A recent development in neoclassical monetary economics is the flurry of research on the Federal Reserve’s (hereafter, the Fed’s) daily implementation of monetary policy in the federal funds market. In the late summer of 2001, for instance, a Federal Reserve Bank of New York symposium on monetary policy offered five papers on the subject (Demiralp and Jorda 2002; Bennett and Peristiani 2002; Krieger 2002; Goodfriend 2002; Woodford 2002) while the July/August 2001 edition of the Federal Reserve Bank of St. Louis Review provided two more (Taylor 2001; Thornton 2001).

Prior to the mid 1990s, the daily implementation of monetary policy had been, relative to recent trends, a neglected area of research among neoclassicals, other than Joshua Feinman’s (1993) paper on the Fed’s daily reaction function. Research on the Fed’s actions generally abstracted from the Open Market Desk’s (hereafter, the Desk’s) daily actions in the federal funds market, concentrating instead upon the strategy involved in setting intermediate targets as in the monetary policy rule and measuring monetary policy literatures. On the other hand, research on the daily federal funds market primarily examined banks as lenders and borrowers of overnight funds, while abstracting from the Desk’s interventions in the market (e.g., Ho and Saunders 1985; Spindt and Hoffmeister 1988; Lasser 1992; Griffiths and Winters 1995).

During the mid to late 1990s, falling required reserves due to the proliferation of retail sweep accounts left banks at risk of overdrawing their reserve accounts during the course of routine settlement of electronic payments. The result was a substantially increased daily volatility in the federal funds rate that both complicated the implementation of monetary policy and provided impetus for new research on the supply and
demand forces in the daily federal funds market\(^1\) (Bartolini et al. 2001, 2002; Bennett and Hilton 1997; Clouse and Elmendorf 1997; Demiralp and Jorda 2000; Furfine 2000; Thornton 1999, 2001; Woodford 2002). Several leading journals have since devoted entire issues on complementary topics, such as the implementation of monetary policy in the information age (Posen 2000), monetary policy implementation when inflation and interest rates are both at or near zero\(^2\) (Fuhrer and Sniderman 2000), and the daily operating procedures of various central banks (Underhill 2002). Clearly, analysis of the Desk’s daily activities in the federal funds market now has an important role in the neoclassical monetary economics literature.

Unlike neoclassicals, Post Keynesians had already been incorporating the Fed’s implementation of monetary policy in the federal funds market within the endogenous money literature. Though this is not the place for a complete treatment of this literature (see Moore 1988 or Wray 1990, 1998), a key argument is that reserves are not an exogenously controllable variable for the Fed; rather, changes to reserves must be made endogenously in response to changes in banks’ demand for reserves. This argument contributes significantly to the views of adherents on several key macroeconomic issues, including the transmission of monetary policy, the proper intermediate targets for monetary policy, and the proper goals of monetary policy. Reserve endogeneity also complements recent contributions made by Post Keynesians to neo-Chartalist literature on functional finance and the inter-relationship/appropriate mix of monetary and fiscal policies (e.g., Wray 1998; Bell 2000).

This paper contributes to the monetary economics literature in general by providing a detailed analysis of the Fed’s current daily tactics, while also serving as a statement on this topic from an institutionalist perspective. The purpose of the paper is the application of an institutionalist “way to go about thinking” to the implementation of monetary policy in the federal funds market through an examination of how timeliness is achieved in the Fed’s daily tactics. “Timeliness” is a term introduced by John R. Commons in the *Legal Foundations of Capitalism* ([1924] 1995) that refers to how institutions go about recognizing what is necessary to sustain a particular system and what are the appropriate times of implementation. “What is necessary,” “sustain,” and “appropriate times” are determined within the institutional context and are normally instituted through working rules. F. Gregory Hayden (1987, 1993, 1998) has shown how timeliness and the operationalization/codification of working rules into laws and regulations can be integrated into the institutionalist research program.

The paper is organized as follows: The first section explains the concept of timeliness and its relationship to analysis of time in real world systems and to Commons’ concept of working rules. The second section describes the relevant categories of time or event sequences the Desk must be concerned with in its tactics and interprets recent events in monetary policy implementation from within this context. The third section illustrates how the discussion of timeliness in the Fed’s daily tactics can inform research on traditional topics in monetary economics and argues that (1) the payments system,
rather than reserve requirements, is the proper starting point for analysis of the Fed’s daily tactics; (2) there is no liquidity effect in the federal funds market; and (3) direct control over the monetary base is not possible. That the conclusions reached in the third section support the conclusions reached by proponents of the Post Keynesian endogenous money approach is not surprising, as their research has similarly focused upon the interactions of real world institutions within the financial system.

