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FEDERAL RESERVE POLICY STRATEGY AND INTEREST RATE SEASONALITY

Thomas A. Lawler

Federal Reserve Bank of Richmond

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During the 1970's short-term interest rates have exhibited extreme variability by recent historical standards. Analysis of these money market rate fluctuations by Sealy [4] suggests that there is a large and significant seasonal component in the various short-term interest rate series. Unfortunately, he was unable to determine the causes of this observed interest rate seasonality. Sealy also found that a shift in both the pattern and the magnitude of seasonal movements in these interest rate series occurred around 1970--the year in which the Federal Reserve shifted from a money market policy strategy to a monetary aggregate policy strategy. The purpose of this paper is to investigate whether the observed interest rate seasonality and the Fed's short-run operating strategy are related. The evidence presented below suggests that there is significant "residual seasonality" in the preliminary seasonally adjusted M_1 growth rate series, and that the Fed's reaction to these incoming adjusted money figures has been a major cause of the observed seasonal pattern in interest rates.

I. Interest Rate Seasonality

Estimates of the seasonal component of short-term interest rates were obtained by applying the multiplicative version of the Bureau of the Census' X-11 seasonal adjustment program to the 3-month Treasury Bill rate series from September 1970 to August 1977. The multiplicative X-11 is based on the ratio-to-moving average method, and therefore the X-11 seasonal factors measure the seasonal component as a percentage of the seasonally adjusted series.[1] The average monthly seasonal factors for the above period

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[1]For a description of the X-11 program, see [5].

are shown in Figure 1. As the figure indicates, the X-11 calculated seasonal component of the 3-month Treasury Bill rate (TBR) is quite large, with the TBR reaching a seasonal peak 13 percent above trend-cycle in August, and a seasonal trough 13 percent below trend-cycle in February. Examination of other money market rates reveals that they also exhibit similar seasonal movements of approximately the same magnitude.[2]

II. Federal Reserve Policy Strategy

In order to relate the observed interest rate seasonality to Federal Reserve behavior during the 1970's, some discussion of the Fed's short-run strategy of monetary policy is necessary. The primary policy objective of the Federal Reserve has been to maintain the various monetary aggregates, notably M_1, along some specified long-run growth path, while at the same time promoting stability in the money market by avoiding large sudden changes in short-term interest rates. Obviously, to achieve some long-run money growth target, some control over short-run money growth is necessary. The basic short-run strategy of the Fed has been to use the Federal funds rate as a means of controlling money growth. When reported money growth is greater than desired, the Fed often allows the funds rate to rise by decreasing the supply of nonborrowed reserves to member banks. Conversely, when money growth is less than desired, the funds rate is often allowed to fall by increasing the supply of nonborrowed reserves to member banks. Since money market rates tend to move together, there will usually be a positive relationship between changes in the preliminary seasonally adjusted money growth rate in one month and changes in money market rates, including the TBR, in the following month.

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[2]See [4], p. 69.

It should be noted that incoming monetary data are not the only information used by the Fed in determining its short-run policy. However, it seems valid to say that, ceteris paribus, a large change in the reported seasonally adjusted M_1 growth rate for the most recent month will more often than not result in a corresponding change in money market rates in the following month. Even if the Fed, in keeping with its goal of money market stability, does not react immediately to incoming monetary data, the market is aware of the Fed's goal of long-run control of the money stock. Therefore changes in the reported monthly seasonally adjusted M_1 growth rate affect market expectations of the future funds rate, and changes in the expected future funds rate will be reflected in the TBR. Thus the Fed's short-run operating strategy suggests that monthly changes in the TBR will be positively related to changes in the preliminary seasonally adjusted M_1 growth rate for the previous month. Empirical support for this is evident in equations regressing the monthly percentage change in the TBR on the preliminary adjusted M_1 growth rate for the previous month. The result for the period from October 1970 to August 1977 is shown below. The numbers in parentheses are t-statistics.

$$\%\Delta TBR = -.0414 + .737\ PSAM_1(-1) \qquad \bar{R}^2 = .28 \qquad D.W. = 1.91 \qquad (1)$$
$$\qquad\qquad (3.94)\quad (5.75)$$

Here $PSAM_1$ = the preliminary seasonally adjusted M_1 growth rate, calculated using the initial monthly figures published in the Federal Reserve Bulletin.

