

Forecasting Float*

In the implementation of credit policy it is important for the Federal Reserve System, and particularly the Manager of the System Open Market Account, to obtain the best possible estimates of day-to-day changes in bank reserve positions. For this reason, the Federal Reserve Bank of New York has for many years made estimates of the daily changes in each of the principal factors which supply or absorb bank reserves.¹ One of the more important of these factors is Federal Reserve float—credit extended to member banks as a by-product of the check collection process—since float is subject to large and often erratic fluctuations. It is not unusual, for example, for the amount of float outstanding to change by as much as \$200 million in a single day. In mid-December, moreover, the daily variation in float may be as much as \$500 million.

The Federal Reserve System currently processes more than four billion checks a year, with a total value of over \$1.3 trillion. It would be a superhuman task for the Reserve Banks to keep track of each individual check and to credit the account of the bank which deposits it for collection at the time when payment is actually received from the paying bank. Instead, the Reserve Banks grant credit for checks deposited for collection according to a time schedule based primarily on the location of the drawee banks relative to their Reserve Bank office. The number of categories varies somewhat from Reserve District to Reserve District, but in general the time schedules provide that credit is to be granted immediately, or with a one- or two-day deferment. In line with this procedure, banks presenting checks for collection through the Federal Reserve System are required to sort them not merely according to destination but also according to the time schedule. The banks then receive credit automatically for the total amount of checks in each category on the days set by the schedule, even though not all the checks in a particular sort

are collected by the time credit is granted. It is the granting of credit for such checks in advance of collection that constitutes Federal Reserve float.

The System's inability to collect all checks according to schedule usually reflects one or more of several influences. In some cases it is not possible to collect the checks within the time limits set, even if there are no unusual processing or transit delays (time schedule float); in others the Reserve Banks are unable to process the checks on the day of receipt (holdover float); and in still others bad weather, strikes, or other factors delay the delivery or payment of the checks (transit float).

Time schedule float develops primarily when a bank in one District deposits for collection checks drawn on a "country" bank in another District. Under the present time schedule, credit for checks drawn on banks in areas where no Federal Reserve Banks or branches are located is granted two business days after such checks are presented to a Federal Reserve office. (These checks are known as "two-day deferred items".) If the depositing and drawee banks are located in the same Federal Reserve District, the checks can normally be collected in the allotted time. But if they are in different Districts, it takes at least three business days after the checks are deposited to collect them, given present transportation facilities.² Thus, one-day time schedule float is necessarily created for all such items. On the day they are deposited, the checks are generally processed by the receiving Federal Reserve office and, as a rule, then sent by air to the appropriate Reserve Bank. If flying weather is normal, the checks will arrive early the following morning. If the checks are processed and transmitted by the Reserve Bank office that day, they will generally arrive at the drawee bank the following business day, the day on which the original depositing bank automatically receives credit from its Federal Reserve office. But still another day must elapse before the presenting Federal Reserve Bank can receive payment from the drawee bank.

Holdover float arises because the Reserve Banks, for reasons of economy and efficiency, generally attempt to keep the number of employees in their check collection de-

* Irving Auerbach had primary responsibility for the preparation of this article.

¹ For a description of the use of the reserve projections by the Manager of the System Open Market Account, see Robert V. Roosa's *Federal Reserve Operations in the Money and Government Securities Markets* (Federal Reserve Bank of New York, 1956) Chapter VII.

² These checks are commonly called inter-District country items.

partments at a level sufficient to process more-than-average work volume but less than the peak loads. Since the daily volume of checks deposited for collection fluctuates widely, holdover float is created in peak periods.

Bad weather is usually the main factor behind transit float. Since air transport is used extensively to ship checks between Federal Reserve offices, inclement weather can and does result in large increases in float. But schedules may also be disrupted by strikes or other factors.

PREDICTABILITY OF FLOAT MOVEMENTS

The problems in forecasting float stem not so much from the fact that the daily swings are large³ as from the erratic nature of many of these swings. Float moves within a reasonably predictable pattern from year to year and month to month, but day-to-day movements are difficult to anticipate. Although daily average levels of float in the different months have in recent years ranged between about \$800 million and approximately \$2.2 billion, it is usually possible to predict such levels within \$50 million. By contrast, the differences between actual and projected levels for particular days are frequently large and at times amount to as much as \$200 million or even more.