**Timeliness Defined**

In defining timeliness, it is useful to embed a definition within a discussion of two additional concepts—time and working rules. Institutionals have long suggested an evolutionary, process-oriented approach to research, rather than an equilibrium-based one, as more appropriate for analysis of socioeconomic phenomena. One issue at the heart of this recommendation, one could argue, is a particular view of time and how it should be incorporated into research. As John F. Henry and L. Randall Wray have argued, “The very notion of time . . . and its significance for analysis is determined by what is being examined. Simply put, there is no single meaning of time, no constant that is independent of the questions being addressed and the field of inquiry within which analysis is undertaken. What is time? It depends” (1998, 1).

Some of the more comprehensive studies of time in the institutionalist tradition have been made by Hayden, who has similarly argued that time is “not a natural phenomenon; rather it is a societal construct” (1987, 1282). As a societal construct, different societies have taken very different perspectives on time that have become more complex as societies have become more complex:

In the simplest technological societies, only a few events had to be synchronized in order to facilitate social life. Time existed only when those events had to be synchronized or when historical occurrences had to be recorded. It did not exist the remainder of the day, week, or year. There were no clocks or a sense of time sequencing. Neither was time divided into units such as weeks or hours.

With the evolution of nomadic and agricultural societies, sociotechnical processes became more complex, thus more synchronization and coordination were needed. Planting, harvesting, and warfare require more refined coordination. In addition, because the seasons became more important to when and where the tribe moved or when crops were planted, the seasons replaced events as the main time instrument.

The regular rhythm of an organized society gave the sense of events passing along a time continuum. However the rate of technological change was so slow that life seemed to be repeating itself from year to year and from generation to generation. Therefore, the time construct was thought to be circular. As new technological combinations began to appear more rapidly, it became obvious
that society was changing. Therefore, the time continuum ceased to be circular and began to move forward, finally becoming linear.

In the industrial era the clock is not just a measure or symbol of passing time. In the minds of that era it is passing time, both operationally and as conscious proof of the passing of time. The clock’s 24-hour-per-day, 60-minutes-per-hour and 60-second-per-minute has given the impression of an evenly divided flowing time to those living in an industrial society. (1304–5; emphasis in original)

The integration of science (and the notion of relative time), technology, and holistic science results in another construct: real time (Hayden 1987, 1306). Real time, or system time (1311, note 42), refers to the sequential events of a system, rather than to clock time (1298). In real time, “the system determines the measurement instrument. . . . Real time is defined in a system context that takes account of the appearance, duration, passage, and succession of events as they are interrelated within a system” (1306). In other words, sequential deliveries themselves are the “clock” with which to measure time in modern sociotechnical processes. What exist in society are duration clocks and coordination clocks selected by society, and the sequencing of events as scheduled by societal patterns (1282). Any uniformly flowing time construct that is independent of a process will, as a consequence, be inadequate for analyzing and planning socioeconomic processes in modern societies (Hayden 1993, 105). As Alfred North Whitehead recognized, “The disassociation of time from events discloses to our immediate inspection that the attempt to set up time as an independent terminus for knowledge is like the effort to find substance in a shadow. There is time because there are happenings, and apart from happenings there is nothing” (Whitehead 1975, 341; quoted in Hayden 1993, 107).

The task of researchers, planners, and policy makers is to effect instrumentally efficient outcomes from a system. Because “our policies determine which species are to exist, which children are to go hungry, how soon the ozone cover will be depleted, the incidence of cancer, the flow of income and investment, and so forth,” Hayden argued, “the task goes beyond [understanding] simple coordinating processes; the task is to determine them. With this recognition, we step beyond real time to social time through which societal decision making determines . . . timeliness” (Hayden 1993, 106). “Timeliness requires that we ask the question: Which projects will deliver the right amount of social goods and services at the right point in the social process to allow for the integration, maintenance, and improvement of the social fabric? . . . How much, when, and how fast are questions that should be answered by system needs” (Hayden 1987, 1296). System needs refers to that which is sufficient to maintain system stability, which can refer either to the re-creation of processes or to the completely different set of sequenced deliveries created in response to technological change or legislative action. The goal of timeliness is the system’s stability as defined by normative criteria set out in policy goals; terms such as optimal or efficient have meaning only within this normative context.
Hayden reminded us that the founders of institutional economics clearly understood the importance of time and timeliness in economic analysis:

