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economic commentary

A Problem of Seasonal Adjustment

by Richard L. Mugel

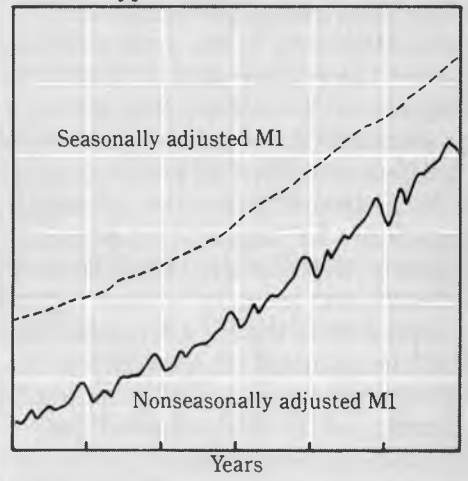
Typically, the public's demand for money fluctuates with changes in the calendar. As a result, money stock data are highly variable and exhibit regular movements within a given year. For example, the money stock typically expands around the year-end holidays and tax-payment time in April. Economists consider these variations to be seasonal; i.e., the variations do not indicate changes in money demand associated with interest rates or with the underlying pace of economic activity. Since Federal Reserve policymakers wish to concentrate on fundamental movements in money demand that are consistent with longer-run objectives, seasonal variation is eliminated from the money-supply series by a process known as *seasonal adjustment.* Thus, policymakers state both long- and short-run targets in seasonally adjusted terms. Accurate seasonal adjustment enables policymakers to accommodate the needs of commerce and to make informed decisions about monetary policy. Accurate seasonal adjustment also helps market participants interpret monetary policy.

Policymakers, academics, and financial professionals recognize that accurate seasonal adjustment of monetary data is an inherently troublesome process. However, because of recent changes in the banking and financial services industry, accurate seasonal adjustment has become even more difficult.[1] This *Economic Commentary* focuses on financial developments since 1980 – the advent of new deposit instruments, the Depository Institutions Deregulation and Monetary Control Act of 1980, and the Garn-St Germain Act of 1982. This new financial environment seems even further to have increased the uncertainty about the meaning of seasonally adjusted monetary data. This uncertainty raises many questions about the merits of techniques currently used to adjust data, the reliability of estimated seasonal factors, even the future of seasonal adjustment itself.

Current Estimating Techniques

Ideally, an economic model of money supply and demand would estimate variations in money that are a result of seasonal events. Unfortunately, in our less-than-perfect world, no such model is possible; instead, statistical methods are used to approximate seasonality. These methods identify regular movements in the history of an economic series and produce a set of seasonal factors.[2] Application of seasonal factors to raw data results in a less variable, or smoother, series (see chart 1). A

Chart 1 Typical Seasonal Patterns in M1



SOURCE: Board of Governors of the Federal Reserve System.

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The views stated herein are those of the author and not necessarily those of the Federal Reseve Bank of Cleveland or the Board of Governors of the Federal Reserve System.

1. A good summary of the chronic problems of seasonally adjusting money stock data is provided by Carlson (1982); see also Hein and Ott (1983), Cook (1984), and Moore (1981).

2. The official procedure used to adjust M1 data – the X-11 ARIMA model – involves dividing the series by an estimated trend, thereby isolating seasonal and irregular components. We then evaluate the resulting quotient series and arrive at seasonal factors by taking a weighted moving average of monthly values for different years. For a concise description of this procedure, see Pierce and Cleveland (1981).

Table 1 Seasonal Factor Revisions in Checkable Deposits
First revisions to monthly seasonal factor estimates

Demand deposits	Average revisions (mean absolute), percent	Average impact on deposit growth, percent (ar)
1971-74	0.06	0.76
1975-80	0.18	2.37
1981-83	0.22	2.94
Transactions deposits		
1982-83	0.39	4.29

SOURCE: Board of Governors of the Federal Reserve System.

