Volume Title: Changes in the Cyclical Behavior of Interest Rates

Volume Author/Editor: Phillip Cagan

Volume Publisher: NBER

Volume ISBN: 0-87014-414-6

Volume URL: http://www.nber.org/books/caga66-1

Publication Date: 1966

Chapter Title: Changes in Cyclical Behavior

Chapter Author: Phillip Cagan

Chapter URL: http://www.nber.org/chapters/c1522

Chapter pages in book: (p. 3 - 11)

by a few months, since the series begin in that year and an earlier turn cannot be ruled out for certain. For comparison with peaks and troughs in general business activity, the chart shades periods of business contraction.[4] Cyclical movements in the rates that do not correspond to reference cycles, and reference phases skipped by the rates, are noted on the chart. Many such discrepancies occurred, but on the whole all the rates usually conform well to business activity, as has long been recognized. Many of the discrepancies pertain to the 1930–49 period. Financial disorders produced extra cycles in rates in the early 1930's; then, with depressed business activity and rapid growth in the money stock during the second half of the 1930's, interest rates declined steeply and did not respond in the usual way to the business cycle. During and after World War II the Federal Reserve pegged U.S. bond and bill yields, indirectly affecting all interest rates, which explains skipped cycles during the 1940's. Aside from these episodes, the only other discrepancy from 1919 to 1961 was the 1924–26 reference expansion skipped by most bond yields, reflecting prolonged declines from the high levels attained in 1920. Between 1878 and 1913 there were few discrepancies. Beginning the analysis with 1878 avoids atypical behavior in the 1870's, when most series had extra cycles during the 1873–79 business depression; in that respect the period resembles the 1930's.

Since 1953 the rates covered by Chart 1 have conformed to every reference phase, which some commentators take as indication of a fundamental change in the money market. Important changes have occurred, to be sure, but the conformity does not appear exceptional. Call money and commercial paper rates had nearly perfect conformity to the ten reference cycles from 1885 to 1919. The chief discrepancies are associated with special disturbances in the money market. After all, price and output series, most of which conform closely to general business activity, also undergo unusual movements when subject to special developments such as strikes and wartime controls. Yet there is a clear difference: Interest rates appear to reflect special influences more often than price and output series do, and each time for a longer period. The highly volatile behavior of financial markets is well known and needs no documentation here.

For present purposes it appears more fruitful to confine the analysis to the typical behavior of interest rates. Most of the analysis therefore excludes the 1930's and 1940's, World War I, and the post-Civil War period to 1878. That leaves the period since 1953 to compare with the 1920's, and these two decades to compare with the four and a half decades between 1878 and 1914.

Chart 2 shows the cyclical behavior of interest rates on a reference cycle basis. The patterns suggest two tendencies to be examined in detail: a shift toward earlier turning points in relation to reference turns and a greater amplitude of fluctuation in the 1950's than earlier. Timing is discussed in Section A and amplitude in Section B of Part II.

## II Changes in Cyclical Behavior

### A *Timing*

The generally lagged timing of interest rates at reference turns, evident in Chart 1, is summarized by Table 1, which gives the median lag of each rate in selected periods. The table covers the 1920's and 1950's (excluding World War I and the period from 1930 to the post-World War II unpegging of long-term rates in 1951), and the period 1879 to 1913 divided at 1900. (The main reason for dividing at 1900 is that two long-term rates are first covered just before that year.) Extra turns in the rates not matching reference cycles are ignored. Also, reference turns which a series skips are excluded. A comparison of median lags for rates that cover a different number or set of turns can be misleading. The medians appear satisfactory, however, for bringing out the changes in timing of each rate over time.

The length of the average lag of long rates has clearly declined at peaks and troughs. Some decline occurred between each period, and by the 1950's the lag had disappeared and in many series gave way to short leads. For short rates the table suggests closer timing to reference peaks

[4] For the dates see Geoffrey H. Moore (ed.), *Business Cycle Indicators*, Princeton University Press for National Bureau of Economic Research, 1961, I, 670. The latest reference trough is February 1961.