Thorstein Veblen advised us in his 1898 article “Why is Economics Not an Evolutionary Science” that socioeconomic analysis should proceed by laying out the sequence of events and decisions in a system. . . . Karl Polanyi’s ideas on economic process are consistent with Veblen’s on the sequencing of events and decisions in a social network. . . . John R. Commons further developed Veblen’s ideas by incorporating the idea of timeliness. He pointed out that to understand a system’s needs, we “must know what, when, how much, and how far to do it at a particular time and place in the flow of events. This we designate the principle of timeliness. . . .” 3

Much of the research found important by institutionalists is dependent on the concept of timeliness. A description without an understanding of the timeliness of deliveries . . . would not be considered complete. Likewise, analysis of either (1) the agents within a system, or (2) recommended policy requires an understanding of what, when, how much, and how far. (Hayden 1993, 107–8)

To aid in the achievement and maintenance of timely deliveries, Commons and Polanyi both explained that normative criteria were established and operationalized by institutions through prohibitions, obligations, and permissions, or what Commons referred to as “working rules” (Commons 1995; Polanyi 1957; Hayden 1998).

A working rule lays down four verbs for the guidance and restraint of individuals in their transactions. It tells what the individuals must or must not do (compulsion or duty), what they may do without interference from other individuals (permission or liberty), what they can do with the aid of collective power (capacity or right), and what they cannot expect the collective power to do in their behalf (incapacity or exposure). (Commons 1995, 6; emphasis in original)

Commons’ “working rule” concept is apparent in Walter Neale’s well-known description of the “governing” role of institutions:

“Most of what people do is governed by the institutions of their society” is a proposition to which institutionalists subscribe. . . . What institutionalists have been emphasizing is that culture governs all—not in the sense that bees’ instincts are supposed to govern precisely their every action, but in the sense that a culture defines the permissible and the forbidden, defines right and wrong, the admirable and its opposite, gives content to these definitions with rules for behavior, and so provides opportunities as well as limits.

Thus govern does not mean “as the springs of a pinball machine govern the movement of the ball . . . .” The institutions constitute the arenas in which people try to accomplish their aims. Institutions imply “you may” as well as “thou
shalt not,” thus creating as well as limiting choices. (228–229, 1988; emphasis in original)

Institutional working rules—which are frequently codified in rules, regulations, and requirements (Hayden 1998)—thus provide the context within which institutions control sequenced deliveries and achieve timeliness. Working rules “determine the patterns of institutional activity that give institutions correlative capability and statistical regularity” (92). There is consequently no duality between dynamic change and stability; indeed, the achievement of timeliness will at times require, for example, that dynamic change to patterns of sequenced deliveries be promoted through changes in working rules.

To briefly summarize, the concepts of time and working rules are both necessary for understanding timeliness. The concept of time refers to the particular sequence of deliveries or events in a real-world system and implies a normative context. Timeliness refers to an evaluation of a particular sequence of deliveries or events within the normative context that gave rise to the sequence (i.e., working rules, institutions, technology) with respect to policy goals; moreover, timeliness further refers to a manipulation of deliveries pursuant to the attainment of particular ends. Societies use working rules to aid in the “governance,” “control,” or management of sequenced deliveries in order to achieve timeliness.

**Time and Timeliness in the Fed’s Daily Tactics**

As is well known, the Fed’s goals, as prescribed by legislative mandate, are to promote both smooth functioning of the financial and banking system and stability in the macroeconomy. The Fed’s obligations in the financial and banking system are to maintain the integrity of the payments system, to act as a lender of last resort, and to regulate banks and holding companies that own banks. The responsibility for macroeconomic conditions has been in effect during the post–World War II period and has been related to manipulation of credit conditions.

From a tactical standpoint, the Desk’s role within the process of attaining these goals is to maintain the FOMC’s targeted federal funds rate on a daily basis. Timeliness in the Fed’s daily tactics thus hinges upon whether or not balances in banks’ Fed accounts are supplied on time and in numbers sufficient for the daily federal funds rate to remain, on average, at the targeted rate. The Desk reports that “the [FOMC’s] objective for the funds rate will be achieved if the rate is sufficiently certain to trade close to the indicated target over the long run, so that temporary deviations from the target do not influence other asset prices” (Federal Reserve Bank of New York 1999, 2). The Desk also desires to keep volatility at manageable levels, since

- a significant increase in volatility in the federal funds rate . . . would be of concern because it would affect other overnight rates, raising funding risks for most
large banks, securities dealers, and other money market participants. Suppliers of funds to the overnight markets, including many small banks and thrifts, would face greater uncertainty about the returns they would earn and market participants would incur additional costs in managing their funding to limit their exposure to the heightened risk. (Meyer 2000, 4)