One reason why it has proved difficult to make more accurate forecasts of changes in float is the uncertain behavior of the weather. Each month of the year characteristically has a number of days of inclement weather which disrupt airline schedules and delay the delivery of checks, consequently increasing float. Needless to say, it is impossible to pinpoint in advance the particular days within the month when the weather will behave in this fashion.

Another source of difficulty is the fact that each day's volume has to be completed in time to meet certain out-going plane, train, or truck schedules. Even if the check collection departments at various Federal Reserve Banks work late hours on heavy volume days, float will increase by the amount of the checks that were not processed in time to be dispatched that day by the available transportation.

Holdover float also depends to some extent upon the day of the week when the peak monthly volume occurs. Float tends to be lower if the largest influx of checks occurs on a Friday rather than on a Monday since more overtime work can be scheduled on week ends. However, experience with the various possible combinations of peak levels of float falling on different days of the week is not sufficient to offer much assistance to the forecaster.

³ In 1962, daily float levels ranged between a low of \$740 million and a high of \$3,107 million.

FORECASTING TECHNIQUES

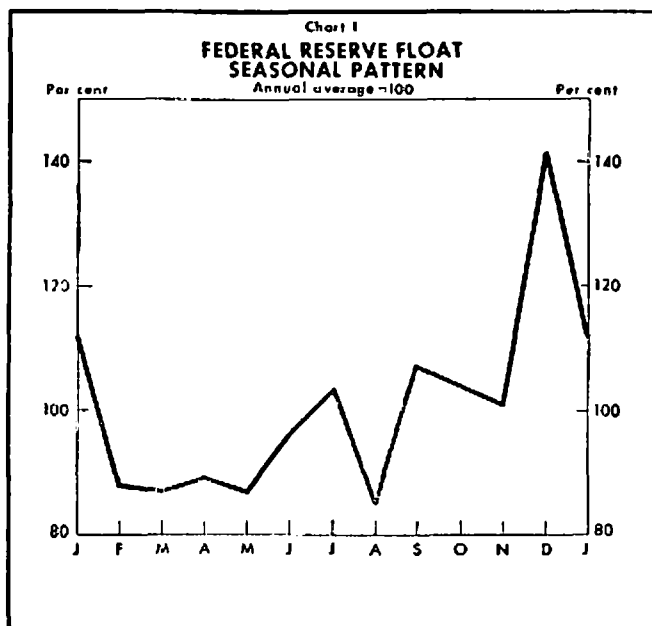
The procedure used to forecast daily fluctuations in the level of float begins with an estimate of a base (i.e., the daily average level) for the year. Seasonal factors calculated by standard statistical methods are applied to the base to derive monthly estimates. Intramonthly and intraweekly patterns are applied to the monthly average to obtain estimates of the daily levels—and ultimately of the daily changes in levels. However, in the final stages considerable subjective judgment is introduced, since no purely mathematical procedure has been evolved which would make a satisfactory allowance for year-to-year shifts in the day of the week on which a particular day of a month falls.

DERIVING THE BASE LEVEL. The base level is generally selected by extrapolating the observed trend, unless there is reason to believe that basic changes have occurred or will emerge in the future. The trend or cyclical fluctuation in float does not closely parallel the secular growth or changes in the volume of checks being cleared and collected through the Federal Reserve System. For example, during 1956 and 1957 the average daily amount of float outstanding over the year was reasonably close to \$1.1 billion. It dropped to about \$1.0 billion during the next two years, rose to a level of \$1.2 billion in 1960, and advanced to \$1.3 billion in 1961. However, the number and dollar amount of checks flowing through the Reserve Banks rose in each of these years.⁴

The long-term fluctuations in float are primarily related to such factors as changes in the deferred-availability time schedule, technological improvements in the check processing operation, and the capacity of the Federal Reserve offices to process checks. On the infrequent occasions when modifications in the time schedule occur, their effect on the trend is allowed for in preparing the estimates. Improvements in processing capacity or in the productivity of the check departments are difficult to gauge in advance, but once made their effects can be taken into consideration.