# BEHAVIOR OF INTEREST RATES

CHART 2. — CYCLICAL PATTERNS OF INTEREST RATES, NINE REFERENCE CYCLE STAGES
(deviations from cycle averages, basis points)

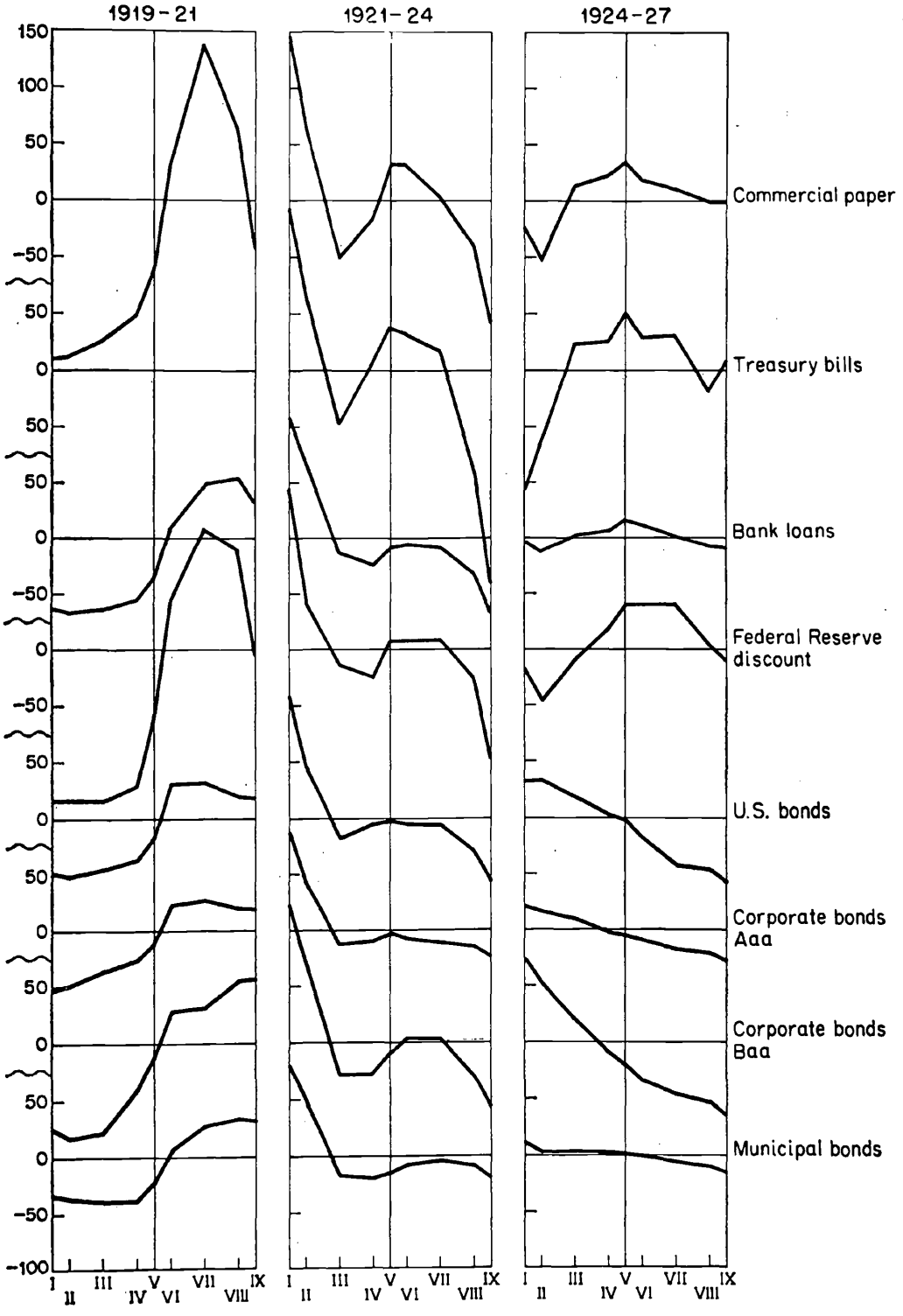
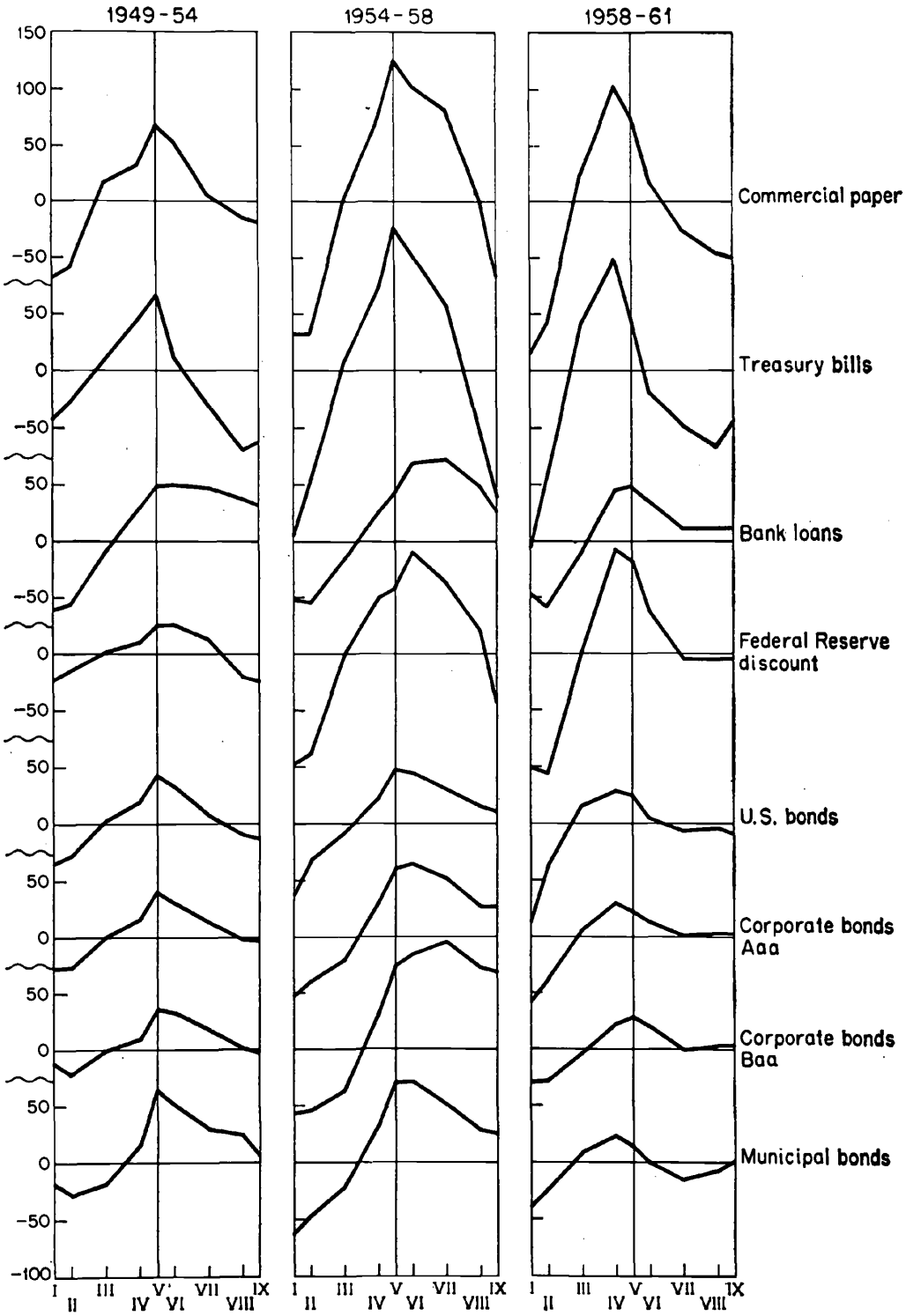