A common misperception of the Fed’s daily tactics comes from the textbook deposit multiplier model, which posits that open market purchases are made to increase reserves and through this action the federal funds rate or growth of a monetary aggregate is targeted. Should a lower federal funds rate or faster money supply growth be desirable, more reserves are created, and vice versa. This is at best an oversimplification, and at worst simply an incorrect description, of the context of actual daily operations by the Desk. Open market operations are not intended to continuously add to/subtract from the quantity of reserves, since doing so would send the federal funds rate substantially below/above the FOMC’s targeted rate. Figure 1 illustrates that—contrary to the textbook deposit multiplier model—changes in the reserve aggregates can be unrelated to the monetary base or monetary aggregates, as total quantities of reserves (defined as reserve balances in Fed accounts—“Fed balances”—plus vault cash used to meet reserve requirements) and Fed balances (total balances in Fed accounts only) have fallen considerably during the past decade, while the monetary base and M2 monetary aggregate have grown during this same period.

Central to understanding the Fed’s daily tactics is an understanding of basic facts about the Fed’s balance sheet (Hamilton 1997; Bell 2000), which are illustrated in figure 2 (adapted from Bell 2000, 604). Part I of figure 2 lists the components of the Fed’s balance sheet. Part II illustrates that, due to double entry accounting, one can understand the quantity of Fed balances as moving with changes in assets or in the opposite direction as changes to liabilities other than Fed balances. Part III illustrates that the quantity of Fed balances increases (decreases) when securities, discount loans, float, or other assets rise (fall), while Fed balances decrease (increase) when currency, the Treasury’s account, or other assets rise (fall). Thus, there are several sources of changes to the quantity of Fed balances besides open market purchases or sales of securities.

Rather than being the driving force of the monetary base and the money supply, the Desk’s daily actions are generally defensive in nature. Outright or permanent open market operations are primarily undertaken to offset the drain to Fed balances due to currency withdrawals by bank depositors, rather than to raise reserve quantities. Temporary open market operations are aimed at keeping the federal funds rate at its target on average through temporary additions to or subtractions from the quantity of Fed balances. Temporary operations attempt to offset changes in Fed balances due to daily or otherwise temporary fluctuations in the Treasury’s account, float, currency, and other parts of the Fed’s balance sheet, in as much as is necessary to meet banks’ demand for Fed balances. In undertaking permanent operations the Desk uses outright purchases or sales of securities; temporary operations are done through repurchase (for
Figure 1. Reserves, the Monetary Base, and M2 since 1995
increasing Fed balances temporarily) or reverse repurchase (or, until recently, matched sale purchases, for reducing Fed balances temporarily) agreements.

There are three different categories of event sequences—or time—within the daily federal funds market that concern the Desk in its operations: seasonal, maintenance-period, and intraday. Each is established by the normative characteristics of the
system—and by the working rules in particular—that impose limits/responsibilities upon institutional behavior at particular times.

Seasonal event sequences are driven by calendar-related influences on the demand and supply of Fed balances, which the Desk counters with outright or medium- to long-term (i.e., fourteen to ninety days) temporary operations. The demand for Fed balances by banks varies over the course of the year with seasonal variations in payment flows (many of which are settled through Fed accounts (discussed below)), which affect both excess balances and required reserve balances. The two most notable peaks in the demand for Fed balances occur during the end of the year during the holiday shopping season and during April/May when the public transfers funds into deposit accounts to pay tax liabilities (Partlan et al. 1986; Federal Reserve Bank of New York 2000).

The Desk’s outright and medium- to long-term repurchase operations also offset seasonal or permanent autonomous changes to its balance sheet items, the most significant of these being changes to currency, float, and the Treasury’s account. Seasonal changes to float are related to the public’s spending patterns throughout the calendar year, with the largest peaks occurring in November and December. Severe weather—because it disrupts the delivery of checks for clearance and settlement—and disruptions to wire transfer services can also significantly raise float.

Changes to the Treasury’s account are most pronounced during tax collection periods in January, April, September, and December; Treasury auctions; and important payment disbursements dates such as the beginnings of months when salaries and social security payments are transferred to recipients’ bank accounts (Hamilton 1997; Federal Reserve Bank of New York 2000; Krieger 2002). The Treasury attempts to offset some of the change through deposits (to add to Fed balances when revenues are larger than outlays) or withdrawals (to subtract from Fed balances when outlays are larger than revenues) from its tax and loan accounts (correspondent account balances held in commercial banks); flows not offset by the Treasury must be offset by the Desk (Hamilton 1997; Meulendyke 1998; Bell 2000; Federal Reserve Bank of New York 2002).