OBTAINING MONTHLY AVERAGE LEVELS. The monthly average levels which are used in this Bank's forecasting procedures are derived by multiplying the base level by the monthly seasonal factors shown in Chart 1. The seasonal variations in float are pronounced and reflect several different influences. Float is at its lowest level in August, because business activity is then at a seasonal lull. It reaches its annual high in December—running at levels that are

⁴ Between 1955 and 1961 the annual volume of checks processed by the Reserve Banks rose by 25 per cent in terms of dollars and 24 per cent in terms of number of items.



about 40 per cent above the year's average—principally because of the mail delays around Christmas.⁵ The relatively high average level of float for January is largely attributable to the carry-over of a heavy volume of checks from December. Bad weather, of course, also frequently contributes to the volume of float during these two months.

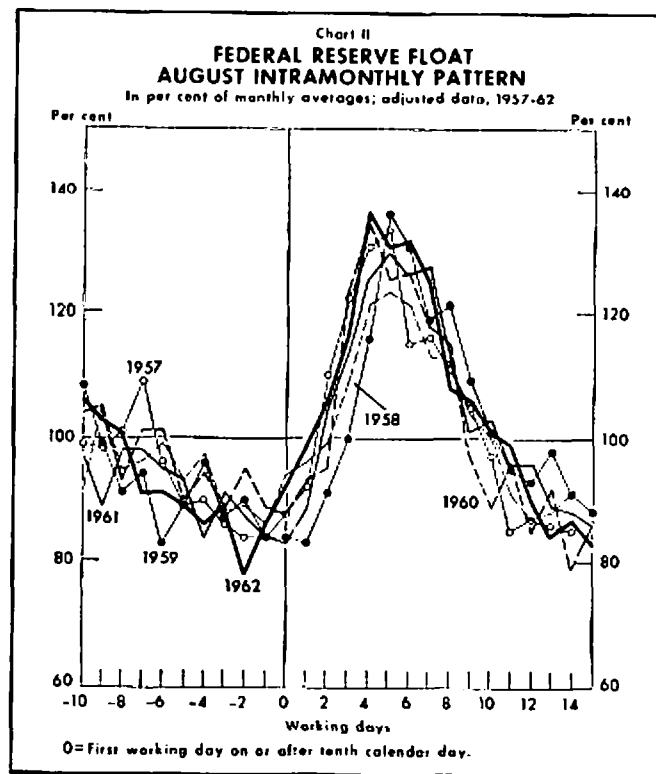
Float rises sharply in June and September, when Federal Reserve clearing facilities are congested by the combined influx of checks for corporate and individual income taxes. In the latter month, there is also the added influence of the seasonal revival in business activity. During March, float remains relatively stable for, although corporate tax checks are large in dollar amount, they are comparatively few in number and do not by themselves unduly overburden the System's check collection facilities. A slight increase in float occurs in April, owing to the payment of final and first-quarter individual income taxes. The number of checks associated with this payment is much larger than those written to pay corporate taxes. The increase in float for April is generally considerably less than the one associated with June, however, since in April the System does not have to process both corporate and individual tax checks simultaneously.

⁵ December is the "high" month despite the fact that, both in numerical and in dollar terms, more checks are generally cleared in November. Apparently, the redemption of Christmas Club deposits in November accounts for an important part of this difference in check volume between the two months.

Float generally increases in July, despite a decline in check volume, because this is the beginning of the vacation season for the experienced high-output personnel on the Reserve Banks' staffs and the time when new high school graduates are added to the force. Both factors tend to reduce the production rates of the Reserve Banks' check departments.

INTRAMONTHLY PATTERNS. Within each month, float typically follows a bell-shaped curve, with the peak falling around the middle of the month and either a plateau or a slight upturn developing around the close (see Chart II).⁶ This pattern chiefly reflects the influence of hold-over and time schedule float. Many business firms bill their customers for outstanding accounts receivable at the end of each month and allow a discount if the debt is paid within ten days. Otherwise, the full amount is due at the end of the next month. Apparently, a majority of the bills are paid shortly before the tenth of each month. Thus, given the mail or delivery times to the payee, to the commercial bank, and to the Reserve Bank, float begins to rise on the tenth and reaches a peak around the fifteenth. If

⁶ The bell shape is not fully apparent in this chart, since the chart begins with the data for the closing days of the preceding month in order to illustrate the transition between the two months.



