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Appendix B

Determination of Reference Dates for Annual Series with Various Timing Characteristics

Reference dates for calendar year series (table 15, upper half)

For the purpose of measuring conformity a series whose cycles tend to turn synchronously with business cycles would be expected to reach calendar year peaks and troughs in the same years as business in general. A series that tends to lag 12 months should reach its peaks and troughs in the years following annual reference cycle turns and one that tends to lead 12 months should reach its peaks and troughs in the years preceding.

Similarly, a calendar year series whose monthly analogue lags 6 months behind business at large should reach its peaks and troughs in the calendar years following the fiscal years (years ending June 30) when business cycle peaks and troughs are recorded. And a calendar year series whose monthly analogue leads by 6 months should reach its peaks and troughs one year earlier. If the fiscal year 1927 is a business cycle peak, a series that lags 6 months should reach its calendar year peak in the calendar year 1927. A series that leads by 6 months should reach its peak in the calendar year 1926.

In the same way a series that lags 3 months behind business cycles should reach its calendar year peaks and troughs in the calendar years following the October-September years when business in general reached high and low levels. Series that lead by 9 months should reach their calendar year peaks and troughs in the calendar years preceding. Thus if the year ending September 1928 is a reference trough for years running from October through September, a series that lags 3 months should reach its trough in the calendar

year 1928, while one that leads by 9 months should be at a trough in the calendar year 1927.

Finally, an annual chronology of business cycle turns for years running from April to March provides us with reference dates for calendar year series with turns that lag 9 months behind those of business or that lead by 3. If business is at peak levels, say, in the year ending March 1930, a series that lags 9 months should reach a calendar year peak in the calendar year 1930, and one that leads by 3 months should reach a peak in the calendar year 1929.

Following this plan we take our reference chronology for series that are assumed to run synchronously (Table 15, col. 5) from the National Bureau standard calendar year reference cycle chronology (cf. Table 4). From these dates we derive also our reference chronology for series that lead or lag one year (Table 15, col. 1 and 9). From the reference dates in the National Bureau fiscal year reference chronology we derive the dates for series that lag 6 months (Table 15, col. 7) and for series that lead by 6 months (Table 15, col. 3).

Reference peaks and troughs for the remaining timing categories were chosen according to the turns in the FRB index of industrial production since 1919, and according to those in the American Telephone and Telegraph Company index of business activity for years before 1919. Neither series was adjusted for trend. Annual averages were computed from the monthly data of these two reference series for years ending in March and September. The peaks and troughs of these series provided the reference chronologies for series lagging 9 and 3 months, respectively (Table 15, col. 8 and 6) and from these we derived the reference dates for series that lead by 3 and 9 months (Table 15, col. 4 and 2).

Two figures appear in Table 15, columns 4 and 8, in connection with one trough and one peak because the annual reference series for years ending March declines steadily and at an increasing rate from a peak in the year ending March 1918 to a trough in the year ending 1921. To maintain symmetry with the other timing categories, a trough is assumed in either 1918 or 1919 and a peak in either 1919 or 1920 in column 4 and a trough and a peak one year later in column 8.

REFERENCE DATES FOR END OF YEAR SERIES (TABLE 15, LOWER HALF)

The procedure for deriving reference dates for December 31 series is analogous to that for calendar year series. Again the reference series used are the FRB index of industrial production since 1919 and the A. T. and T. index before that year. The conformity of year end series that run synchronously must be measured in conjunction with reference dates that show the year ends when business was at peak and trough levels. The conformity of year end series whose monthly analogues lag 3 months must be measured in conjunction with reference dates that show the September 30's when business reached peaks and troughs. And so on.

A complete scheme by 3-month intervals follows. Only the first four of the nine sets of dates are independent; the others are derived from these four by predating or postdating one year.