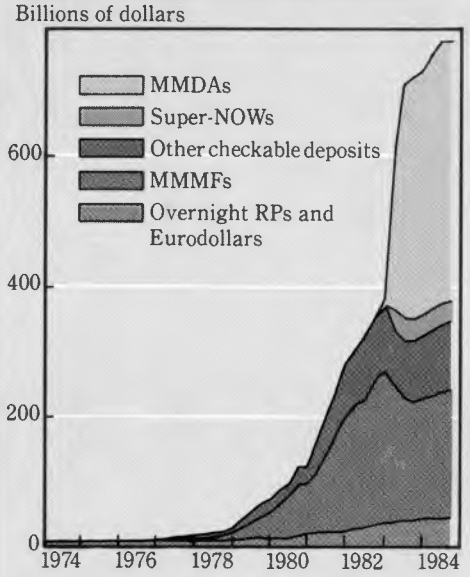
given year's seasonal factors are calculated early in the year and thus cannot incorporate actual movements that year in the series; they are then re-estimated in subsequent years when complete data for that year are available. Seasonal factors are calculated separately for transactions deposits (demand deposits and other checkable deposits) and currency — the two major components of the M1 aggregate. Since the true seasonal pattern cannot be determined, one standard to assess the accuracy of the first reported (preliminary) seasonal factors is the size of subsequent revisions. Within a given year, however, re-estimations are not usually available as yardsticks of accuracy. There are other clues, however: because current adjustment methods generally smooth the raw data, highly volatile monthly (or weekly) seasonally adjusted data might indicate inaccurately identified seasonal variations.

Seasonal Adjustment in a New Environment

The new and changing menu of financial assets seems to have increased the probability of errors in seasonal adjustment. As measured by the size of first revisions to preliminary seasonal factors, the average revision to monthly growth of demand deposits was less than 1 percent (ar) between 1971 and 1974 (see table 1). After 1974, traditional money demand models consistently overpredicted the growth of M1 and demand deposits. Economists have attributed much of this aberrant M1 behavior to increased use of cash-management techniques and to the emergence of new deposit instruments. Between 1974 and 1980, the average revision to monthly growth of demand deposits increased to a little more than 2 percent (ar).

First revisions to demand deposit seasonal factors grew still larger after 1980 with the nationwide introduction of interest-bearing checking accounts (see chart 2). The growing importance of other checkable deposits (OCDs) prompted definitional changes, which, in 1982, resulted in these interest-bearing instruments being included in M1[3] At about the same time, seasonal adjustment was applied to all transactions accounts (the sum of demand deposits and OCDs) to adjust the checkable deposit portion of M1[4] Seasonal factors for currency are still calculated separately. Although there are only two years of data available for seasonal factor revisions to all transactions deposits, these data indicate significant changes. Between 1982 and 1984, seasonal factor revisions to transactions deposits were roughly twice those for demand deposits from 1975 to 1980, and over six times greater than for demand deposits between 1971 and 1974.

Chart 2 Growth of New Instruments
Billions of dollars



SOURCE: Board of Governors of the Federal Reserve System.

M1 and the New Financial Menu

Changes in the nation's financial environment that began in the mid-1970s accelerated after passage of the Depository Institutions Deregulation and Monetary Control Act of 1980. Many new assets with a variety of transactions features have been made available to the public in the last several years. The negotiable order of withdrawal (NOW) account, introduced in New England during the early 1970s and authorized nationwide in late 1980, is similar to the traditional demand deposit account, but pays an explicit rate of interest. The yield on NOW accounts is fixed by regulation. Super-NOW accounts (introduced January 5, 1983) have a $2,500 minimum deposit requirement ($1,000 as of January 1, 1985) and offer a market-related yield[a] These accounts, along with interest-bearing automatic transfer service (ATS) and credit union share draft accounts, make up other checkable deposits (OCDs), which, combined with demand deposits, form the transactions deposit component of the monetary aggregate M1. Explicit rates of return and unlimited checking privileges made OCDs extremely popular. They increased more than 500 percent between December 1980 and the middle of 1984, and currently account for about one-quarter of the M1 aggregate.