CHART 2 (continued)

CHART 2 (concl.)




SOURCE: Same as Appendix Table B. Municipal bonds are the Standard and Poor's series for 1919–27 and Moody's Aaa series for 1949–61.

TABLE 1. — MEDIAN LEAD (−) OR LAG (+) OF INTEREST RATES AT REFERENCE CYCLE TURNS, SELECTED PERIODS (months)

| | Troughs | | | | Peaks | | | |
|---|---|---|---|---|---|---|---|---|
| | Six: 1879–97 | Four: 1900–12 | Four: 1919–27 | Three: 1954–61 | Six: 1882–99 | Four: 1902–13 | Four: 1920–29 | Three: 1953–60 |
| Short rates | | | | | | | | |
| Call money | +2 | −1 | 0 | +7(1) | +3 | +2 | −3 | +5 |
| Commercial paper | +4 | +4 | +2 | +4 | +7 | +6 | +1 | 0 |
| Treasury bills | — | — | +1(1) | −2 | — | — | −2 | −1 |
| Acceptances | — | — | 0(1) | +4 | — | — | +2 | +1 |
| Bank loans | — | — | +3 | +4(1) | — | — | +3 | +5 |
| Federal Reserve discount | — | — | +12 | +5(1) | — | — | +10 | +3 |
| Bond yields | | | | | | | | |
| U.S. | — | — | +4(1) | 0 | — | — | +5(1) | −1 |
| Corporate Aaa | — | — | +5(1) | +1 | — | — | +1(1) | −1 |
| Corporate Baa | — | — | +3(1) | +2(1) | — | — | +5(1) | +2 |
| Corporate and municipal | — | +13 | +4(1) | +1 | — | +9 | +4(1) | −1 |
| Municipal | — | +5 | +3(1) | 0 | — | +8 | +7(1) | −1 |
| Railroad | +14 | +7(2) | +1(1) | — | +8(1) | +11(1) | +4(1) | — |
| New England municipal | +20 | +5 | — | — | +10 | +8 | — | — |

SOURCE: Appendix Table A.

