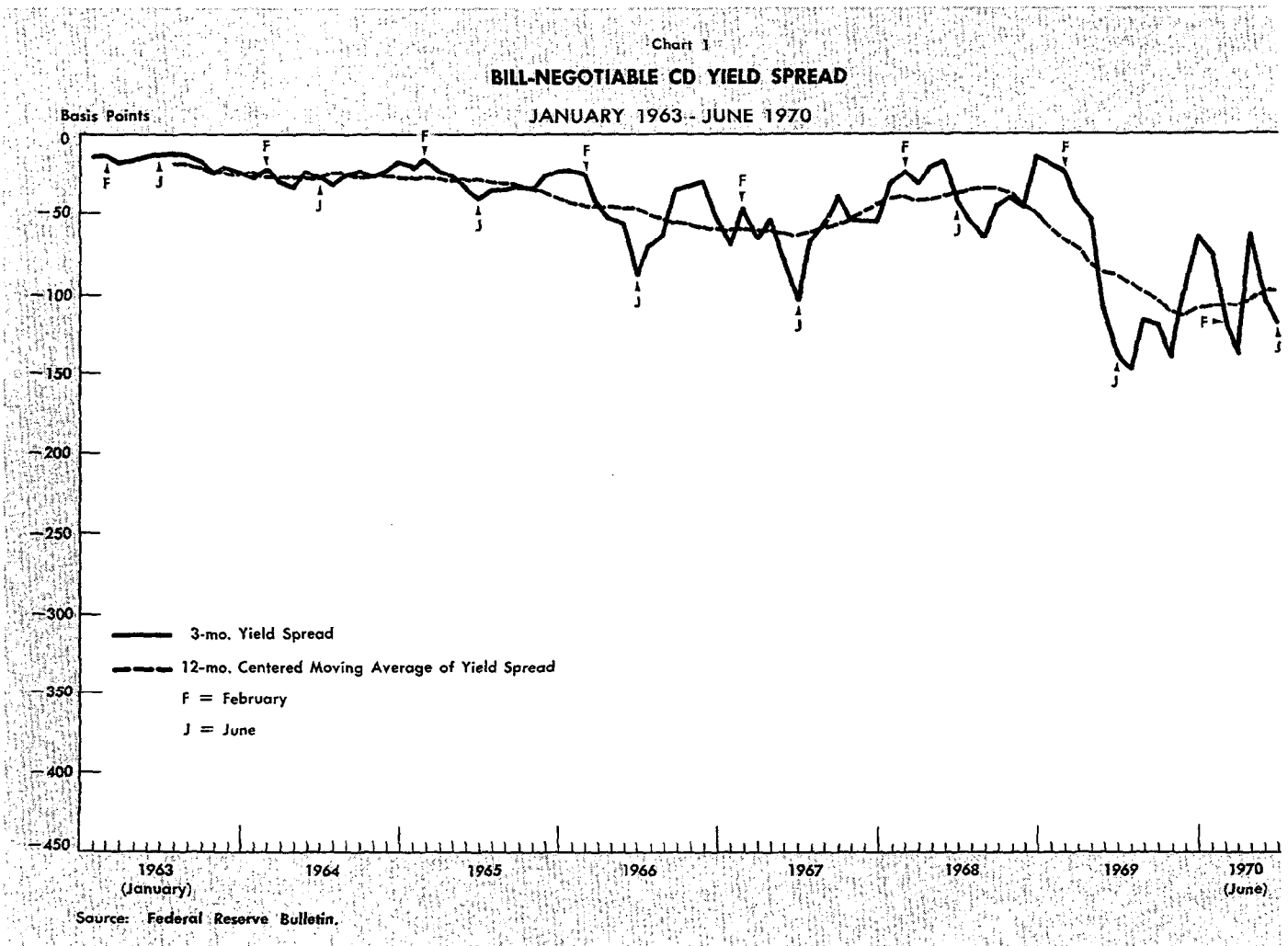


SEASONAL MOVEMENTS IN SHORT-TERM YIELD SPREADS

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One of the more interesting aspects of the behavior of short-term interest rates over the past 15 years has been the volatility of the spread between the yield on Treasury bills and the yield on private money market instruments. One such spread, the difference between the three-month Treasury bill yield and the yield on three-month large negotiable certificates of deposit (CD's) traded in the New York secondary market, ranged from 3 basis points to over 400 basis points during the 1963 to 1977 period. (All yields referred to in this paper are bond-equivalent yields.) The volatility of this spread, which is shown in Chart 1, appears, at least on an intuitive basis, to be much greater than can be attributed to changes in the relative riskiness of bills and negotiable CD's.