In the mid-1970s money market mutual fund (MMMF) shares began to grow as small savers (individuals and businesses with small balances) sought high rates of return in the face of rising nominal interest rates and inflation. MMMFs are highly liquid instruments that generally offer checking privileges and carry no minimum maturity requirement. Most require a minimum balance, usually about $1,000, which varies among funds. Growth of MMMFs accelerated in the late 1970s and early 1980s, but tapered off after December 1982, when depository institutions were permitted to offer money market deposit accounts (MMDAs). These accounts have attractive savings and transactions features, pay a market-related rate of interest, require a minimum deposit of $2,500 ($1,000 as of January 1, 1985), and offer limited checking privileges. They have attracted almost $400 billion in deposits since their introduction, most of which accumulated in the first six months. Because they are used primarily for savings, both MMDAs and MMMFs fall outside the M1 definition of money, but are included in the M2 aggregate.

a. Because of the high minimum-deposit requirement and prohibitive fee structures at many depository institutions, Super-NOW accounts have not been as popular as regular NOW accounts.

3. In early 1982, the M1A measure of money, which consisted primarily of currency and demand deposits, was dropped, and the M1B measure of money became M1.

4. A similar procedure was used for seasonal adjustment of M1B in 1981.

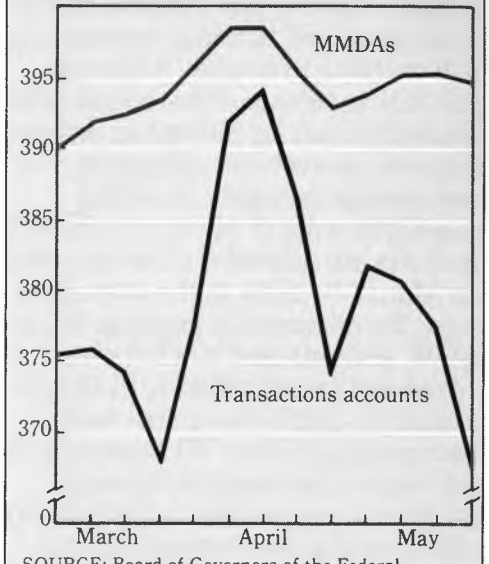
There are two principal ways that innovation and deregulation seem to have affected the accuracy of seasonal factor estimates for M1. First, unusual and sometimes substantial flows of funds caused by the growth of new instruments confounded attempts to separate trend and irregular components from seasonal components. At the same time, the growth of new instruments altered the way individuals managed their monetary assets, including how they met their seasonal needs. This caused the seasonal pattern of money to change and had a detrimental impact on the accuracy of M1 seasonal factor estimation. The deficiency of standard methods of approximating seasonality is its assumption that all information about seasonal variation in a given series is contained in the history of that series. Such a backward-looking estimation technique, necessary because of insufficient information about the determinants of seasonality, might not be able to capture a changing pattern, unless it is changing slowly and predictably.[5] Even after a new seasonal pattern has evolved, several years of historical data might be needed to capture the new seasonality.[6]

The growth of interest-bearing transactions accounts, both within and outside M1, probably affected the seasonal pattern of M1 by reducing the intensity of seasonal increases in money balances. The behavior of money balances around April illustrates this point. Transactions balances and M1 typically swell as people fund their checking accounts to pay the nonwithheld portion of their income taxes. Also, money balances increase when funds are parked temporarily in transactions accounts until investment and spending decisions are made. This swelling usually subsides in late April and early May, as tax returns are received and processed by the U.S. Treasury. Seasonal factors, which correct for these temporary distortions, reduced M1 growth in April by about 35 percent (ar) on average in the last five years.

