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CHAPTER 1

Introduction

ALTHOUGH VARIATIONS in interest rates coinciding with the seasons of the year were virtually nonexistent during the 1930's and World War II, they reappeared in the late 1940's and grew in amplitude during the 1950's. The amplitude reached a high point between 1957 and 1959 then diminished substantially in the early 1960's. These gyrations have attracted wide attention among money market analysts. The seasonal movement in short-term rates reached a peak in December and a trough in July. It constituted 20 per cent of the average level of the interest rates. For long-term rates the movement was considerably less. In the past year or so the seasonal has shown new vigor.

A study of the seasonal variation of interest rates contributes to our understanding of the money market and the behavior of interest rates. Interest rates depend upon the supply and demand for credit; therefore, the seasonal variation of credit conditions is likely to contain an explanation of seasonal movements in rates. There is a well known and long standing increase in the economy's demand for short-term credit in the fall and early winter and a corresponding decrease in the late spring and summer. There is an equally well known increase in the supply of Federal Reserve credit in the fall and early winter and a withdrawal of credit in the late spring and summer. The sea-

sonal in short-term rates depends upon a combination of the seasonals in the demand and supply for credit. In years of unusually high demand for credit in the fall combined with a smaller increase in supply (and vice versa for late spring and early summer), the seasonal in interest rates will be large. When the seasonal changes in supply and demand are offsetting, no seasonal appears in interest rates. The amount of change in supply required to offset a change in demand is a statistical question considered in Chapter 4.

The determination and measurement of seasonal movements are hindered by other sources of variation in economic factors, as well as by the volatility of the seasonal component itself. While statistical methods differ in detail, they all attempt to isolate the seasonal component from the other sources of variation and to determine its size and stability. Chapter 2 of this study describes some of the methods used to measure seasonal movements, and Chapter 3 considers in some detail the application of one of these methods to a variety of interest rate series.

The method used here is that currently used by the U.S. Bureau of the Census. The nonseasonal variation of the series is captured by a long-term moving average designed to eliminate any seasonal movements. Each term in the time series is then separated into a moving average component and a component consisting of the difference or ratio of the original series to the moving average. If a series has no seasonal component, the ratios will tend to average unity (the differences, zero) for each set of observations relating to a specific month; that is, the mean of all the ratios calculated for July or November (or any other month) will tend to equal unity, and all such means will of necessity tend to be equal. There will, of course, be observable differences in the mean ratios because of erratic movements in the series, but none of these differences will be significantly different from unity. Thus, averages that do differ significantly from unity provide evidence of seasonality.

The remainder of this chapter describes and analyzes the pattern of seasonal variations in interest rates over the 1948–65 period and discusses some historical developments which are widely thought to have influenced these patterns.

SHORT-TERM RATES

Short-term rates typically decline from a relative high in January through seasonally neutral February, to a trough in June or July, then sharply incline past seasonally neutral August to September, gradually rising to a peak in December. Chart 1 plots the seasonal factors for 1951, 1957, and 1965 (the years before, during and after the period of peak seasonality) for the four short-term rates studied, and Chart 2 shows the factors for call-money rates in 1915 computed by Macaulay.[1]

Seasonal variation of interest rates is the net result of seasonal variation in both the supply and demand for credit, arising when the effect of a given variable on demand is not offset by a comparable movement in supply, as in the following description of an earlier period:

> Before the establishment of the Federal Reserve System, there were four more or less distinct seasonal variations in interest rates. . . . The first movement, from early January until about the middle of February, is characterized by low interest rates, . . . attributable to the fact that the crop movement, with its great demand for money in the West and South, has passed its peak, and has been followed by a heavy flow of cash from the country banks to the primary money market. At the same time, the demand for funds is relatively slack, for business in general is characteristically full during the interval between the holidays and the opening of the spring manufacturing and trading season.
>
> The second period, which is marked by rising interest rates, is largely attributable to the monetary demand of producers and manufacturers. This demand is supplemented, particularly in the latter part of the period, by crop planting requirements.
>
> The third important seasonal variation is that of a weakening money market in April and May, followed by a genuine depression in June and July. This period at its beginning reflects a declining demand for funds by the manufacturing and producing interests of the industrial centers,

[1] The 1915 factors are given in Frederick R. Macaulay, *Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856,* New York, NBER, 1938, insert after p. 216. The method used to compute the recent factors is described briefly in Chapter 2. Here it suffices to note that a factor exceeding 100.0 implies a seasonal high. The factors for the postwar period were computed with the Census Bureau's X-11 seasonal adjustment program.