Analysis of the three-month Treasury bill-negotiable CD yield spread indicates that it is subject to seasonal variation. Chart 1, which also plots a centered 12-month moving average of the spread, reveals a definite seasonal pattern in the yield spread series. For example, the Treasury bill-negotiable CD yield spread in February lies above its corresponding 12-month moving average in every year save one, and for 11 of 14 years the June yield spread is below its moving average. Moreover, in all but two of the fifteen years from 1963 to 1977 the June Treasury bill-negotiable CD yield spread was below the February yield spread. Analysis of the three-month bill-prime bankers acceptance and three-month bill-prime commercial paper yield spreads reveals that they exhibit seasonal movements similar to that of



the three-month bill-negotiable CD yield spread. The presence of seasonality in the spreads between three-month Treasury bill yields and three-month private money market yields also suggests that risk factors alone cannot explain movements in these spreads, since it is unlikely that investors' perceived risk of default on these private debt instruments varies in a *seasonal* fashion.

At first glance it seems perplexing that the spread between Treasury bills and private money market yields exhibits such seasonality. When, for example, the three-month bill-negotiable CD yield spread widens beyond that point which reflects the relative riskiness of the two instruments, one would think that investors would demand fewer bills and more negotiable CD's, bidding up the relative yield on bills until the risk-adjusted yields of the two instruments are equal. The apparent absence of this equalization, at least in the short run, suggests that a significant number of billholders view private money

market instruments as imperfect substitutes for Treasury bills, and that these billholders have at times dominated the market for bills in such a way that they have kept the risk-adjusted yields on bills and private money market instruments from equalizing.

When investors who view private money market instruments as imperfect substitutes for Treasury bills dominate the market for bills, then a change in the supply of bills may affect the yield spread between bills and other money market instruments. Thus the seasonal behavior of the bill-private money market yield spread may be the result of seasonal movements in the supply of bills, which in turn arise from seasonality in the Treasury's short-term debt-financing needs. The hypothesis that the seasonal pattern of the supply of bills has been the dominating factor affecting the seasonal pattern in the spread between bill yields and other money market yields is held by a number of participants in the money