Note: Numbers in parentheses give the number of reference turns missed or not covered by the series in the period. Calculation of the median sometimes gives numbers with the fraction ½, such as a lag of 2½ or 3½ months; the ½'s have been dropped in the table.

in the 1920's than before World War I, but no definite change thereafter, and at troughs apparently no change over all. The lag in timing of long behind short rates, apparent before World War I, has narrowed consistently over the years, so that by the 1950's it was no longer evident.

Timing among the series shows the active open-market rates generally turning first and the rates of thin or negotiated markets turning last. One indication of this pattern is that Treasury bills and U.S. bonds usually have the earliest turns, and bank loans and low-grade corporate bonds the latest. The policy-determined Federal Reserve discount rate also turns late. The call-money rate used to be consistent with this sequence by generally turning ahead of commercial paper rates, but it became a laggard after World War II. These differences in timing are all well known and, given certain institutional developments, they are to be expected, except perhaps for the discount rate, which could in theory lead all the other rates under certain policies but in fact lagged under the policies pursued.

The varied timing of the short rates points up the difficulty of comparing their behavior before and after World War I. The two short rates for the pre-1914 period differ in function from those available for the later period, and in addition have changed in character over the years. Call money rates are undoubtedly not the sensitive indicator of money market conditions today that they once were. There is some question also about comparing commercial-paper rates today with earlier times.[5] A comparison of short rates before and after World War I by means of these data, therefore, may be misleading. For the moment let us disregard this difficulty and summarize the behavior of the open-market short rates (that is, excluding bank loan and discount rates). If we suppress deviant behavior by taking the median lag of rates at each turn, Table 2 gives an arithmetic average of these medians for the earlier and later period, excluding the 1930's and 1940's. The lag of short rates at peaks declined significantly, but at troughs it increased (though not significantly). The latter increase appears exceptional, and if we exclude the 1921 depression, from which short rates recovered unusually late, the average lag at troughs for the later period drops to 2.1 months. That figure suggests, more plausibly, that the lag diminished slightly from the earlier period. The table also gives averages for all of the long rates. Their lag declined significantly at both peaks and troughs.

The large ranges of error for troughs in the right-hand column of Table 2 reflect large variations in timing between different reference

[5] See Selden, *Trends and Cycles in the Commercial Paper Market.*

TABLE 2. — ARITHMETIC AVERAGE OF MEDIAN LAGS IN SHORT AND LONG RATES AT SELECTED REFERENCE PEAKS AND TROUGHS BEFORE AND AFTER WORLD WAR I

(months)

| | Period | | Later Minus Earlier Period |
|---|---|---|---|
| | 1879–1913 | 1919–61 | |
| Short rates | | | |
| Troughs | +2.7 | +3.7 | +1.0 (±5.8) |
| Peaks | +4.7 | +0.1 | −4.6 (±2.9) |
| Bond yields | | | |
| Troughs | +11.1 | +2.7 | −8.4 (±7.7) |
| Peaks | +9.2 | +1.1 | −8.1 (±2.7) |

SOURCE: Appendix Table A.

Note: Parentheses contain range of error at .05 level of significance based on the *t* distribution, which assumes the normal distribution of leads and lags about reference peaks and troughs. Coverage: Turns covered are the same as in Table 1 except for inclusion here of 1937 peak, and exclusion of one trough and one peak for bond yields from the beginning of the earlier period (for 1879 and 1882). The excluded turns had very long lags which would make the medians for the earlier period even larger than they are. Rates covered are the same as Table 1 except for exclusion here of bank loan and discount rates and of railroad bond yields after World War I. Exact coverage is indicated in Table A.

troughs, but not exceptional variability between the rates at each turn. Turning points in the rates actually cluster relatively closer to each other at troughs than at peaks, as demonstrated by a measure of clustering in Table 3. The measure compares as a ratio the variation in the average lag of the rates among reference turns with the variation in lags among the rates. The ratio is significantly greater than unity in seven of the eight comparisons, indicating substantial clustering. In all cases turns in the rates cluster together more at troughs than at peaks and more in the later than in the earlier period. The two ratios for short rates in the later period would probably be even larger if we excluded the insensitive bank loan rate, not represented in the earlier period.