CHART 1

Seasonal Factors on Short-Term Securities for Selected Years

1. Treasury bills
2. Commercial paper
3. Bankers acceptances
4. U. S. government securities, 9 to 12 months

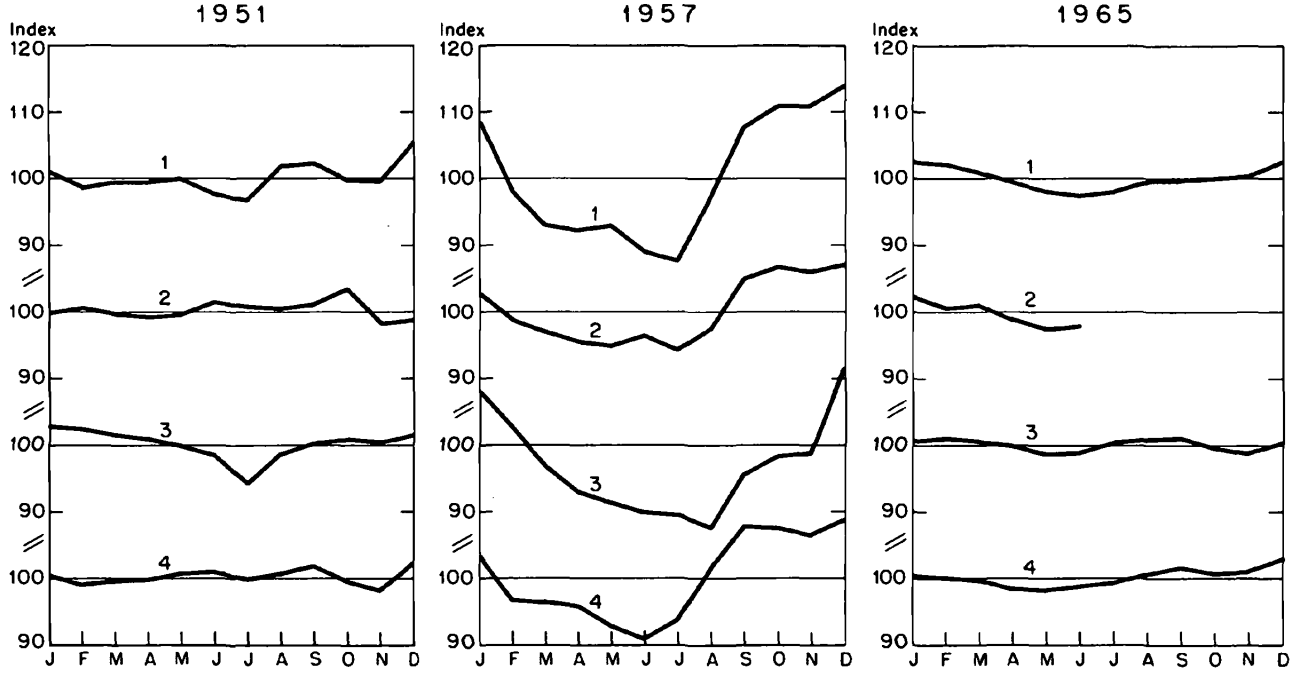
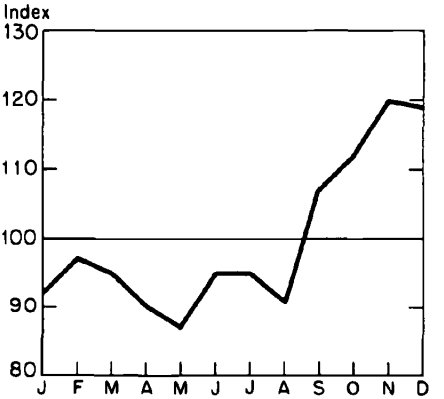


CHART 2

Seasonal Factors for Yield on Call Money, Macaulay's Series, 1915



and in its latter stages the return of funds from the country districts following the completion of the crop planting period.