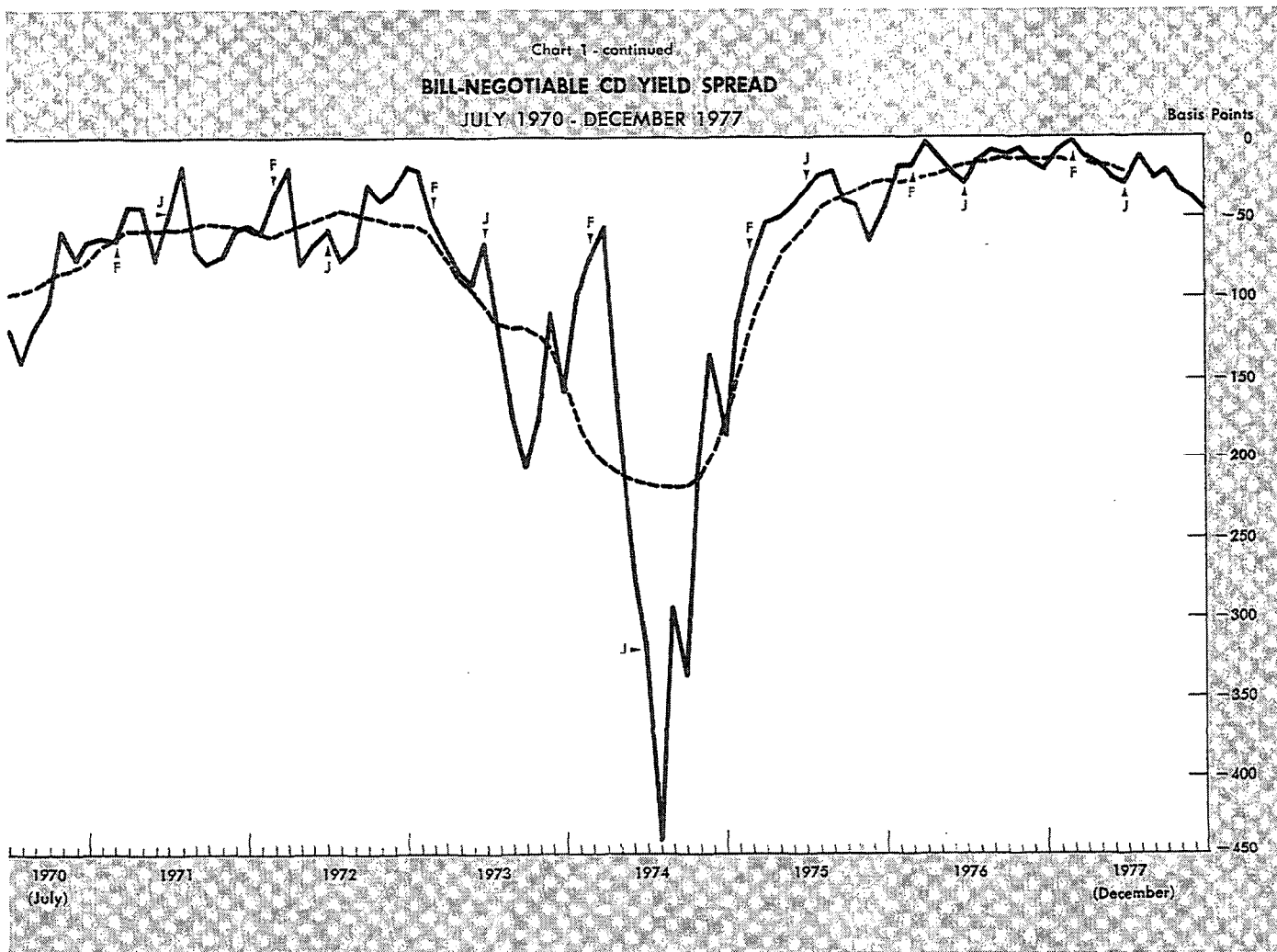