During tax collection periods, tax and loan account balances occasionally reach the total system capacity. Since transferring from the Treasury to tax and loan accounts is not possible in these cases, the Desk’s offsetting operations—frequently through medium- or long-term repurchase agreements—can be substantial in order to maintain the targeted federal funds rate (see Federal Reserve Bank of New York 1999, 17–18). In past years, after the tax season would pass, the Desk would drain Fed balances through matched sale purchases; more recently, the Desk has been authorized by the FOMC to use longer-term repurchase agreements to offset the flows to the Treasury at these times.

Currency in circulation varies by month, quarter, shopping seasons, and economic conditions and has fluctuated around a recent trend of 6 to 7 percent annual growth (Federal Reserve Bank of New York 2001, 9). To meet the demand, banks exchange Fed balances at a one-for-one exchange rate for currency; the currency is then held by banks as vault cash until it is withdrawn by the public as currency. As banks exchange Fed balances for vault cash, Fed balances are drained from circulation; an offsetting operation
by the Desk is necessary to replace the Fed balances. The Desk’s permanent operations therefore follow movements of currency and vault cash. Temporary changes to the public’s currency holdings, such as the large buildup in currency at the end of each year related to the shopping season, are offset through term repurchase agreements (end-of-year term repurchase agreements expire early in the new year to coincide with reduced currency in circulation).

Maintenance period time is the result of Regulation D, which requires banks to hold some combination of Fed balances and vault cash to equal a percentage of deposits. Under the current lagged accounting method, the two-week computation period—during which a bank’s period-average deposits and vault cash are computed—ends seventeen days prior to the beginning of the maintenance period. During the maintenance period, a bank holds Fed balances, less vault cash held during the computation period (the bank’s “applied vault cash”), to meet its reserve requirement. Banks also voluntarily contract with the Fed to hold required clearing balances during the maintenance period, which earn credits that can be used to pay for Fed payments services. Required reserve balances and required clearing balances together make up virtually all of the total balance requirements that must be held during the maintenance period. Any Fed balances, vault cash applied to reserve requirements, and deposits held at the end of most business days count (for purposes of computation and maintenance periods) once toward the period average; exceptions are those held at the close of business on Fridays (which count three times) and on days prior to holidays (which count once plus one more time for each coming holiday).

As the New York Fed pointed out,

The ability of depository institutions to average their holdings of balances at the Fed over two-week maintenance periods to meet their reserve and clearing balance requirements gives them some flexibility in managing their accounts from day to day. This ability to average is an important source of elasticity in banks’ daily demands for balances, limiting the volatility in rates that can develop when the Desk misestimates either the supply of or demand for balances. (2000, 1)

At the same time, banks have a less than perfect ability to substitute balances across days within the maintenance period, which is illustrated by the predictable pattern the federal funds rate typically follows within the period (otherwise, there would be no predictable pattern at all). For instance, rates on Fridays are typically soft (since balances count three times), while they tend to be higher on Mondays (due to increased payment flows (Furfine 2000, 540–541)). Substitutability of Fed balances across days is substantially reduced in the last days of the maintenance period, leading to substantially higher variability in the federal funds rate on these dates. On settlement Wednesday, for example, a bank with a period average of $1 million in unwanted excess reserves must lend $14 million overnight to avoid ending the maintenance period with forgone interest earnings, though it may not be able to without drawing its reserve account below
zero; in this case, the excess Fed balances might not be lent at any price. Alternatively, a
bank with a $1 million period-average deficiency in meeting its reserve requirement on
settlement Wednesday must borrow $14 million overnight but may not have sufficient
unutilized lines of credit and/or may not otherwise be able to find a lender on short
notice; in this case, the federal funds rate could rise substantially until banks turn to
their District Fed Banks to borrow the funds.

Another factor limiting the substitutability of Fed balances across days is banks’
“strong preference for concentrating their accumulation of Fed balances late in the
maintenance period, after the second weekend,” since period-average levels of Fed bal-
dances held can be significantly altered during the maintenance period by unexpected
variations in payment flows (Federal Reserve Bank of New York 2002, 5–6). As a result,
excess balances (Fed balances held in excess of total required balances) through the sec-
second Friday of the maintenance period generally average around $1 billion—though with
substantial variation from day to day—and occasionally fall below zero (i.e., total Fed bal-
dances in circulation on some days are fewer than total balance requirements). Excess bal-
dances rise substantially thereafter; since 1998, the increase has been to an average of
around $3 billion on the second Monday and Tuesday and to more than $6 billion on
average on settlement Wednesday (Bartolini et al. 2001; Federal Reserve Bank of New
York 2002, 5).