The fourth season is generally referred to as the crop moving period. The demand for funds in the country districts for the paying of farm labor, the storing of grain, and the moving of produce to the primary markets calls for an outflow of funds from the financial centers to the interior. At the same time, the demand from producing and manufacturing enterprises which are making ready for the fall trade becomes very heavy, thus bringing added pressure to bear on the financial markets. This period ordinarily reaches a peak in October, with interest rates commonly remaining high till January.[2]

What, then, are the present sources of seasonal influence on the demand for credit? These sources are likely to be found in wholesale and retail trade; government fiscal activity, particularly short-term borrowing in autumn to close the gap between tax revenues and expenditures; corporate demand for credit to finance tax and dividend payments in the final quarter of the year, which may be regarded as an increased demand for credit or as a diminished supply of funds that at other times are available to finance government and trade debt; and no doubt other factors as well.[3]

[2] Richard N. Owens and Charles O. Hardy, *Interest Rates and Stock Speculation,* Washington, D.C., The Brookings Institution, 1930, pp. 3–5.

[3] One measure of the diminished supply of corporate investment funds in autumn is the increase in government dealer positions, although other forces

During the fifty years preceding the adoption of the Federal Reserve Act in 1914, seasonal changes in the demand for currency confronted a virtually inelastic currency supply. This situation caused steep movements in both short-term interest rates and, with the fractional reserve system, in the money supply itself. One of the Federal Reserve System's initial objectives was to facilitate the easy transfer of deposits into currency, thereby preventing the sudden declines in the supply of money that had attended the seasonal increases in the demand for currency. Their success in this regard is conspicuous in the contrast between the seasonal amplitudes both in currency outstanding and in short-term interest rates during the periods before and after 1914. The seasonal amplitude of currency outstanding increased substantially in the later period because of the more elastic supply, as well as, given the smaller amplitudes of short-term interest rates, the reduced incentive to economize on its use.[4]

Federal Reserve activity, however, did not entirely eliminate the seasonal variation in short-term interest rates. Seasonal influences persisted, although with much smaller amplitude, throughout the 1920's. In the 1930's, with bank reserves well above legal requirements, seasonal variation in short-term interest rates was barely perceptible despite the absence of the Federal Reserve's seasonal influence. Again in the 1940's, with interest rates pegged within narrow limits, there was little room for seasonal variation. It was only when the authorities removed the peg—gradually in the 1951–53 period—that seasonal variation in short-term rates reappeared. Erratic at first, and with a small amplitude, the seasonal pattern became more systematic in the late 1950's, when its amplitude exceeded 10 per cent on either side of the level of rates. After 1959, however, the seasonal amplitude quickly collapsed and became a mere ripple by

affect these positions as well. Dealer holdings of government securities increase, on average, by 33 per cent in December when compared with the preceding June, one study found. See U.S. Congress, Joint Economic Committee, *A Study of the Dealer Market For Federal Securities,* Washington, D.C., 1960, p. 41.

[4] The change in the seasonal amplitude of call money rates is shown graphically in Macaulay, *op. cit.,* p. 217. The change in the seasonal amplitudes of currency outstanding is described in Milton Friedman and Anna Schwartz, *A Monetary History of the United States, 1867–1960,* Princeton for NBER, 1963, p. 293. The smaller the autumn increase in rates the less is the need to rely on money substitutes, such as trade credit, or to increase the velocity of currency.