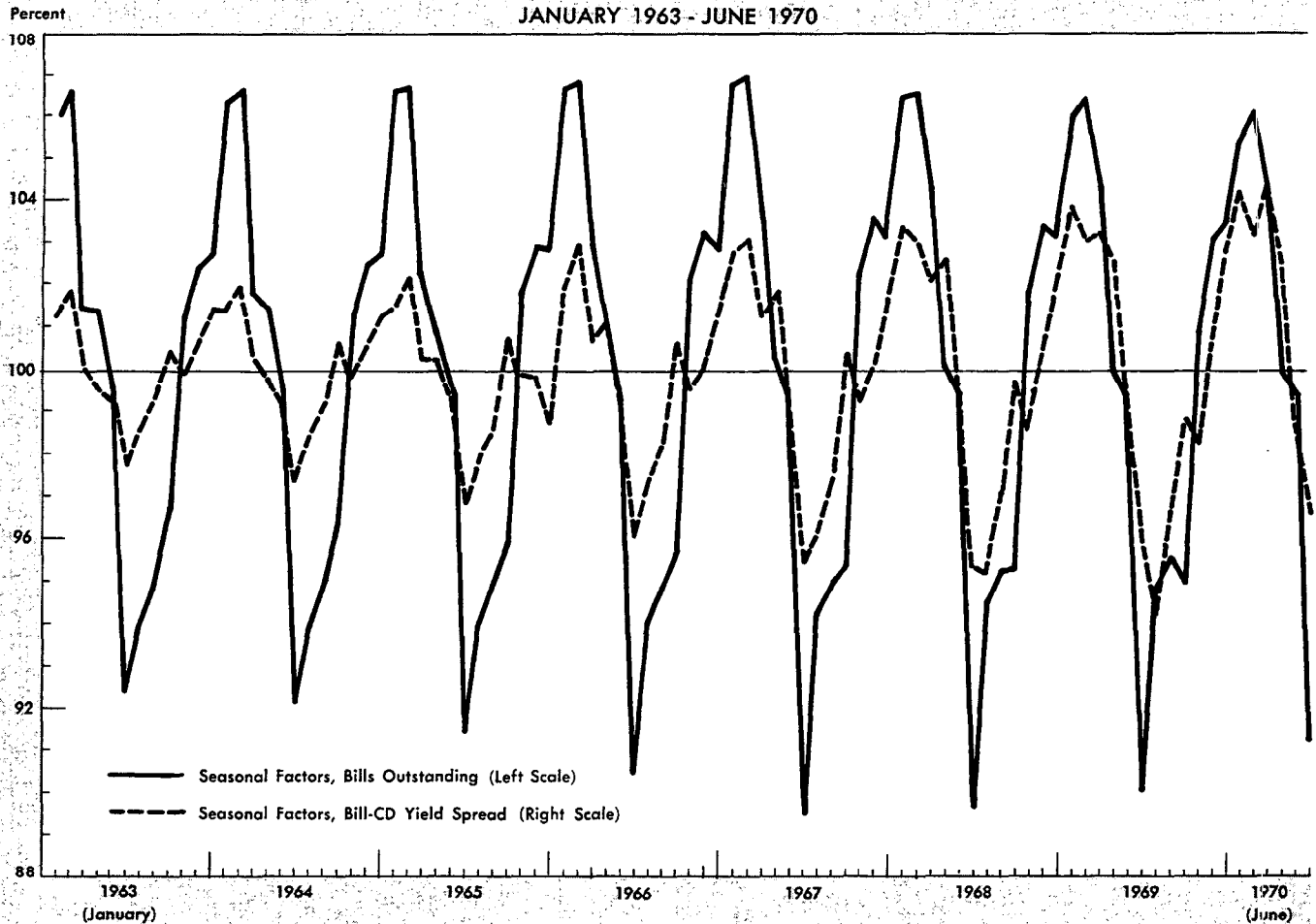


