11.0 | +8.7 | 2.2 | 0.7 | 2.7 1.6 | None | 51 |
| 6 | Subcycles | 0 11 0 | +7.5 | +9.7 | +8.0 | 2.0 | 1.5 | 1.9 1.8 | 0 | 48 |
| 7 | Shipments, all durables | 0 9 0 | +9.0 | +9.5 | +9.3 | 5.4 | 1.5 | 3.7 3.7 | 0 | 41[h] |
| 8 | Stocks | 1 7 1 | +3.7 | +7.0 | +7.0 | 4.9 | 0.5 | 3.2 3.0 | +7 | 79 |
| 9 | R:ownership to shipments | 0 7 0 | +9.5 | +4.3 | +5.3 | 6.4 | 1.8 | 4.6 4.4 | +5 | 69 |
| 10 | R:outstandings to shipments | 0 6 0 | +13.0 | +9.5 | +11.5 | 5.3 | 3.3 | 4.3 4.3 | +11, +12 | 73 |
| | *Specific Series: Ratio of Outstanding Orders to Shipments* | | | | | | | | | |
| 11 | Business cycles | 5 1 0 | -14.0 | +2.0 | -3.5 | 6.7 | 4.0 | 8.0 5.3 | 0 | 57 |
| 12 | Subcycles | 4 2 0 | -4.3 | +2.0 | -1.0 | 6.2 | 4.0 | 5.2 5.1 | 0 | 60 |
| 13 | Shipments, all durables | 3 3 0 | +1.0 | +1.3 | +1.5 | 4.7 | 4.4 | 4.5 4.6 | 0,-1,+1,+2 | 63 |
| 14 | Outstandings | 2 1 3 | -0.3 | +1.0 | 0 | 0.4 | 3.3 | 1.7 1.9 | 0 | 79 |
| 15 | R:material stocks to shipments | 6 0 0 | -13.0 | -9.5 | -11.5 | 5.3 | 3.3 | 4.3 4.2 | -11,-1 | 73 |

For notes a through g, see Table 1.

[h]Adjustments that maximize percentage in phase are, respectively, line 3: +2, 68 per cent; line 7: +9 or +10, 72 per cent.

The ratio did not rise during the expansion in shipments starting in 1958; it fell most of the time.

Materials stocks on order, measured in months of sales, declined uninterruptedly from wartime highs until the end of the 1949 recession. Thereafter they had two bold rises with subsequent bold falls and a less bold episode in 1958–60. Both troughs and peaks in these waves occurred much earlier than in the stock-on-hand ratio, and the outstandings-shipment ratio therefore tended to reach troughs much closer to the upturn in shipments than did the stock-on-hand-shipments ratio; indeed it even turned earlier than shipments at two of the three comparisons (Table 8, line 13). In other words, a rise in shipments and an increase in the number of months' supply on order tended to occur around the same time. Chart 3 shows another fact worth noting. Apparently the rise in materials outstanding that started early in 1961 was no greater than necessary to maintain a constant number of months' sales on order. The ratio slid continuously downward from late 1959 to the beginning of 1964, when it again turned up.

### *Behavior During Business Cycles*

The tendency for stocks to rise when sales do is a well-explored aspect of business cycle dynamics. If stocks tend to rise even faster than do sales, this tendency for stocks to add to or partly generate cyclical fluctuation would thereby be emphasized. Accordingly, it is interesting to ask how the stock-sales ratio behaves during business cycles and particularly during cyclical expansions. Do stocks of materials tend to rise faster than shipments at times when business as a whole is expanding? If so, there is a tendency to add an element to the leavening influence.

Column 6 of Table 7 is addressed to this question and it shows that materials stocks are rising faster than shipments (which, of course, also tend to rise during expansion) during 52 per cent of the months of reference expansion 1948 through 1961. The range of fluctuation comprehends very nearly all of the conforming specific fluctuation in the ratio (compare lines 1 and 3, column 4). Materials stocks on order, because of the long leads at peaks, were rising for a smaller proportion of cyclical expansion than stocks on hand; the figure was 44 per cent, which, though smaller, is still not insubstantial. However, the full impact of the specific rise in the ratio occurred during months of cyclical expansion; peaks occurring during expansion were about 50 per cent higher than troughs—an extra four weeks' supply (Table 7, line 6, columns 3 and 4). Generally similar observations apply to total ownership.