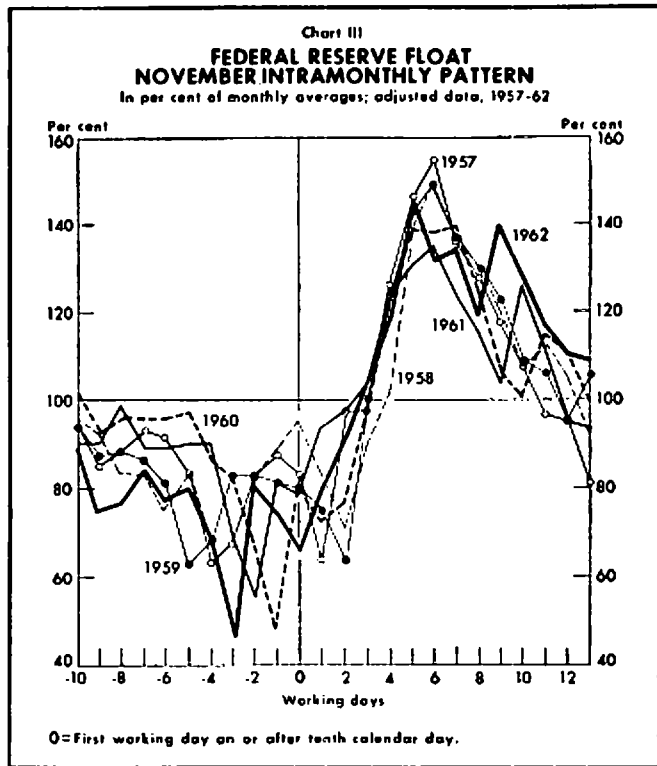
tax checks are due, as noted above, the midmonth peaks are elongated. Float either rises again at the end of each month—though only slightly—or levels off, and then drops slowly in the succeeding month (except in January) until a trough is reached shortly before the tenth.

Each month of the year, however, is subject to a number of unique influences which affect the basic bell-shaped monthly pattern differently. Therefore, special intramonthly "seasonal" patterns have been developed for each month of the year. The month-to-month differences stem primarily from the effects of holidays that are observed nationally or in particular regions of the country and from the influence of tax collections. In addition, the very large amount of holdover and transit float that develops in December and carries over into January causes the latter month to be the only one in which float is higher at the beginning of the month than in the middle.

Each of the quarterly tax months has a somewhat higher peak at the middle of the month than is common for the other months and a second but more moderate peak around the twenty-second. The latter rise is attributable to the influence on float of certain large tax checks drawn on out-of-town banks which temporarily retain all or part of the funds by crediting them to the Treasury's Tax and Loan Accounts. In June and September (when both corporate and individual income taxes are payable), the midmonth peaks tend to be higher than those for the two other tax months. Also, as a result of individuals' tax payments, April's pattern diverges from the bell-shaped curve in that float tends to remain at a plateau for a number of days after the middle of the month. In October, due to the influence of the Columbus Day holiday, float drops precipitously shortly after the tenth of the month and rises sharply over the next few days. Finally, in December, when float reaches unusually high levels, sharp declines can be expected on each of the last three Mondays of the month, or on the next working day if Monday is a holiday. This results from the additional time available over the week end to catch up on any backlog of work and to allow delayed checks to reach their destination.

In making estimates for a particular month, the daily levels of float (adjusted by the reciprocal of the intraweekly "seasonal") for the past six years are plotted on a chart in the form of percentages of the daily averages for the month.⁷ The data are plotted in terms of the number of

⁷ Relative values are used instead of absolute amounts in order to have the curves reasonably close to each other. If there were any marked changes in the absolute levels from year to year, the curves would be distributed over different areas of the chart and would be unsuitable for preparing patterns.



working days preceding and following the tenth calendar day of the month (see Charts II and III).⁸ This arrangement provides the most uniform alignment of each year's peak and trough with those of other years.

In deriving an estimate of the daily level of float, the daily figures for several past years are studied and the mode of the various observations for each day is determined by inspection. Points that are substantially above or below the others are ignored, especially if the observation is known to have been the result of a storm, strike, or some other special circumstance.⁹ If the observations are not clustered in a narrow area, greater weight is given to the values for the more recent years.

There are, however, always a number of days when the spread between observations is rather wide—even in August, the month with the most consistent year-to-year float behavior. For example, in Chart II, which shows the intramonthly pattern for August, the highest value on the third working day after the tenth is 23 percentage points above the lowest value. (In absolute terms, this amounts to about \$290 million.) When there is such a large spread,

⁸ The tenth of the month is relevant because of the pattern of bill paying outlined earlier.