Chart 2

SEASONAL FACTORS: TREASURY BILLS OUTSTANDING AND BILL-NEGOTIABLE CD YIELD SPREAD



market.¹ The hypothesis states that a seasonal increase in the supply of Treasury bills causes bill yields to be bid up relative to private money market yields, and a seasonal decrease in the supply of bills results in bill yields being bid down relative to private money market yields. Consequently, evidence indicating that seasonal movements in the supply of bills are positively related to seasonal movements in the spread between bill yields and private money market yields would tend to support the hypothesis that investors who consider private money market instruments as imperfect substitutes for Treasury bills have been dominating the market for bills, at least in the short run.

This paper examines the relationship between seasonal movements in the three-month Treasury bill-negotiable CD yield spread and seasonal movements

in the amount of Treasury bills outstanding. In the first section the seasonal components of the two series are analyzed. The second section deals with some of the reasons why certain investors may consider instruments such as negotiable CD's and prime commercial paper as imperfect substitutes for Treasury bills. Finally, the last section discusses some of the implications of the analysis.

Seasonal Movements in Treasury Bills Outstanding and in the Bill-Negotiable CD Yield Spread

Treasury Bills Outstanding The multiplicative version of the Bureau of the Census' X-11 seasonal adjustment program was used to estimate the monthly seasonal component of the amount of Treasury bills outstanding.² The series used measures

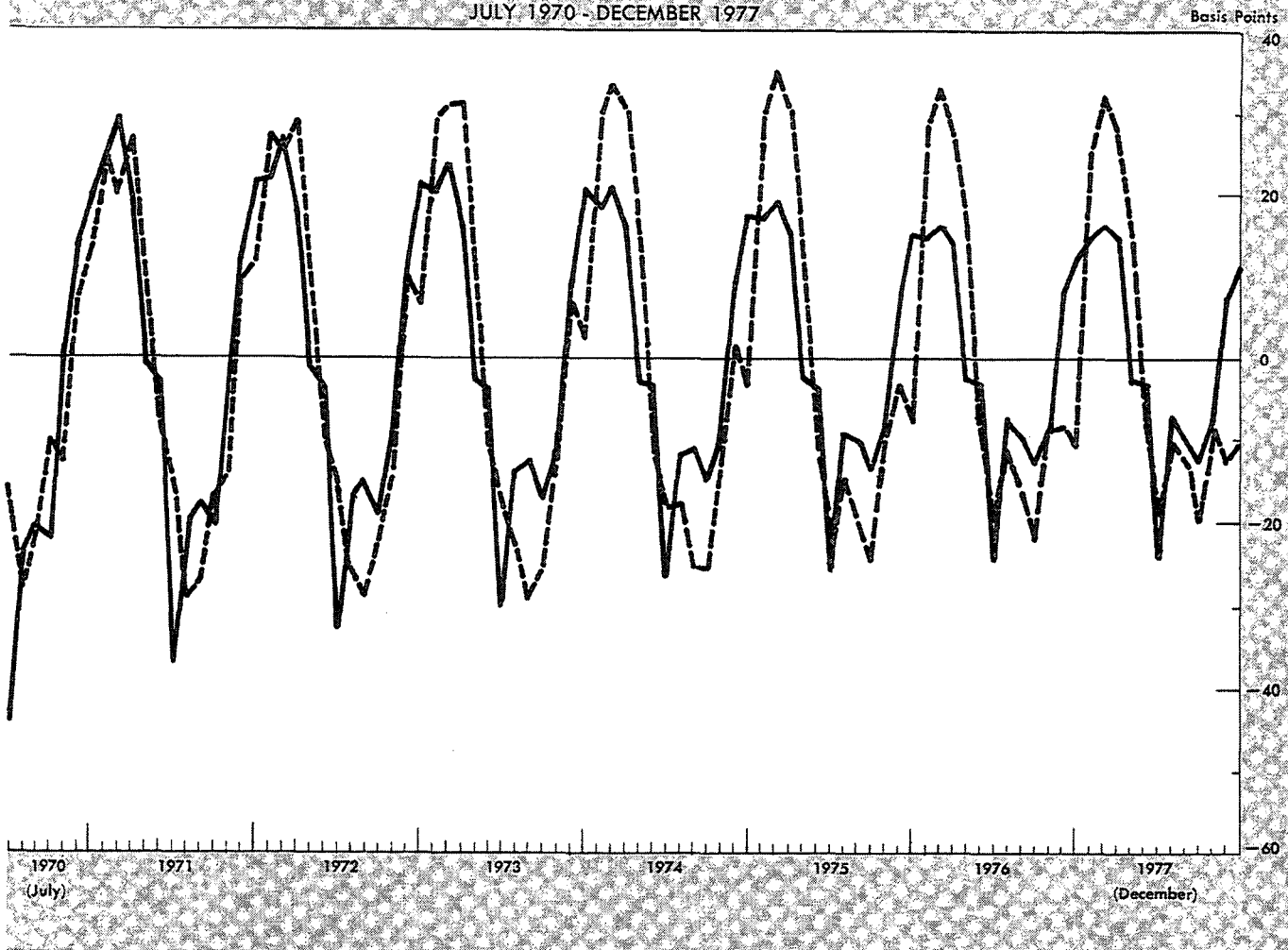
¹ For example, see Salomon Brothers, *Comments on Credit*, March 31, 1978.