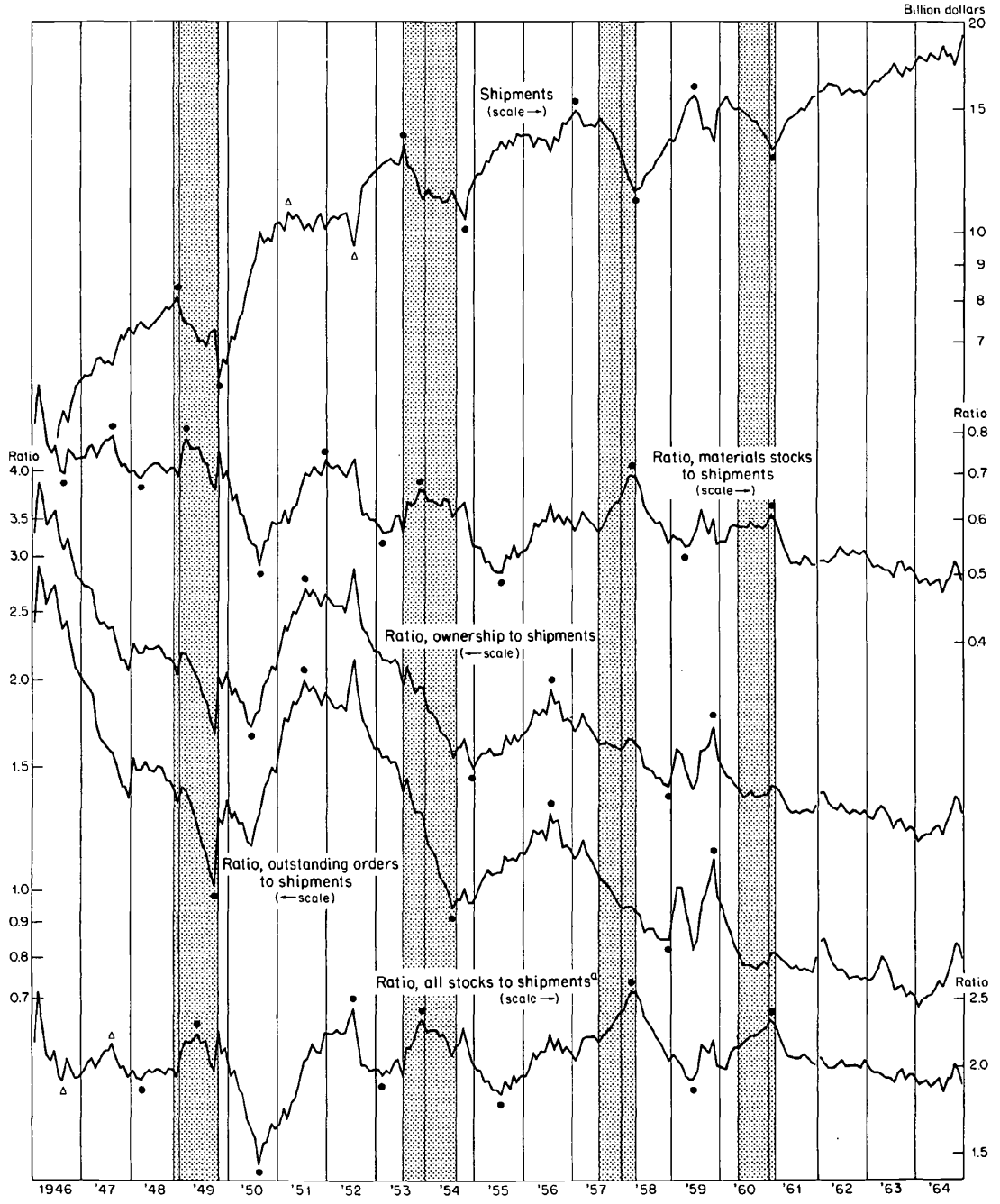
Manufacturers' purchasing of materials, then, tended to add to other forces of expansion not only by causing an absolute rise in materials on hand and on order but a rise proportionately greater than that of the rise in shipments of finished goods.

The behavior of purchasing at the very start of cyclical expansion is interesting. In 1949 and in 1954 the outstandings-shipment ratio began increasing one month before the cyclical trough dates. Accordingly, part of what I have called the first thrust of expansion consisted in this increase in the number of weeks' supply on order. For materials on hand, the number of weeks' supply went down at first, and, as we shall see in Chapter 9, this is not without significance. But a few months before the terminal dates of periods of "thrust," stocks started to rise relative to sales and continued to do so for some months after the outstandings-shipments ratio started to decline.

The expansion starting early in 1961 was different in several respects from the earlier postwar movements. Though outstanding materials orders rose as usual about the same time that business reached its low, they did not rise relative to shipments. (It will be recalled, incidentally, that unfilled orders for final product did not rise at all.) The stock-sales ratio likewise did not start to rise within

CHART 3

*Relation of Stocks and Unfilled Orders to Shipments, Durable Goods Manufacturers, 1946–64*




Note: Shaded areas represent business contractions. Specific cycle turns are marked by dots, additional minor turns by triangles.

[a] Ratio of finished, in process, and materials stocks of all durable goods manufacturers to shipments, all durable goods manufacturers.

the usual eight to twelve months after business troughs were acknowledged (Table 8, line 5 or 6). Can this taming of inventory movements be explained in terms of the firm rein on stock management afforded by electric data processing? Before this popular explanation is accepted, we shall need to move as far as possible toward understanding some of the factors other than sales which seem to influence materials ownership. Chapter 11 returns to the question and recommends a different answer.

The facts that have been assembled describe the character of the participation of durable goods manufacturers' stocks of materials on hand and on order in business fluctuation, one of the two questions to which the behavior of the time series are referred. Outstanding orders for materials appear to be large—about half as large as all stocks and twice as large as materials stocks. The facts point to movements that correspond to business cycles, to the presence of two minor movements in outstandings, to leads in the outstandings segment. We have seen also that the amplitude of fluctuation is strong—greater than can be accounted for by fluctuations in shipments alone, even assuming that it was actually necessary for stocks to increase or decrease as much as shipments, an assumption which Chapter 2 denied. We saw also that whatever stimulating influence on the economy is generated by increases in outstandings was particularly strong in the first year of expansion.

Most of these observations also have some bearing on the dynamics of change in stocks on hand and on order, the second major question concerning which information is to be assembled. Of particular interest in this connection is the large size of outstandings, their tendency to parallel stocks though with a lead which at peaks is longer than can be readily explained. The early thrusts likewise require explanation in terms of the business problems that they reflect.

It will be useful to summarize these several findings somewhat more carefully since they are hard to fasten in memory. However, the summary will be more useful if it also covers a parallel study of department stores. Behavior is more noteworthy if it is found in enterprises as different as the large retail store and the manufacturer of heavy equipment. Insofar as a characteristic is not repeated in these very different industries, it is useful to try to learn why.