⁹ Such facts are noted on the charts.

it is difficult to obtain a reliable forecast for that day. Even when the observations for a given day are very close, there is still no certainty that the next year's level will be in the same area. Nevertheless, a general pattern is evident for the month of August and a similar one is apparent for each of the other months, even those where the deviations from "normal" are larger or more frequent.

HOLIDAYS. Special problems arise in months that include national or important regional holidays. Each holiday has a distinctive influence on float. In general, however, holidays affect float as follows: a moderate decline on the holiday (if it is observed in only parts of the country), a sharp decline the day after, and a steep rise for a few days thereafter. The additional time available to collect and possibly process checks accounts for the decline, but the subsequent accumulation of checks after the holiday results in an increased workload at the Reserve Banks and consequent increases in holdover float. Since many holidays do not fall on the same days of the week each year and may affect different workdays within the month, no clear-cut

pattern of float behavior emerges on the regular monthly charts for periods affected by such a holiday. This is evident in Chart III which shows the intramonthly fluctuations for November, a month which has three holidays—Election Day, Veterans Day, and Thanksgiving Day.

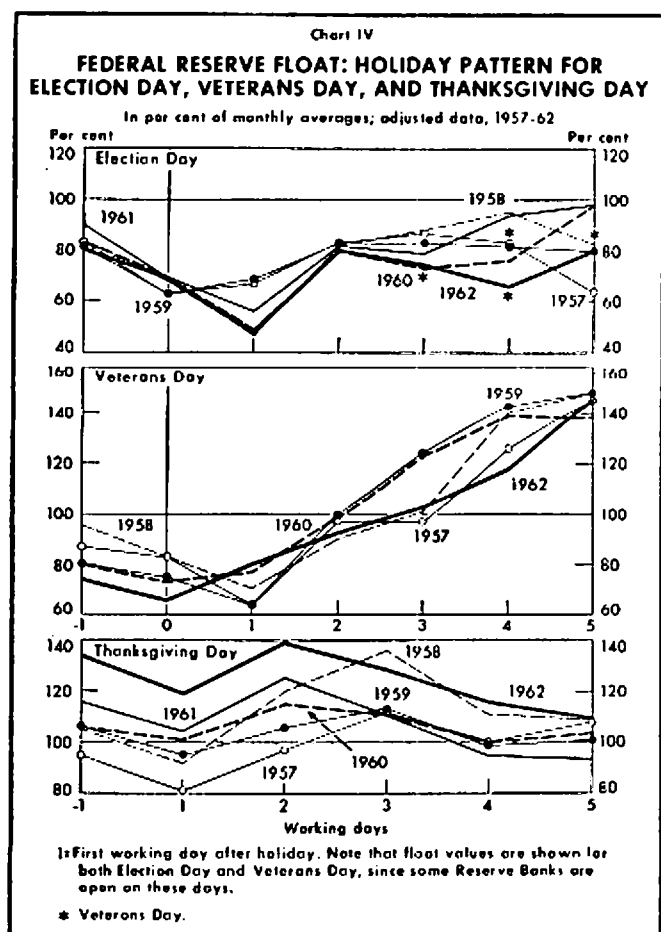
The effect of each of the major holidays may be analyzed more effectively if the figures on the amount of float outstanding around the holiday are aligned in terms of the days preceding and following the holiday (compare Charts III and IV). In making allowances for holiday influences in the float projections, the patterns derived from special holiday charts, such as Chart IV, are superimposed on the monthly charts.