² For a description of the X-11 program see [9]. For a less technical description, as well as a discussion of some of the shortcomings of the X-11, see Lawler [5].

Chart 2 - continued

SEASONAL FACTORS: TREASURY BILLS OUTSTANDING AND BILL-NEGOTIABLE CD YIELD SPREAD

JULY 1970 - DECEMBER 1977



the par value of Treasury bills maturing within one year that are held by private investors at the end of each month.³ The solid line in Chart 2 represents the monthly X-11 seasonal factors obtained for this series from 1963 to 1977. The chart shows that the amount of Treasury bills held by private investors has exhibited a recurring intrayear pattern, with the amount of bills outstanding falling on average from February to June as Federal tax revenues rose relative to expenditures, and increasing on average from September to February as tax revenues fell relative to expenditures.

Three-Month Treasury Bill-Negotiable CD Yield Spread The monthly seasonal component of the spread between the three-month Treasury bill yield and the three-month negotiable CD yield was esti-

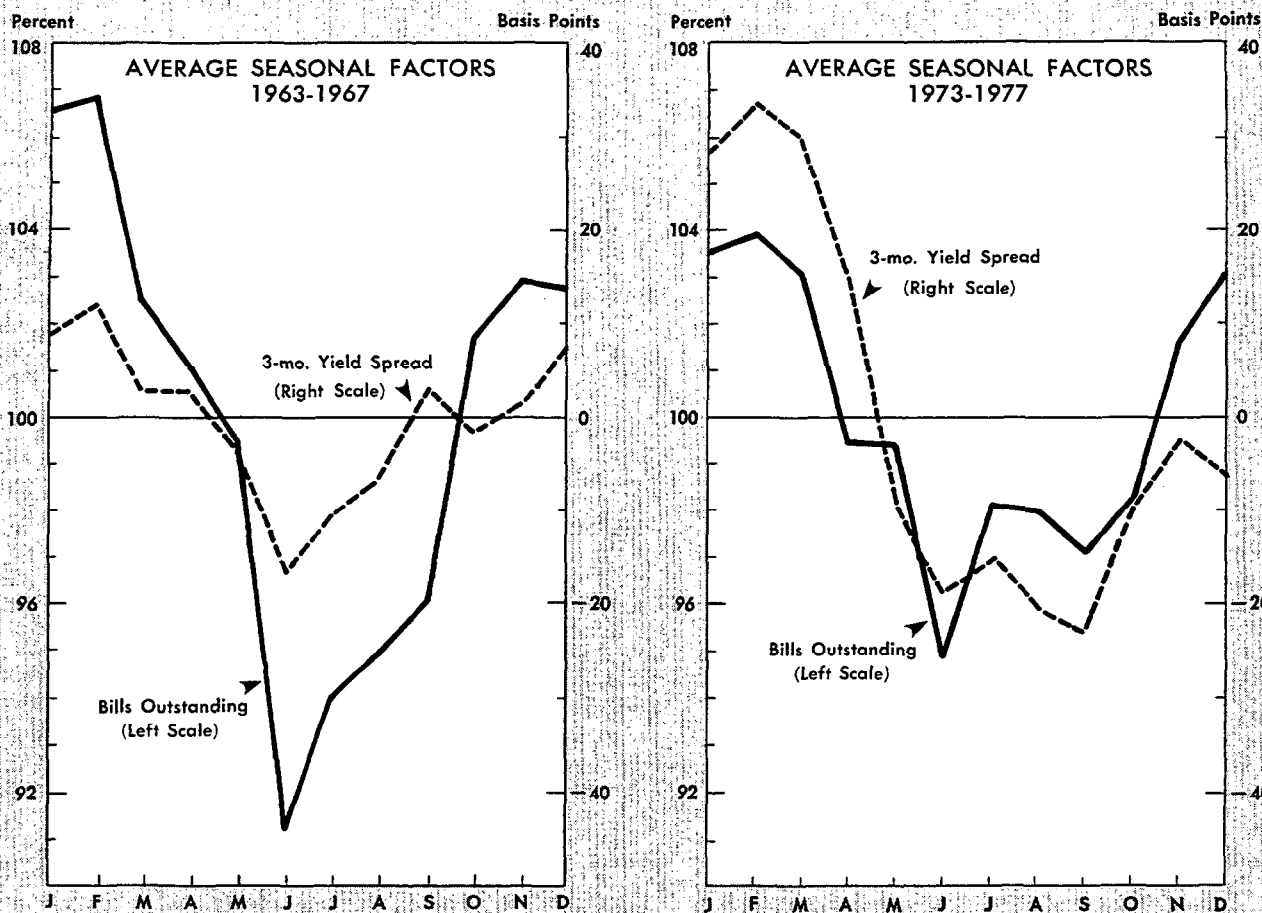
mated by using the *additive* version of the X-11 seasonal adjustment program. Since the additive version assumes that the seasonal component equals the difference between the original series and the seasonally-adjusted series, the seasonal factors for the bill-negotiable CD yield spread series are measured in basis points. The dashed line in Chart 2 plots the monthly X-11 seasonal factors obtained for the three-month Treasury bill-negotiable CD yield spread series from 1963 to 1977. The chart indicates that on average the spread has tended to rise from September to February and decline from January to June.

Comparison Chart 2 also illustrates the remarkable similarity between the seasonal pattern of the three-month Treasury bill-negotiable CD yield spread and the seasonal pattern of the amount of bills outstanding. The chart shows that, on average, both series have tended to peak in February, fall from

³ That is, Treasury bills held by Federal government agencies and the Federal Reserve are excluded.

Chart 3

**CHANGING SEASONAL PATTERNS:
BILL-NEGOTIABLE CD YIELD SPREAD AND BILLS OUTSTANDING**



Source: Federal Reserve Bulletin.

February to June, and rise from September to February. It should be noted that seasonal movements in the two series do not coincide exactly. This is not surprising, since the bills outstanding series is an end-of-month series, while the yield spread series is a monthly average series. On the whole, however, Chart 2 suggests that there is indeed a positive relationship between seasonal changes in the amount of bills outstanding and seasonal movements in the bill-negotiable CD yield spread.