1963.[5] The seasonal variation in the period following the Treasury-Federal Reserve accord of 1951 is alike, both in its evolution over the period and its pattern, for the four short-term rates studied: commercial paper, bankers' acceptances, nine- to twelve-month Treasury securities, and 91-day Treasury bills. The variation is similar, moreover, to the pattern Macaulay found for call-money rates during the early part of the century; a surprising similarity, in view of the changes in the capital markets resulting from the relatively recent prominence of government fiscal activity.

This study has not attempted a systematic analysis of the factors affecting seasonal variation in the demand for credit. It may be merely coincidental that the changes over time in the incidence and importance of the factors affecting the seasonal variation of demand have not substantially altered the seasonal pattern of interest rates. The timing of crop movements in the earlier period appears to have affected the seasonal demand for credit in approximately the same pattern as the more important fiscal influences do today. There has been, however, some variation in the timing of fiscal activity that appears to have affected the seasonal variation of interest rates. (This variation is considered in Chapter 4.) Apart from this variation the significant difference between the early and later periods lies not in the variation of demand factors but rather in the conditions of supply. Whereas in the pre-Federal Reserve period the means of accommodating the supply to changes in the demand for credit were limited, these means were virtually unlimited in the later period. Since interest rates vary in response to differences in the rates of

[5] The evidence for these statements is presented in Chapter 3.

While this study was in final manuscript form seasonal adjustments through the middle of 1968 became available. These data reveal an apparent resurgence of seasonal variation in both short- and long-term rates. Whereas this study calculated a seasonal factor for Treasury bills in December 1965 of 102.6, the more recent data indicate a factor of 104.6 for December 1967. In the case of long-term U.S. government bonds the figures for September, the peak month for this series, are 100.3 and 101.0 for 1965 and 1967, respectively. By the nature of the adjustment process inclusion of the more recent data will alter the calculated factors for earlier years. The factors for the last three years reported in this study are therefore subject to upward revision just as the most recent figures would be if the seasonal were to change subsequently. (Seasonal factors are measures of seasonal change. The method of computing them is described in Chapter 2.)

change of supply and demand, the ability to vary the supply implies the ability to remove the seasonal factor in interest rates. Of course, the ability to offset changes in demand requires recognition of those changes, the failure of which would result in an unwanted seasonal influence on interest rates.

That the Federal Reserve did not exercise its ability to expunge the seasonal variation in interest rates does not *imply* an error in judgment. It is arguable, in fact, whether the Federal Reserve should eliminate the seasonality in interest rates—an argument that rests largely on whether removing the symptom of monetary tightness would tend to aggravate the cause of the problem. Just as palliating a sore throat with syrup to increase one's temporary tolerance for cigarettes at the expense of subsequent aggravation, the attempt to ease the cyclical tightness in the money market with infusions of money will stimulate inflationary forces. It is doubtful, however, that a similar response to the more ephemeral seasonal tightness would provoke excessive demand for productive resources—especially in view of the contraction of the money supply some months later that a seasonal monetary policy implies.[6]

In a later chapter this paper argues that the seasonal pattern, if any, of interest rates is determined by the factors affecting the demand for credit; while the seasonal amplitude is determined by the degree of accommodation of the supply of credit.

LONG-TERM RATES[7]

While few would contest the occurrence of seasonal shifts in the demand for money or the possibility that the Federal Reserve allows

[6] For a discussion of whether the Federal Reserve should accommodate short-period fluctuations in the demand for credit see Jack Guttentag, "The Strategy of Open Market Operations," *Quarterly Journal of Economics,* February, 1966, 23–25, and the references cited there.

[7] The computation of the monthly bond yields used in this study is described in the *Federal Reserve Bulletin* as follows:

U.S. Govt. bonds: Averages of daily figures for bonds maturing or callable in 10 years or more. *State and local govt. bonds:* General obligations only, based on Thurs. figures. *Corporate bonds:* Averages of daily figures.

"Corporate" bonds comprise industrials, rails, and utilities. Remarks made about monthly movements do not reflect intramonth variation. Evaluation of this variation requires use of weekly or sometimes daily figures, which is beyond the scope of this study.