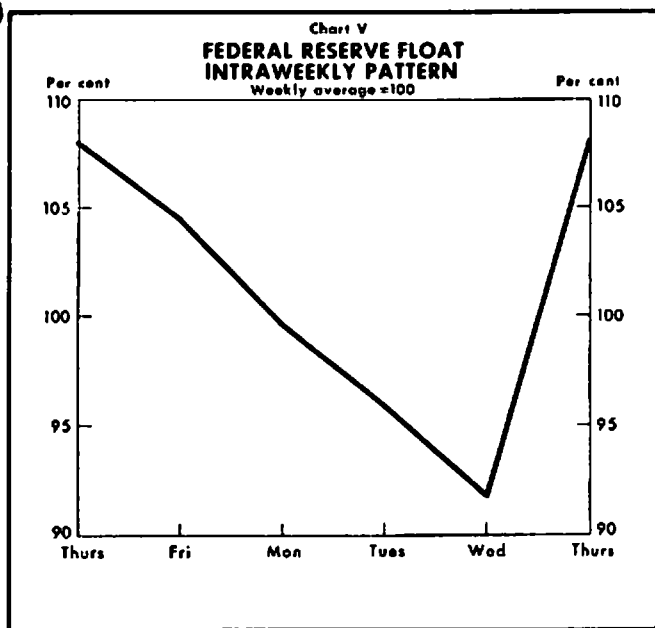
After the modal points for each day of the month (adjusted for any holidays) have been selected, the values are adjusted so that their average equals 100. These daily relatives are then multiplied by the estimated daily average for the month, to arrive at an estimated level for float for each day of the month.

ADJUSTING FOR INTRAWEEKLY FACTORS. As a final step, the daily levels obtained from the monthly charts are adjusted for an intraweekly "seasonal". This intraweekly pattern is indicated in Chart V. The intraweekly high is reached on Thursdays when the level tends to be 8 per cent above the daily average for the week, and the low occurs on Wednesdays when it is about 8 per cent below the week's average.

Time schedule float is partly responsible for the weekly pattern. The remainder is attributable to the effect of the week end on check flows. Over the week end the number of checks mailed increases, as does the time in which these checks have to arrive at their destination before the next normal working day. Consequently, banks receive the largest influx of checks for the week on Mondays. In turn, Tuesdays are the peak volume days for the Reserve Bank offices. Since each inter-District country item automatically gives rise to float two business days later, there is a marked increase in float on Thursdays. On Fridays, float tends to decline moderately, reflecting the collection of the checks that give rise to float on Thursdays, offset in part by the float increase caused by the country items that enter the Reserve System on Wednesdays.

Mondays, on which float used to decline sharply, now have a tendency to show a more moderate contraction. This behavior reflects differing Reserve Bank practices with respect to counting Saturdays for credit availability in intra-District sendings. In Reserve Districts where Saturday is counted as a business day, a large number of banks are now closed on Saturdays. Consequently, checks sent to these banks on a Friday are not processed until Monday and the Reserve Banks do not receive payment until Tues-





day. But since the Reserve Banks are obligated to give reserve credit on Monday, a large increase in float generally occurs on this day in these Districts. In Districts where Saturdays are not counted as business days, but where some commercial banks are open, the opposite situation occurs. The proceeds for some checks sent out on Friday are received by the Reserve Banks on Monday but reserve credit is not granted until Tuesday. This provides some offset to the float which is created by the Saturday closings in the first group of Districts. In the remaining Districts, virtually all commercial banks are closed and the Reserve Banks in these Districts do not count Saturday as a business day. However, their check operations also

tend to reduce float on Mondays because of the extra work and delivery time available over the week end.

The decline on Tuesdays reflects mainly the influence of the collection of Fridays' intra-District sendings by the Reserve Banks that count Saturday as a business day. A decline in the volume of new checks entering the System's collection facilities after the week-end peak is the primary reason for Wednesdays being the low point in the week.

When a full holiday falls on a work day, the intraweekly pattern must be realigned. If the holiday occurs on a Monday, for example, Tuesday's behavior is comparable to Monday's and Friday's to Thursday's. Accordingly, each adjustment factor other than Friday's is shifted forward one day, and the change that would be allowed for Friday is integrated into the estimate for the following Monday. On the other hand, if there is a holiday on which some Reserve offices remain open, the adjustment factors are themselves adjusted to the extent that the intraweekly pattern is interrupted by the holiday. For example, if the Reserve offices that are closed for the holiday account for 40 per cent of float, then the adjustment used on the day of the holiday would be 60 per cent of its regular value and the remainder would be transferred to the following business day.

ADJUSTING FOR FORECASTING ERRORS. Since actual float figures become available with only one day's lag, it is possible to reappraise float estimates daily to take account of current developments. If the estimates should deviate sharply from the actuals, a continuing comparison of estimates and actuals provides some clue as to whether the monthly average level needs to be revised or whether adjustment is needed only in the estimated changes for the days ahead. Nevertheless, determining whether a large error is due to a faulty estimate of the monthly average or is only a temporary aberration is largely a subjective judgment based upon experience and "feel" for the data.