In managing the maintenance period, the Desk estimates the period-average need,
which is the difference between expected period-average demand for Fed balances and
the expected period-average supply of Fed balances averaged over the course of the main-
tenance period. The expected demand for Fed balances is the period-average quantity of
total balance requirements plus the expected excess balances at the FOMC’s targeted
rate less the Desk’s estimate of borrowing from District Fed Banks for the period. Daily
changes to float, currency, the Treasury’s account, and other items on the Fed’s balance
sheet affect the supply of Fed balances and therefore are also projected. Each morning
the research staffs at the New York Fed and the Board of Governors update estimates of
the demand for Fed balances and the supply of Fed balances with incoming information
and data; the updates may lead to revision of the period-average need if previous esti-
mates are considered inconsistent with the FOMC’s target (Partlan et al. 1986; Feinman

While the period-average need must be met throughout the course of the mainte-
nance period in order to avoid large deviations from the FOMC’s target, daily opera-
tions toward that aim require a blend of art and science. In planning permanent and
longer-term operations, the Desk will leave room for error in early projections (i.e.,
those made before the start of the maintenance period) of the period-average need that
can be met through temporary operations (both overnight and short-term repurchase
agreements). During the maintenance period, however, the Desk may not react com-
pletely—or even at all—to daily projected deficiencies or surpluses in the period-average
need or to deviations of the daily federal funds rate from the target rate (Feinman 1993).
For instance,
Recent deviations in the funds rate inform the Desk’s decision only to the extent that they help predict current or future conditions. For example, a soft or a firm funds rate could be associated with a Friday, a Monday, or a high payment flow date (discussed below), rather than a surplus or deficiency for the period.

Overly aggressive adds (drains) in response to a deficiency (surplus) or to a firm (soft) funds rate early in the maintenance period could leave the Desk with less ability to target the funds rate later in the period—when banks have less ability to substitute across days—if banks end up with too many (too few) excess balances.

Similarly, the Desk’s responses to surpluses/deficiencies and to deviations above/below the funds rate are not symmetric since banks effectively have a zero-bound in their reserve accounts (discussed below) and thus have less ability to work off an excess of Fed balances later in the maintenance period. The Desk also avoids pushing the funds rate above the target if it had been trading below the target for several days—or vice versa—in order to have the average rate over some period of time closer to the target (Federal Reserve Bank of New York 1999, 3).

Regardless of the actual or expected federal funds rate or the size/direction of the rate during a maintenance period, during the last three days of the maintenance period there is a substantial and predictable increase in the demand for Fed balances—due to rising desired excess balances—that is accompanied by reduced substitutability across days (and thus potentially greater variability in the funds rate).

Intraday time, like maintenance-period time, is also affected by the Desk’s ability to estimate the demand and supply of Fed balances, but the motivation in this case relates to the daily needs of the payments system rather than to maintenance-period averages. In 2000, Fed Banks processed more than $2.4 trillion in payments per day through reserve accounts, including basic funds transfers, payment for securities transfers, net settlement transfers from private clearinghouses, automated clearinghouse transactions, and cash deposits/withdrawals from Fed Banks (Panigay Coleman 2002, 74). About 95 percent of this amount occurred by way of large ($1 million or larger) wholesale payments, securities payments, or net settlement transfers from clearinghouses posted through Fedwire (the Fed’s real-time gross settlement electronic payment system) (Panigay Coleman 2002, 74). According to Craig Furfine, “Banks active in the payment system typically send and receive payments [via Fedwire] whose value is around 30 times greater than the bank’s overnight reserve balance, with the most active banks having a ratio of payments to balances of nearly 200” (Furfine 2000, 539).

The Fed ensures in Regulation J that payments on Fedwire are immediately final and irrevocable whether or not the sender has sufficient balances in its Fed account. The Fed provides intraday credit (daylight overdrafts) or overnight credit (overnight overdrafts) when a sender’s reserve account has a negative balance for all transactions settled through Fed accounts, though the vast majority of credit is incurred through Fedwire transactions (Panigay Coleman 2002). Finality, irrevocability, and overdrafts
are intended to minimize the exposure of payments system participants to credit and liquidity risks (Shen 1997). Penalties on daylight overdrafts were instituted as part of the Fed’s payments system risk policy in order to reduce the Fed’s exposure to systemic risk and to encourage sound use of intraday credit by banks and privately owned clearing-houses (Richards 1995; Panigay Coleman 2002). Intraday credit for a reserve account overdraft cleared by the end of the day is relatively inexpensive (36 basis point (bp) annual rate); there is, however, a substantial penalty—the day’s federal funds rate plus 400 basis points—on overdrafts not cleared by the end of the business day at 6:30 p.m. Consequently, while a large amount of intraday credit is used—the daily average is $30–35 billion and daily average peak daylight overdrafts are $80–100 billion (Zhou 2000, 33; Panigay Coleman 2002, 76)—banks attempt to avoid overnight overdrafts at nearly any cost; in other words, the system-wide demand for Fed balances is very interest inelastic when the threat of overnight overdrafts is present (Clouse and Elmendorf 1997; Furfine 2000).