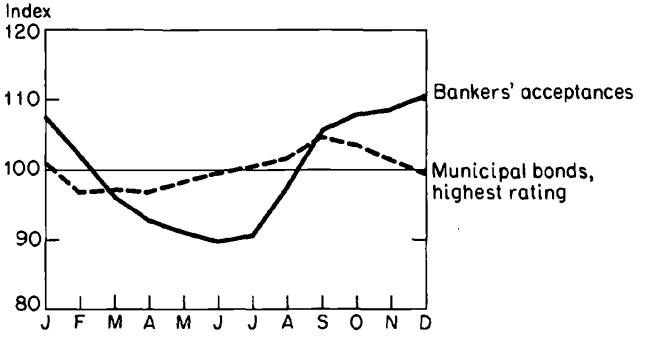
these shifts to affect short-term interest rates, seasonal variation in long-term rates is another matter. There are no obvious reasons for seasonality in long-term rates and some cogent reasons for its absence. To meet seasonal needs for cash corporations, including banks, seldom sell off long-term securities and thereby raise rates. Firms, moreover, can usually delay their long-term borrowing to take advantage of seasonal (i.e., expected) declines in rates; and in so doing eliminate the seasonal variations. Finally, seasonality of sufficient amplitude would invite arbitrage; that is, investors would buy bonds when rates were high and sell them, say, six months later when rates fell—reducing their incentive in the process. To invite arbitrage the seasonal amplitude must be large enough to cover the significant transaction costs involved in holding long-term securities for limited periods. Rough calculations with respect to the orders of magnitude involved may be found in Chapter 4.[8]

This study has found significant seasonal movement in all of the long-term securities examined. The evolution of the seasonal pattern over the postwar period resembles that for short-term rates, with a peak in the late fifties, and the pattern, similar for each of the long-term securities, leads that for short-term rates by about three months. Chart 3 compares the 1958 seasonal factor for bankers' acceptances and municipal bonds (highest rating). The seasonal amplitude of long-term rates is much smaller than that of short-term rates, seldom exceeding 3 per cent on either side of the average level during the period of peak seasonality in the late fifties. The common evolution of the longs and shorts together with the inverse relation between seasonal amplitude and term to maturity is shown in Chart 4. This chart, restricted to government securities—ninety-day, nine- to twelve-month, three- to five-year, and long-term Treasury securities—plots the variances, computed separately for each year and each security, of

[8] Some additional constraints allow the short-term markets fewer opportunities for arbitrage. Since there is usually six months between the seasonal peak and trough, both for the long- and short-term securities, it is not possible to hold, say, 91-day Treasury bills over the full range of variation—that is, from peak to trough or the reverse. Moreover, while yields on long-term securities differ imperceptibly between, say, a nineteen and one-half and a twenty year maturity, the yield curve for short-term securities has a substantial slope. Therefore, the typically higher yield on six-month compared with three-month securities may nullify the advantage of borrowing for six months at low summer rates instead of for three months at high winter rates. Chapter 4 considers this point in greater detail.

CHART 3

Seasonal Factors for Bankers' Acceptance Rates and Yields on Municipal Bonds, Highest Rating, 1958



the twelve monthly seasonal factors. Since the variance measures the dispersion of the factors around 100.0, it is a good summary statistic for the seasonal amplitude.[9] These bell-shaped curves neatly sketch the rise and fall in the amplitude of the seasonal components of the four series and order them with respect to seasonal amplitude. The symmetry of the four curves after 1952 is as remarkable as their movements before 1952 are inscrutable. The seasonal amplitude of each of the four series rises steadily from 1952 to its peak in 1957 and then falls off at approximately the same rate at which it rose. After 1952, the evolution of the seasonal factors is virtually identical in all four sets of securities.