Because OCDs pay an explicit rate of interest, holders of these funds incur a lower opportunity cost (foregone earnings on alternative investments) than do holders of demand deposits. Consequently, economists estimate that a significant portion of OCDs are managed more like savings deposits than transactions accounts. That is, many OCDs are intended for future consumption rather than for immediate purchases. They are, therefore, less responsive to fluctuations in immediate transactions needs than ordinary demand deposits. The seasonal pattern of the aggregate was probably altered as OCDs came to represent a larger share of M1. For example, individuals who once accumulated balances in savings accounts, then transferred them to demand accounts just before paying taxes, may now find it advantageous to build up balances slowly in NOW accounts and make transactions without transferring any funds.

Non-M1 innovations, such as money market deposit accounts (MMDAs), might have also affected the seasonal pattern of the M1 aggregate. Because of the limited transactions features of MMDAs, many payments, including tax payments, can be made directly through MMDAs. Thus, individuals can earn a market-related rate of interest until the payment is debited from their accounts and can avoid the cost of transferring funds as well. Similarly, individuals can deposit a refund check into an MMDA and earn a higher rate of return without sacrificing much of the liquidity advantages of a demand or other checkable deposit. In other words, seasonal needs can be met through MMDAs, without affecting M1 at all.

Chart 3 MMDAs and Transactions Deposits in 1984
Billions of dollars



SOURCE: Board of Governors of the Federal Reserve System.

Since 1981, growth of M1 in April that is attributed to seasonal influences declined by more than 3 percent. Furthermore, volatile growth of M1 around April 1984 suggests that 1984 preliminary factors might have overstated the intensity of the seasonal increases.[7] In addition, raw data on MMDAs reveal a bulge around April similar to that seen in transactions deposits (see chart 3). With MMDAs accommodating some of the seasonal need, the seasonal bulge in M1 during times of large payments is reduced. Unfortunately, techniques for estimating seasonality that consider only the historical variation of the M1 aggregate are unlikely to capture very quickly such changes in M1 behavior. In fact, first revisions indicate that these techniques overestimated the April surge in transactions accounts in 1982 and 1983.

5. If the seasonal trend is judged to be changing, the user of the X-11 procedure can exercise some discretion in deciding which parameters to use and which years to weight most heavily in the adjustment process.

6. See Simpson (1984).

7. As first reported, M1 growth slowed appreciably in April 1984, but surged dramatically in the following two months. This pattern is similar to that of M1 first reported in 1983, when seasonal factor revisions substantially increased the April growth as first reported.

Looking Ahead

Difficulties in measuring the seasonal pattern of M1 are likely to persist, because banking and financial institutions, laws, and financial instruments will continue to change. Although existing statutes prohibit commercial banks from paying interest on demand deposits, interest-rate ceilings on time and savings accounts, including negotiable order of withdrawal (NOW) accounts, are scheduled to be eliminated by March 31, 1986. In the immediate term, the minimum deposits on Super-NOW accounts and MMDAs are scheduled for reduction to $1,000 on January 1, 1985. How much such changes might affect M1 seasonality is not known, but uncertainty might continue to plague seasonal adjustment efforts until a more static financial environment emerges, free of the complications that have developed in recent years.

Because seasonally varying patterns of transactions cause movements in raw monetary data that obscure underlying trends and cyclical changes, the Federal Reserve seasonally adjusts raw money-stock data to identify temporary seasonal fluctuations. These variations can then be accommodated as policymakers aim at a desirable level of money growth. While it might be appealing to abandon seasonal adjustment because of its inherent shortcomings in pursuing monetary targets, policymakers find it useful to distinguish seasonal from fundamental variations in money demand. Since a model that explains all of the variations in raw data cannot exist, economists will continue to attempt to perfect techniques for approximating seasonal variations. The Federal Reserve System has maintained an ongoing interest in the area of seasonal adjustment of monetary data and research to improve seasonal factor estimation.[8]

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8. For a brief summary, see Pierce and Cleveland (1981) and Moore (1981).

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