Equation (1) shows that preliminary adjusted M_1 growth and the monthly percentage change in the TBR are positively related. Note that the constant term -.0414 in (1) implies that there will be no change in the TBR when M_1 grows at a rate of .0414/.737 = 5.62%, which is quite close to the Fed's

average long-run money growth target over the period studied.[3]

III. Seasonality in the Seasonally Adjusted M_1 Growth Rate Series

If monthly movements in money market rates are positively related to the reported seasonally adjusted M_1 growth rate for the previous month, then any "residual seasonality" in the preliminary seasonally adjusted M_1 growth rate series may cause money market rates to exhibit seasonality. Such residual seasonality would occur if the preliminary seasonal factor used by the Fed to adjust the incoming money stock figure for any given month either consistently understates or consistently overstates the actual influence of seasonal forces on the money stock in that month. This conjecture was tested by adjusting the preliminary seasonally adjusted M_1 growth rate series ($PSAM_1$) for seasonality using the additive version of the X-11 program.[4] The additive X-11 assumes that the seasonally adjusted series equals the original series minus the seasonal component, and therefore the additive X-11 seasonal factors are estimates of actual seasonal movements in the series. The average monthly seasonal factors for $PSAM_1$ for the September 1970 - August 1977 period are shown in Figure 2. The figure illustrates that the preliminary seasonally adjusted M_1 growth rate series has been characterized by substantial residual seasonality. The standard test for significance suggests that this seasonality is statistically significant.

Thus according to Figure 2 the preliminary seasonally adjusted M_1 growth rate has been on average almost 6 percent below trend-cycle growth in

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[3] E.g., see [3].

[4] The multiplicative version of the X-11 is inappropriate for growth rate series, since a multiplicative relationship among the components assumes that all values of the series are greater than zero.

January and 4-1/2 percent above trend-cycle growth in March. Figure 2 also shows that $PSAM_1$ has on average been seasonally high from February to July, and seasonally low from August to January. Since the preliminary money figures already include the Federal Reserve's estimate of the actual seasonal pattern of the money stock, the reaction of the Fed to the remaining seasonal pattern in $PSAM_1$ has probably been no different than its reaction to other movements in $PSAM_1$. Therefore, since monthly changes in money market rates have been shown to be positively related to changes in $PSAM_1$ lagged one month, Figure 2 suggests that the seasonal pattern in short-term interest rates caused by the remaining seasonality in $PSAM_1$ should be characterized by seasonally increasing rates from February to August and seasonally decreasing rates from August to February. Note that this pattern describes the actual seasonal variation in the Treasury Bill rate shown in Figure 1.

As an alternative illustration, suppose that the relationship between percentage changes in the TBR and deviations in the previous month's $PSAM_1$ from trend-cycle growth were linear. That is

$$\%\Delta TBR = b[PSAM_1(-1) - M^*] \qquad (2)$$

where M^* is the trend-cycle growth of M_1, and b is some constant greater than zero. Since the average monthly $PSAM_1$ seasonal factors measure the average difference between actual and trend-cycle $PSAM_1$ for each month, equation (2) implies that the relationship between percentage changes in the TBR seasonal factor (SFTBR) in Figure 1 and the $PSAM_1$ seasonal factors ($SFPSAM_1$) in Figure 2 lagged one month will be positive and linear. The result of regressing the percentage change in SFTBR on $SFTSAM_1(-1)$ is shown below. The number in parenthesis is the t-statistic.

$$\%\Delta SFTBR = \underset{(3.66)}{1.10}\ SFPSAM_1(-1) \qquad R^2 = .55 \qquad D.W. = 1.74 \qquad (3)$$

The result shown in equation (3) indicates that changes in the TBR seasonal factor are indeed positively related to the $PSAM_1$ seasonal factor lagged one month. Note that the coefficient in (3) is larger than the coefficient in (2) above (.737), but not all that much larger. One reason the coefficient in (3) is larger may be that the X-11 calculated trend-cycle component of $PSAM_1$ is more sensitive to current short-run money growth than are the actual Fed money growth targets.

Figure 3 compares the seasonal pattern in the TBR implied by equation (3) and the actual TBR seasonal pattern shown in Figure 1. The figure shows that the seasonal pattern in the TBR implied by the residual seasonality in $PSAM_1$ is quite similar to the observed TBR seasonal pattern. This result strongly suggests that undetected residual seasonality in the preliminary seasonally adjusted M_1 figures, given the way in which the Fed reacts to incoming adjusted M_1 data, has been a major contributing factor underlying the observed seasonal pattern in money market rates in the 1970's.

IV. Implications

There are a number of implications of the above results. First, the root cause of at least part of the observed seasonal pattern in short-term interest rates must be traced to the causes of the residual seasonality in the preliminary M_1 growth rate series. Some possible reasons for the seemingly inadequate adjustment of preliminary M_1 figures are discussed in Broaddus and Cook [1] and Lawler [2].

Second, the accuracy of bill rate predictions based on the X-11 seasonal factors for the bill rate will depend at least partly on whether the preliminary M_1 seasonal factors used by the Federal Reserve continue to either systematically understate or systematically overstate the true influence of seasonal forces in the same pattern year after year. Analysis

of M_1 seasonal factors over the 1970's, however, suggests that deficiencies in past seasonal factors have been at least partly corrected, and therefore estimates of future bill rates based on seasonal factors of the magnitude of those in Figure 1 may prove to be no better, and may be even worse, than predictions that assume that future short-term rates will exhibit no seasonality.