This statement, of course, implies nothing about the reliability of the estimates of the seasonal factors, the determination of which is the main objective of this study. Chapter 3 concludes, for example, that long-term government bonds evinced no significant seasonality outside the period 1955–60; whereas it finds a significant though small seasonal pattern in the private long-term bonds throughout most of the postwar period. These issues will be considered in greater detail in Chapter 3.

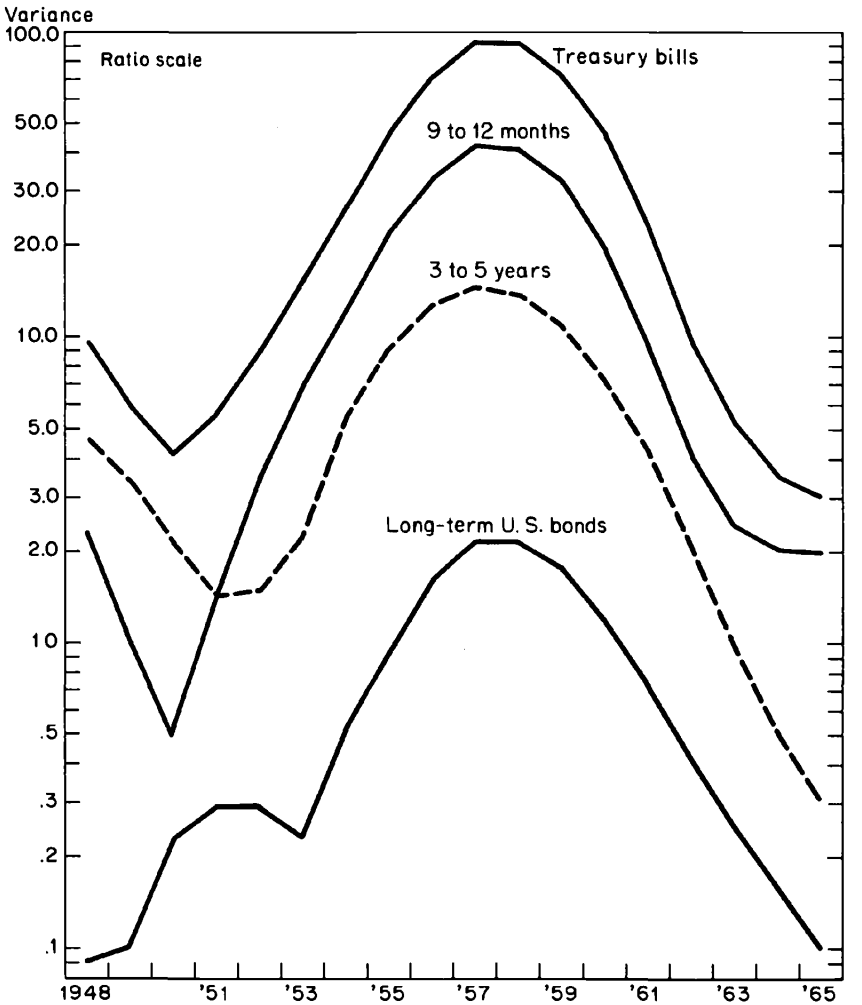
For most of the long-term series considered, 1955 divides the postwar period into two parts with distinctly different seasonal patterns. Typically, the earlier pattern starts with a January low and falls

[9] To conserve space the curves are plotted on four-cycle semi-log paper.

slightly to a trough in March, then rises through May (roughly 100.0) to a plateau extending from June through October, and afterwards returns to the 100.0 level for November and December. Although the general patterns for all the private long-term bonds agree with this picture, there are differences in detail. For most series the plateau

CHART 4

Variances of Seasonal Factors of Yields on U.S. Government Securities, 1948–65



actually tilts toward a peak, usually in September but sometimes in June or October. The patterns for all the private long-term bonds are alike with respect to their midyear highs and January lows, the characteristics of which distinguish these patterns from those of the same securities in the later period, as well as from the patterns of the short-term rates. Chart 5 plots the seasonal factors for 1954 for selected private long-term rates.