TABLE 3. — DEGREE OF CLUSTERING OF CYCLICAL TURNS IN SHORT AND LONG RATES, AS INDICATED BY VARIATION IN LAGS AT SELECTED REFERENCE PEAKS AND TROUGHS

| | F Ratios (and levels of significance): Variation Between Reference Cycle Turns as Multiple of Variation Around Each Turn | |
|---|---|---|
| | 1879–1913 | 1919–61 |
| Short rates | | |
| Troughs | 4.6 (.025) | 10.7 (.005) |
| Peaks | 0.27 (.05) | 3.8 (.005) |
| Bond yields | | |
| Troughs | 9.4 (.005) | 40.0 (.005) |
| Peaks | 4.9 (.005) | 7.0 (.005) |

Note: Coverage is same as Table 2 except for inclusion here of bank loan rate. Method of computation: If $L_{it}$ is the lag (in months) of *i*th interest rate at reference turn *t*, the F ratio is

$$\frac{\sum_{t}^{T} (L_t - \bar{L})^2}{T-1} + \frac{\sum_{t}^{T}\sum_{i}^{I} (L_{it} - L_t)^2}{I-T}$$

where $L_t$ is the average lag of all rates at turn *t* and $\bar{L}$ is average lag of all rates at all turns.

The one ratio less than unity (absence of clustering) among the eight comparisons — for short rates at peaks in the earlier period — indicates that turning points in call-money and commercial-paper rates then conformed less closely to each other than to reference turns. The call money market was highly sensitive to business conditions before the 1930's, producing close conformity of the rate to general business activity. The rate was related loosely to commercial paper rates and hardly at all to the long-term rates. In its affinity to business conditions, the call money rate before 1930 resembles the Treasury bill rate in the 1950's. If we link these two series in 1920 (when rates on short-term Treasury securities start) to form a single series representing the most sensitive short-term interest rate over the full period, a definite downtrend in the length of lag has occurred only at peaks (see Table 1). If instead we take commercial paper rates as the best single indicator of short rates over a long time span, that series also suggests that the lag at peaks shortened after World War I but remained substantially the same thereafter, and that the lag at troughs remained largely unchanged over all periods.

Secular trends in the rates can affect timing. A rising trend in rates might be expected to produce longer lags at reference peaks and shorter lags at troughs; and conversely for a falling trend. Table 4 tests this expectation for four periods which have fairly definite trends. Bond yields fell secularly from the mid-1870's to around 1900, rose subsequently to World War I, fell again during the 1920's and until after World War II, and then rose thereafter until 1960. The trend since then has been unclear. In Table 4 turning points near a change in direction of trend have been omitted. The table covers bond yields only; short-term rates have not displayed well-defined trends.

The relative timing at peaks and troughs is largely the reverse of the expectation. A comparison of periods, summarized in the right-hand

TABLE 4. — MEDIAN LEAD (−) OR LAG (+) OF BOND YIELDS AT REFERENCE CYCLE TURNS FOR PERIODS OF FALLING AND RISING TREND
(months)

| | FALLING TREND (Expectation: short lags at peaks, long lags at troughs)[e] | | | | RISING TREND (Expectation: long lags at peaks, short lags at troughs)[e] | | | | COMPARISON OF PERIODS Number with Shorter Lag during: | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1879–97 | | 1919–29 | | 1902–13 | | 1953–60 | | Falling Trend | | Rising Trend | |
| Bond Yields | Peaks | Troughs | Peaks | Troughs | Peaks | Troughs | Peaks | Troughs | Peaks[e] | Troughs | Peaks | Troughs[e] |
| U.S. | | | +5 | +4 | | | −1 | 0 | | | 1 | 1 |
| Corporate Aaa | | | +1 | +5 | | | −1 | +1 | | | 1 | 1 |
| Corporate Baa | | | +5 | +3 | | | +2 | +2 | | | 1 | 1 |
| Corporate and municipal | | | +4 | +4 | +9 | +13 | −1 | +1 | 1 | 1 | 1 | 1 |
| Municipal | | | +7 | +3 | +8 | +8 | −1 | 0 | 1 | 1 | 1 | 1 |
| Railroad | +8 | +14 | +4 | +1 | +11 | +7 | | | 2 | 1 | | 1 |
| New England municipal | +11 | +20 | | | +8 | +9 | | | | | 1 | 1 |
| | | | | | | | | | | *Total* | | |
| | | | | | | | | | 4 | 3 | 6 | 7 |

SOURCE: Appendix Table A.
Note: The fraction ½ has been dropped from the medians, as in Table 1.
[e]Expected direction of shift in turning points resulting from trend.

columns, also suggests that trends play no part in the timing changes. While eleven of the twenty comparisons fit the expectation of shorter lags at peaks during falling trends and at troughs during rising trends, this is no more than would occur by chance. By contrast, nineteen of the twenty show a shorter lag in a later period. (Railroad bonds at peaks are the exception.)