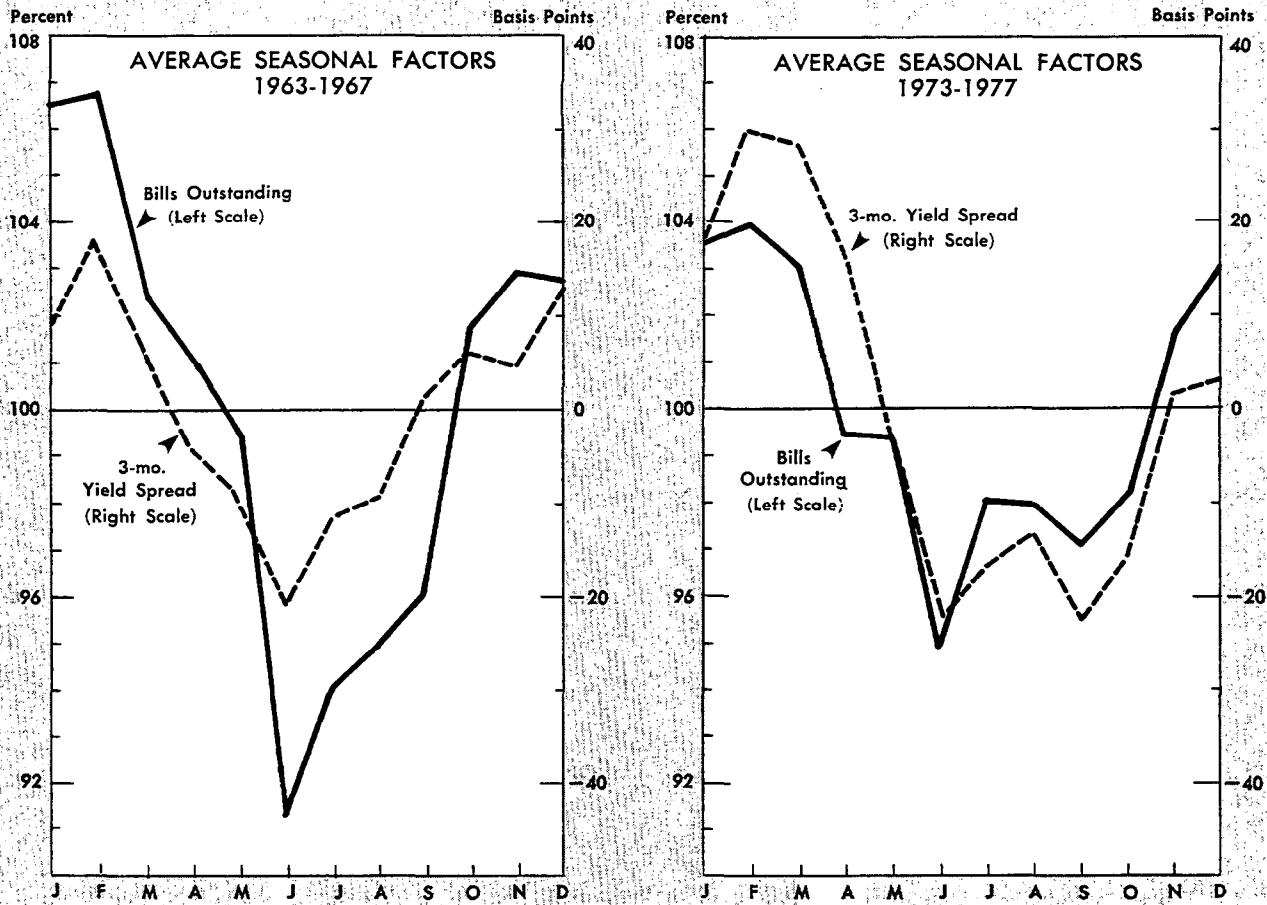
Closer examination of Chart 2 also reveals that changes in the shapes of the two seasonal patterns over time are related. Chart 3 compares the average estimated seasonal factors of the two series for the 1963 to 1967 period with the average seasonal factors of the two series for the 1973 to 1977 period. Ac-

cording to the chart, the major change in the shape of the seasonal pattern of bills outstanding over the ten year period was that the amount of bills outstanding declined on average from July to September during the 1973 to 1977 period, while in the earlier period the amount of bills outstanding increased seasonally from July to September. The chart also shows a similar change in the seasonal pattern of the three-month Treasury bill-negotiable CD yield spread.

The seasonal pattern in yield spreads, moreover, is not limited to the spread between Treasury bill yields and negotiable CD yields. Chart 4 plots the average X-11 seasonal factors for the three-month Treasury bill-prime commercial paper yield spread for the 1963-1967 and 1973-1977 periods as well as

Chart 4

**CHANGING SEASONAL PATTERNS:
BILL-COMMERCIAL PAPER YIELD SPREAD AND BILLS OUTSTANDING**



Sources: Federal Reserve Bulletin and Salomon Brothers [7].

the average seasonal factors for the amount of bills outstanding for these two five-year periods.⁴ The chart illustrates that the seasonal pattern of the Treasury bill-commercial paper yield spread is quite similar to that of bills outstanding and that of the bill-negotiable CD yield spread.

⁴ The three-month prime commercial paper rate used here is that for high-grade prime commercial paper quoted by Salomon Brothers [7]. The commercial paper yield for each month is the average of the yield for the first day of the month and the yield for the first day of the following month. Since the Treasury bill yield series employed is a monthly average of daily yields, the different averaging procedures may cause this bill-commercial paper yield spread series to be more volatile. There is no reason, however, why the different averaging procedures themselves should cause the yield spread series to exhibit either seasonal or cyclical movements.