While individual banks can borrow or lend Fed balances to/from each other to clear a daylight overdraft or to earn interest on unwanted excess balances, in the aggregate this does not change the quantity of Fed balances in circulation. Therefore, on a daily basis, the Desk attempts to offset autonomous reductions in the supply of Fed balances that might otherwise create a substantial increase in the level and volatility of the federal funds rate as banks attempt to avoid overnight overdrafts. On days when payment flows are substantially increased due to calendar-related effects (such as before and after holidays, first and last business days of months and quarters, and dates upon which flows to/from the Treasury are substantially increased), the potential for overnight overdrafts is also increased; as a result, the Desk attempts to accommodate a doubling or tripling in desired excess balances for the day (Federal Reserve Bank of New York 1999, 21–23). Not surprisingly, it is historically on high payment flow dates—particularly when coupled with banks’ increased demand for Fed balances in order to “window dress” balance sheets at the ends of quarters (Allen and Saunders 1992)—that the federal funds rate has substantially more variability and tends to be higher than on other days (except at the end of the year, when it is much lower due to the Desk’s aggressive accommodation of increased demand for Fed balances) (Hamilton 1996; Krieger 2002; Federal Reserve Bank of New York 2001, 23).

Aside from the effects on high payment flow dates, the Fed’s payments system risk policy has traditionally complemented the Desk’s job of targeting the federal funds rate: discouraging overnight overdrafts reduces unpredictable quantities of overnight credit that can complicate monetary policy implementation, while discouraging excessive daylight overdrafts (see note 10) reduces the likelihood of overnight overdrafts (Richards 1995). However, the complementary aspects became less so if not actually contradictory in the mid to late 1990s. As a result of the tax on reserve holdings implied by reserve requirements, banks have historically sought to reduce required reserves through reduction of reservable deposits (i.e., accounts that banks are required to hold reserves
against). The most recent method—management of retail sweep accounts using computer software programs—enables banks to monitor money holding patterns of all customers and “sweep” unused balances—for one or several evenings at a time—into nonreservable money market deposit accounts (MMDAs), thereby reducing reservable deposits (O’Sullivan 1998). Transaction account balances swept into MMDAs totaled only $5.3 billion in January 1994 and accumulated to just $9.9 billion by January 1995. The amount of sweeps thereafter increased dramatically—growing to $68.5 billion by January 1996—and continued to grow during the next several years to a level of $499.1 billion as of June 2002 (Federal Reserve Bank of St. Louis 2002). As reserve requirements fell, many banks became “non-bound” or nearly so in that they were able to meet all or most of their total reserve requirements through applied vault cash; this led to reduced required reserve balances and reduced total Fed balances (as seen in figure 1). As Fed balances fell, heretofore-routine errors made by individual banks in estimating intraday payment flows or made by the Desk in estimating intraday supply or demand for Fed balances raised the possibility of overnight overdrafts; this fact together with the large penalty on overnight overdrafts led to a substantial increase in the federal funds rate’s deviations from the FOMC’s target and in its average daily volatility12 (Clouse and Elmendorf 1997; Bennett and Hilton 1997; Federal Reserve Bank of New York 1998, 1999, 2000). The sequence of deliveries in the Fed’s daily tactics consequently became less timely.

In order to re-establish timely deliveries, several actions were taken. In the summer of 1998, the Fed altered the reserve accounting method in Regulation D to that described above. Under the previous method—in effect since 1984—the computation period ended two days prior to the end of the maintenance period. By lagging the maintenance period, there would be less uncertainty for both the Desk and banks in forecasting the period-average need. The Fed also supported legislation (to this point unsuccessfully) to allow it to pay interest on Fed balances in order to reduce the implied tax on required reserves, to encourage banks to hold more Fed balances, and to create a buffer against overnight overdrafts (Meyer 2000). Banks responded by increasing required clearing balances and (temporarily) raised excess balances in order to bring Fed balances to levels more consistent with daily payment settlement needs. Banks also increased internal monitoring of daily payment flows to avoid overdrafts, while the unrelated increase in bank mergers may have reduced uncertainty about payment flows (Federal Reserve Bank of New York 2001, 21). At the Desk, “the day-to-day swing in factors affecting the supply of [Fed] balances and the potential for error in the projections of these factors [were both given] a greater role in the Desk’s daily reserve management deliberations”; similarly, “the day-to-day volatility in the demand for excess [balances] and the potential error in the judgment of the daily excess demand have also become more important considerations in the Desk’s management of [Fed balances]” (Federal Reserve Bank of New York 1999, 14). Consequently, the period-average need “provides a general indication of the overall [i.e., for the duration of the maintenance period] need for open market operations, but the specific operational strategies employed by the
Desk are driven largely by the estimated daily patterns of both demand and supply behavior and the behavior of the funds rate” (Federal Reserve Bank of New York 1999, 1–2).