The evidence therefore supports the following generalizations: (1) Interest-rate fluctuations maintain a sequence, with the active open-market rates usually turning first and the rates of negotiated and inactive markets usually turning last. (2) All long rates used to but no longer lag far behind short rates. (3) The turns within the group of shorts, and within the group of long rates, occur fairly closely together, so that the variability of the lags within each group is much less than the variability of the average lag for the group between cycle turns. (4) Turning points have clustered closer to each other and closer to reference cycle turns over the years, though a shortening of the lag is more evident for longs than shorts, and for shorts more at peaks than at troughs. In recent cycles the vanguard of interest rates turns with, or sometimes even before, business activity as a whole.

So far as turning points are concerned, therefore, financial markets react more in unison with each other and closer to changes in business conditions than formerly. The next section brings out a similar development in amplitude of fluctuation.

### B *Amplitude*

The amplitude of expansions and contractions provides, along with timing, a revealing measure of cyclical behavior. The cyclical amplitudes of the interest-rate series, listed in Appendix Table A, are summarized in Table 5 for the same four periods covered by Table 1, except that here the first period begins with 1885 for the shorts also, to omit some early cycles which do not match reference cycles. Unmatched cycles lessen the comparability of data between periods. With the coverage here, the only cyclical movement not matching a reference phase is the contraction in commercial paper rates, 1898–99.

Panel A gives per-month changes in the series from peak-to-trough stages of reference contractions and trough-to-peak stages of expansions, taking the negative of the algebraic change over reference contractions. Hence the measure can be, and sometimes is, negative, reflecting inverted cyclical movements. Panel A amplitudes are generally larger for later periods. As in the timing comparisons, the main exception is the call money rate.

Much of the increase in amplitude appears to reflect the closer conformity in timing. Lags shift the specific cycles out of phase with refer-

TABLE 5. — AVERAGE AMPLITUDE OF CYCLICAL PHASES FOR SELECTED PERIODS
(basis points per month)

| | 1885–1900: 5 Expansions and 5 Contractions (1) | 1900–13: 4 Expansions and 3 Contractions (2) | 1919–29: 4 Expansions and 3 Contractions (3) | 1953–61: 2 Expansions and 3 Contractions (4) |
|---|---|---|---|---|
| **A. REFERENCE CYCLE PHASES** | | | | |
| Short rates | | | | |
| Call money | 15.5 | 13.9 | 15.5 | 5.7 |
| Commercial paper | 3.6 | 6.8 | 3.8 | 11.4 |
| Treasury bills | | | 6.0[a] | 12.4 |
| Acceptances | | | 5.6 | 11.3 |
| Bank loans | | | 0.9 | 2.7 |
| Federal Reserve discount | | | 3.0 | 7.3 |
| Bond yields | | | | |
| U.S. | | | 0.8 | 3.8 |
| Corporate Aaa | | | 0.2 | 3.2 |
| Corporate Baa | | | 0.4 | 2.4 |
| Corporate and municipal | | −0.3 | 0.1 | 3.5 |
| Municipal | | −0.1 | −0.4 | 3.4 |
| Railroad | −0.5 | 0.0 | | |
| New England municipal | −1.0 | | | |
| **B. MATCHED SPECIFIC CYCLE PHASES** | | | | |
| Short rates | | | | |
| Call money | 31.1 | 27.9 | 19.5 | 7.3[b] |
| Commercial paper | 22.8 | 11.6 | 10.7 | 11.6 |
| Treasury bills | | | 11.3[c] | 14.5 |
| Acceptances | | | 11.9[c] | 12.4 |
| Bank loans | | | 4.7 | 5.4[b] |
| Federal Reserve discount | | | 8.3 | 9.4[b] |
| Bond yields | | | | |
| U.S. | | | 3.3 | 3.8 |
| Corporate Aaa | | | 2.5 | 3.9 |
| Corporate Baa | | | 4.4 | 3.7[b] |
| Corporate and municipal | | 1.6 | 2.2 | 4.2 |
| Municipal | | 1.5 | 2.6 | 4.2 |
| Railroad | 1.4 | 0.9 | 2.2 | |
| New England municipal | 1.8 | 1.8 | | |

SOURCE: Appendix Tables A and B.

Note: Method of computation: Algebraic change per month from trough-to-peak stages of expansions, plus negative of algebraic change per month from peak-to-trough stages of contractions, divided by number of phases. Inverted conformity to reference cycles, therefore, gives a negative amplitude over such cycles. The amplitude for specific cycles, of course, is always positive. If doubled, the figures give the average amplitude of a full cycle in the period.

In Panel B the amplitude is taken as zero when no specific cycle phase matches the reference phase. The only extra specific cycle in the periods covered was the contraction in commercial paper rates, 1898–99; it was suppressed by computing the change per month from one matching specific turn to the next. Skipped and extra cycles for each series are marked on Chart 1. Exact coverage is indicated in source.