Starting in 1955, the seasonal patterns of private long-term bond rates change. The January factors change from lows to highs, the June and July factors from highs to lows. The troughs remain in March and April and the peaks in September and October, the amplitude on these months increasing during the late fifties and tapering off afterward.

Chart 6 illustrates the differences in both pattern and amplitudes between the two periods for two long-term rates. Starting roughly at

CHART 5

Seasonal Factors for Yields on Selected Long-Term Securities, 1954

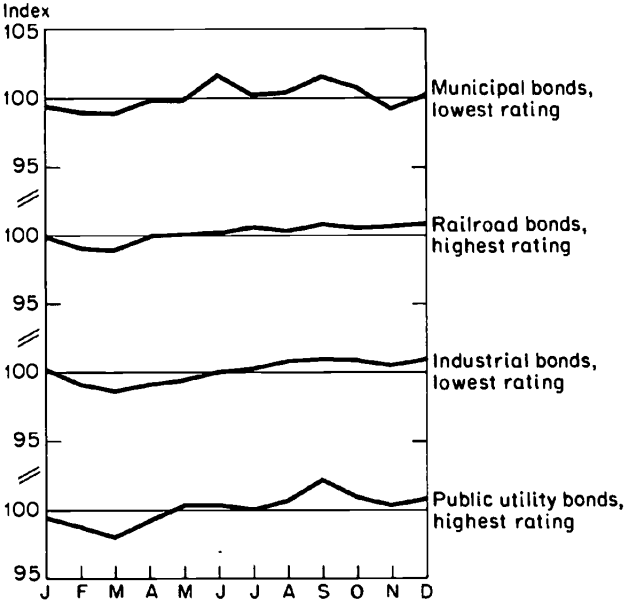
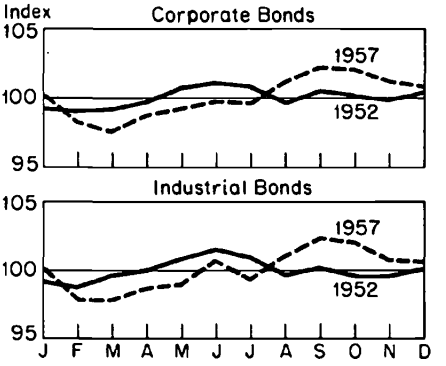


CHART 6

Seasonal Factors for Yields on Corporate Bonds and Industrial Bonds, Highest Rating, 1952 and 1957



the 100.0 line in January, the 1957 factor curve drops to a trough in March and gradually rises, crossing the 100.0 line in July to a peak in September, from which it declines to the December position, slightly above the 100.0 line. Unlike the Treasury securities, this pattern persists, though with diminished amplitude, at least through 1963 and, for some series, all the way to 1965.

Unfortunately, analysis of seasonality is not founded on principles that permit the unambiguous determination that a seasonal influence exists at a given time, and whether it is significant or otherwise. Aside from some special cases there are no criteria whose satisfaction provides compelling evidence for or against the existence of seasonality. In many cases, perhaps most cases, this hiatus is academic in the sense that an experienced analyst can profitably rely on his judgment, and forego the statistical accouterments, to test for seasonality, although, even here, the problem remains of making the point-estimates of the seasonal factors for the adjustment itself. In borderline cases, however, when the evidence for seasonality is not conclusive, intuitive methods invite disagreement. The dearth of adjusted data for interest rates in the postwar period combined with the widely held belief that a seasonal pattern did exist at least for some of the rates over part of the period is strong evidence that interest rates are a borderline case. Chapter 2 reviews the concepts underlying seasonal analysis

and some of the methods used for adjustment.[10] Chapter 3, then, considers the evidence of seasonality in interest rates. Chapter 4 analyzes factors contributing to the extent of seasonal amplitude of both short- and long-term rates and tests a hypothesis relating the seasonal amplitude of short-term rates to that of the money supply. Chapter 5 summarizes the report and lists some conclusions.

[10] Those readers already familiar with seasonal analysis can skip this chapter without loss of continuity.