The similarity of the seasonal patterns of Treasury bills outstanding and the spread between bill yields and private money market yields suggests that short-run changes in the supply of bills have affected the yield on bills relative to the yield on other money market instruments. This implies that investors who are insensitive to the differential yields of Treasury bills and other money market instruments have indeed at times dominated the market for bills, at least in the short run. The next section examines possible reasons for such investor behavior, as well as who these investors might be.

Determinants of the Substitutability of Treasury Bills and Private Money Market Instruments
Investors manage their portfolios in such a way that the risk-adjusted return on the marginal dollar of

each asset held is equal to that on the marginal dollar of all other assets held. Optimal portfolio behavior does not, however, necessarily imply that the pecuniary risk-adjusted market yields on all assets held will be equal. For example, investors hold demand deposits even though the pecuniary yield on such deposits is zero. The reason demand deposits are held, of course, is that they provide nonpecuniary returns to the investor in the form of safety, convenience, liquidity, and the like.

The relative risk-adjusted pecuniary yields on any two debt instruments of the same maturity may not reflect their implicit relative returns to a given investor for a number of reasons.⁵ For one thing, one debt instrument may provide services not adequately measured by its explicit market yield and not provided by other instruments. Additionally, the markets for different debt instruments may be such that the minimum denomination of one instrument is much larger than that of another instrument, and wealth constraints may limit an investor's choice of investments to those debt instruments below the minimum denomination of one but not another instrument. Finally, legal constraints may prohibit certain investors from holding one instrument but not another instrument.

Commercial banks constitute an investor group for which Treasury bills provide services not provided by private money market instruments. Banks in most states are required to pledge certain assets equal to a set percentage (typically 100 percent) of their state and local deposits, and Treasury bills are acceptable pledging assets in all states while private debt instruments are almost never acceptable.⁶ Further, thirty states allow banks outside of the Federal Reserve System to hold some fraction of their reserve requirements in Treasury bills, while only a few states allow any private debt instruments to fulfill part of a bank's reserve requirements.⁷ Finally, bank regulators often judge a bank's capital adequacy by its ratio of equity to risky assets, where the latter are defined as total assets less cash and U. S. Government securities. Therefore a bank may hold Treasury bills simply to maintain this capital adequacy ratio and thus appease its regulators.⁸ For these and other reasons, a bank's demand for Treasury bills may be sizable even when the explicit yield

differential between bills and private money market instruments exceeds that corresponding to their relative riskiness.

A group for whom wealth constraints have limited the substitutability of Treasury bills and private money market instruments consists of small investors. The minimum denomination of negotiable CD's is \$100,000, and commercial paper, while sometimes issued in units as small as \$25,000, is usually traded in the money market in lots of \$100,000 face value. Treasury bills, on the other hand, are issued in denominations as small as \$10,000. Consequently, a number of small investors have been able to purchase Treasury bills but have been unable, due to wealth constraints, to purchase negotiable CD's and commercial paper.

Finally, state and local governments' holdings of Treasury bills have been fairly insensitive to bill-private money market yield spreads because a number of state statutes allow these governments to hold Treasury bills but not commercial paper or out-of-state CD's.⁹ A number of foreign official institutions face similar constraints in that their holdings of U. S. securities are limited by regulation to Treasury securities such as bills.

These examples do not comprise an all-inclusive list of those investors whose demand for bills is inelastic with respect to the bill-private money market yield differential. They do illustrate, however, that there exist a large number of billholders whose demand for bills is relatively insensitive to these yield spreads. On the other hand, there are a number of investors whose demand for bills is quite sensitive to yield differentials. Consequently, the question of whether a change in the supply of bills results in a change in the relative yield on bills and other instruments is an empirical one. The evidence presented in this paper supports the hypothesis that changes in the supply of bills have affected the spread between bill yields and private money market yields, at least in the short run. It should be realized, however, that past dominance of the bill market by investors who view private money market instruments as imperfect substitutes for Treasury bills does not imply that they will dominate the bill market in the future. Indeed, the emergence of money market funds, which pool individual investors' funds to purchase money market instruments, suggests that small investors' holdings of Treasury bills will be more sensitive to the spread between bill yields and private money market yields than they have been in the past.

⁵ This discussion assumes that there are no technical factors such as differential tax treatment affecting short-term yield spreads.

⁶ See Gilbert and Lovate [3].

⁷ See Haywood [4].

⁸ See Summers [8].

⁹ See [1].