[a] Five phases only; first two phases not covered.
[b] Four phases only; last contraction not covered.
[c] Six phases only; first expansion not covered.

ence cycles and reduce this measure of amplitude. A measure independent of timing, and therefore a better indicator solely of the amplitude of cyclical fluctuations, is the change for specific cycle phases shown in Panel B. To be comparable with A, Panel B excludes extra specific cycles not matching reference cycles. Also, the B averages incorporate a zero entry when the series skips a reference phase, so as to record the absence of any recognizable cyclical movement.

The specific cycle amplitudes are necessarily always positive and (barring an unusually large number of skipped phases, not a problem here) equal to or greater than the reference cycle amplitudes. Aside from that difference, Panel B does not show a clear difference in amplitude between periods. Among the short rates excepting call money, there is a slight increase from the 1920's to the 1950's; but call money and commercial paper had considerably larger fluctuations before 1900 than in the three periods since, which can be attributed only in part to the pre-1914 cycles with financial panics. Among bond yields, the evidence, though mixed for the later periods, shows a substantial increase from before to after World War I.

A comparison of amplitudes between periods

can be influenced, however, by the severity of the reference cycles that each period happens to cover. The 1920's include the 1920–21 contraction, for example, which in severity far exceeds any contraction during the 1950's. To allow for differences in severity, Table 6 gives ratios of amplitudes for specific cycle phases in which the amplitudes of the corresponding reference cycle phases are approximately similar as judged by indexes of general business activity.

Well over half the ratios are above unity, indicating that fluctuations in rates, holding the severity of the corresponding reference phases approximately equal, were generally greater in the 1950's. The strongest exceptions are for call money and low-grade corporate bonds, and for the short rates in column 4. Also, by these pairings, most rates had a comparatively greater amplitude in the two cycles after 1957 than in previous cycles. The largest increases are shown by commercial paper and Treasury bills and by high-grade corporate and municipal bonds (again, the more active rates). The U.S. bond yield is an exception to the behavior of the active rates, perhaps because it already had a comparatively large amplitude in the 1920's (Table 5).

Tables 5 and 6 together give strong evidence of a large though not uniform rise in amplitudes. Bond yields had a doubling or more of amplitude from the 1880's to the 1950's. Increases occurred from before to after World War I as well as later. For short rates, on the other hand, an increase shows up clearly only from the 1920's to the 1950's.

Secular trends in interest rates do not account for these results. Amplitude is measured on a per-month basis, so a steady trend adds the same amount to each expansion and contraction. With contractions treated negatively, the trend cancels out over each cycle. Since the figures cover two expansions and three contractions in the 1950's, however, the upward trend in that decade on net makes our estimates of amplitude slightly too low. Such trend effects in the other periods are insignificant.

The similar behavior of municipal bond yields to the other series appears to deny an explanation based on the high marginal tax rate on corporate and personal income in the 1950's. It has been argued that the tax rate cuts the effectiveness of any given yield to both lenders and corporate borrowers. If corporations take advantage of the tax deductibility of interest costs and individual lenders attempt to avoid the tax on interest income (by seeking capital gains or nontaxable investment income), the level and amplitude of fluctuations in market yields might increase. There is evidence that investors now favor tax-exempt municipal bonds and capital-gain investments, probably for these reasons.

TABLE 6. — COMPARISON BETWEEN SPECIFIC CYCLE PHASE AMPLITUDES FOR WHICH SEVERITY OF CORRESPONDING REFERENCE CYCLE PHASES IS SIMILAR, RATIO OF 1950's TO 1920's

| | Expansions | | | Contractions | | | |
|---|---|---|---|---|---|---|---|
| | 1954–57 / 1921–23 (1) | 1958–60 / 1924–26 (2) | 1958–60 / 1927–29 (3) | 1953–54 / 1923–24 (4) | 1953–54 / 1926–27 (5) | 1957–58 / 1923–24 (6) | 1960–61 / 1926–27 (7) |
| Short rates | | | | | | | |
| Call money | .5 | .6 | .4 | .1 | .3 | .5 | — |
| Commercial paper | .7 | 3.0 | 1.5 | .6 | 2.8 | 1.6 | 3.1 |
| Treasury bills | .6 | 1.3 | 1.3 | .9 | 3.0 | 1.5 | 3.8 |
| Acceptances | 1.1 | 2.6 | 1.4 | .2 | .8 | 3.6 | 1.1 |
| Bank loans | 1.4 | 4.5 | 1.0 | .2 | .9 | 1.7 | — |
| Federal Reserve discount | 1.9 | 3.0 | .8 | .2 | .4 | 1.0 | — |
| Bond yields | | | | | | | |
| U.S. | 1.6 | — | 1.0 | 1.4[a] | | 1.5 | .9 |
| Corporate Aaa | 2.0 | — | 2.8 | 2.6[a] | | 3.4 | 3.2 |
| Corporate Baa | .9 | — | .7 | .8[a] | | 1.1 | — |
| Corporate and municipal | 2.2 | — | 2.5 | 3.2[a] | | 4.7 | 2.5 |
| Municipal | 2.5 | 1.1 | 1.6 | 2.7 | 4.2 | 3.7 | 5.6 |