Finally, the relationship found between seasonal movements in the bill rate and seasonal movements in the preliminary seasonally adjusted M_1 growth rate suggests that problems with the seasonal adjustment of the money stock have hampered the Fed's ability to achieve its dual policy goal of controlling money growth while avoiding unnecessary movements in money market interest rates.

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FIGURE 1 AVERAGE SEASONAL FACTORS, 3-MONTH TREASURY BILL RATE, 9/70 - 8/77

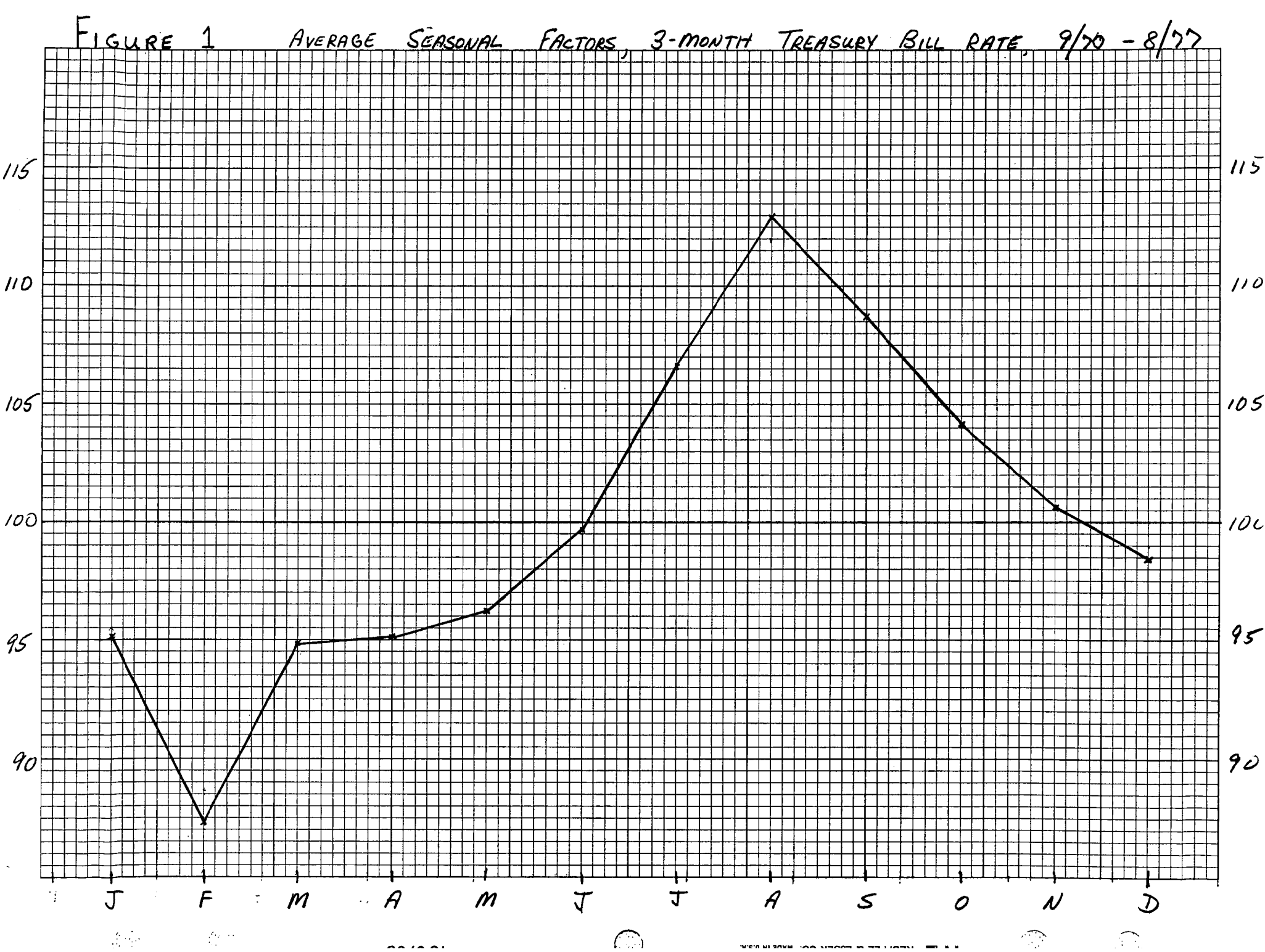

FIGURE 2 AVERAGE SEASONAL FACTORS, PRELIMINARY M_1 GROWTH RATE SERIES, 9/70-8/77

FIGURE 3 IMPLIED VS ACTUAL TBR SEASONAL PATTERN, 9/70 - 8/77