Timing Category of Series	Reference dates derived from peaks and troughs of business recorded annually at:
Synchronous	December 31
Lags 3 months	September 30
Lags 6 months	June 30
Lags 9 months	March 31
Lags 12 months	December 31, postdated one year
Leads 3 months	March 31, predated one year
Leads 6 months	June 30, predated one year
Leads 9 months	September 30, predated one year
Leads 12 months	December 31, predated one year

The process of selecting turning dates was simple in almost every instance. The first step was to chart four annual series, one of December 31 standings (average of December and the following January), the second, of September 30 standings, and so on. The peaks and troughs in these series represented the reference dates required.

Some exceptional instances remain to be noted.

1) The June 30 and September 30 series reached a peak in 1933 and a trough in 1934. As this contraction is not recognized in the National Bureau standard set of reference dates, it was disregarded in our chronology.

2) The December 31 series derived from the FRB index of industrial production does not show a decline in 1923-24 corresponding to the contraction recognized by the National Bureau. A contrac-

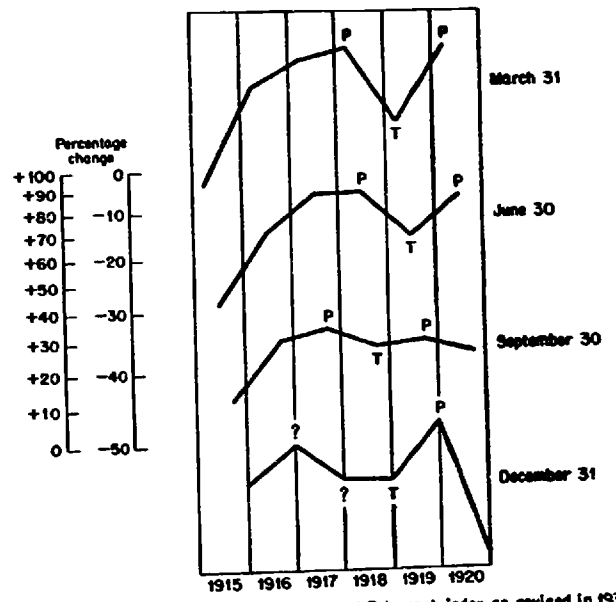
tion is nevertheless entered in our chronology to correspond with the contraction recognized in the National Bureau standard chronology and dated in the light of the pronounced decline in the rate of growth of this series which began on December 31, 1922 and ended a year later.

3) In the same way a contraction in the June 30 FRB series was considered to begin in 1926 and end in 1927 although the series shows merely a decline in its rate of growth.

4) A somewhat different source of trouble was found in dating the peaks in general business near the end of 1917. Reading the turning dates directly from the charts we would have to accept for synchronous series, the end of 1916; for series lagging 3 months, the end of 1917; for series lagging 6 months, the end of 1918; for series lagging 9 months, the end of 1918; for series lagging 12 months, the end of 1917.

Chart 102

American Telephone and Telegraph Index
End of Year Standings for Years Ending on Various Dates



Data are based on the American Telephone and Telegraph Index as revised in 1932. Revisions in 1944 altered the composition and method of computing the index. The new data indicate a peak in 1918 and a trough in 1919 for series lagging 3 months, instead of 1917 and 1918 respectively. In view of the uncertainty of conditions during this period it was decided not to alter the reference chronology based on the original series.

If this schedule were accepted at face value we would have to say that series lagging 12 months are expected to turn before those lagging 6 months. The trouble arises because of a sharp random decline in the A. T. & T. index at the end of 1917 which causes the peak in the December 31 series to shift back to the end of 1916. But the September 30 (+3) series has its peak in 1917 and the others in 1918 (Chart 102).

We decided to take the peak in the synchronous series at the end of 1917 in accordance with the evidence of the National Bureau standard set of fiscal and calendar year reference dates (Table 15). The calendar year peak is placed in 1918 and the fiscal year peak in the fiscal year 1918 (July 1917 to June 1918). Thus, the set of peaks for end of year series as finally selected falls within the period straddled by the fiscal and calendar year peaks as selected by the National Bureau on the basis of more comprehensive evidence. A peak at the end of 1916 would fall well outside this period.