SOURCE: Appendix Table A. Paired cycles of similar severity in business activity are based on Geoffrey H. Moore, *Business Cycle Indicators* II, pp. 104–5 and unpublished revisions.

Note: Dates are for corresponding reference cycle phases.

[a] Amplitude per month of the unbroken specific cycle contraction from 1923 to 1928 is used for both the 1923–24 and the 1926–27 contractions.

But this cannot explain the increased amplitude of corporate (and taxable U.S.) bond yields from the 1920's to the 1950's, because municipal bond yields display roughly the same increase (Table 5).

Although the evidence is based on a group of series which are not entirely comparable from period to period, the consensus of the measures is that, along with timing, the amplitude of cycles in most interest rates has responded more and more sharply to fluctuations in business activity of a given severity. The main qualifications involve the timing and amplitude of the two short rates before World War I, which cannot be appropriately compared with the series for the later period. Effects of financial disturbances in the 1930's and of interest-rate pegs in the 1940's and early 1950's are wholly excluded from the comparisons. Amplitudes have been larger in the 1950's than the 1940's, of course, because the Federal Reserve pegged interest rates during and after World War II. Amplitudes would not be larger in the 1950's than the 1920's, however, unless monetary policy or other relevant factors differed between the two periods.

### III Monetary Influences on Interest Rates

From a formal point of view, changes in interest rates can be interpreted as stemming from either the demand to borrow funds or the supply of new funds. While numerous developments have no doubt affected the timing and amplitude of particular interest rates, the changes discussed appear broadly based, so that the factors responsible seem to encompass the entire market for funds. Moreover, since we took account of the amplitude of business activity (Table 6), a satisfactory explanation must account for an increased amplitude in business cycles of given severity. The analysis here is confined to monetary influences on the supply of funds. Money is defined as currency outside banks plus demand and time deposits at commercial banks. The emphasis on money is not meant to imply that it is the most important factor affecting interest rates. Others are probably more important. But money plays a key role in monetary theory and policy, and the evidence to be presented indicates that it helps to account for the cyclical behavior of interest rates.

New money first enters the economy mainly through the banking system and hence becomes part of the supply of loanable funds. An increased rate of monetary growth might therefore be expected to depress interest rates and a reduced growth rate to increase them. This has long been a tenet of monetary theory and became a famous thesis of the Swedish economist Knut Wicksell, writing over half a century ago. It implies an inverse association between the rate of change of the money stock and interest rates, which the evidence to be presented substantiates. Previous studies of the financial system have largely ignored this tenet of monetary theory and the implied effects on interest rates.[6]

Bank lending produces the first-round effect on interest rates of an injection of new money. Subsequent effects could be of equal or greater importance. A change in monetary growth may produce temporary discrepancies between the public's actual and desired money holdings. In response to such a discrepancy, the public can be expected to alter its expenditures on goods as well as financial assets, with repercussions on interest rates, though the direction and duration of these subsequent effects are complicated because they depend upon how the public adjusts its desired money holdings as changes occur in income, wealth, and commodity prices. (The demand schedule mentioned in footnote 6 implies an equilibrium relation between the actual stock of money and interest rates, for given income and wealth. The relation can help to identify discrepancies, but does not itself indicate how adjustments take place and at what speed.) Price changes can affect market interest rates insofar as the public takes into account the expected rate of depreciation in the real value of fixed-dollar loans and securities, though that adjustment is likely to occur slowly. An examination of the way in which monetary growth affects interest rates is left to a later

[6] Numerous studies have documented an inverse association between the *stock* of money and interest rates, holding national income or wealth constant. This allegedly reflects a dependence of the demand to hold money on interest rates, in which an increase in the stock induces a fall in rates to equate the demand and the supply. Such a relation is different from (though not inconsistent with) that discussed in the text, which postulates an effect of the *rate of change* of the money stock on the supply of loanable funds and thence on interest rates, which equilibrates the supply and demand for loanable funds. Both effects could of course occur at the same time. Some evidence on the stock demand to hold money is presented below.