As a result of these changes, the Desk reported in 2001 that “volatility in the federal funds rate . . . was significantly lower in 2000 than in previous years. Median values of daily intraday standard deviations of the funds rate, and median and average values of the absolute deviations of daily effective rates from target were the lowest since 1995” (Federal Reserve Bank of New York 2001, 19). The Desk’s report on the same data for 2001—for the period prior to September 11—was only slightly worse but still much improved relative to the late 1990s (Federal Reserve Bank of New York 2002). Timeliness, to some degree at least, appeared to have been restored. In January 2003, the Fed took the additional step of altering Regulation A by replacing the discount window with the primary lending facility, replacing the discount rate with a modest penalty rate (100bp above the federal funds rate), and eliminating the non-monetary costs associated with borrowing from District Fed Banks; the desired effect was to invite banks in danger of overnight overdrafts (and others needing immediate liquidity) to borrow overnight from the Fed without concern about additional regulatory oversight and in the process to reduce the likelihood of spikes and volatility in the federal funds rate (Madigan and Nelson 2002).

To summarize this section, the Fed’s daily tactics and recent events can be interpreted within the time/timeliness/working rules framework discussed in the previous section. The Desk adjusts the quantity of Fed balances within the context of working rules that influence bank behavior in the federal funds market and generate seasonal, maintenance period (e.g., Regulations A, D, and J and the payments system risk policy), and intraday time durations in order to achieve the FOMC’s target (i.e., timeliness). When banks react to the working rules—Regulation D in particular—by reducing Fed balances through retail sweep accounts, a new environment is created in which timeliness is threatened. To restore timeliness, both banks and the Desk react to the new environment by becoming more concerned with intraday event sequences while the Fed reacts by changing some working rules within which both banks and the Desk function in order to make them more consistent with the new environment.

**Integrating Timeliness with Research in Monetary Economics**

This section illustrates how the above description of event sequences in the Fed’s daily tactics can inform research in monetary economics. The following discusses implications of the institutional prerequisites for timeliness in the Fed’s daily tactics for research on the payments system and monetary policy implementation, the liquidity effect in the federal funds market, and control of the monetary base.
The Payments System and Monetary Policy Implementation

As required reserves have fallen, the threat of overnight overdrafts on the demand for Fed balances has led to changes in behavior by both banks and the Desk, while also stimulating research on the daily implementation of monetary policy in its own right and as part of the announcement effect literature (discussed below). The proliferation of retail sweep account technology has made it clear that payment needs matter for the implementation of monetary policy. As Furfine pointed out, “successful future implementation of monetary policy relies on understanding how the funds rate obtains each day when reserve requirements need not be of great importance” (2000, 536). Despite the fact that timeliness requires that the Desk’s operations have always been concerned with the daily settlement needs of banks, payment flows are an “often ignored determinant of bank reserve demand” in the monetary economics literature (536). Given that “recent developments suggest that the traditional view of the reserves market . . . needs to be reformulated” (Demiralp and Jorda 2000, 7), it is important that the reformulation occurs via recognition of the fundamental role of the payments system in the Fed’s daily tactics, regardless of the size of reserve requirements.

Though payments system structures and the roles played by central banks differ across countries, a recent report by the Government Accounting Office recognizes that “the primary objective of all central banks is to ensure the smooth functioning of their countries payment systems” (Government Accounting Office 2002, 2; emphasis added). According to the Board of Governors, “A reliable payments system is crucial to the economic growth and stability of the nation. The smooth functioning of markets for virtually every good and service is dependent upon the smooth functioning of banking and financial markets, which in turn is dependent upon the integrity of the nation’s payments system” (Board of Governors 1990, 2). Not surprisingly, a characteristic of all payments systems is therefore the provision of intraday and/or overnight credit at some price by the central bank; even the few countries that do not supply intraday credit (e.g., Switzerland and Japan) supply collateralized overnight credit (Emmons 1997, 27–28).

Because the integrity of the payments systems is “the primary objective” of the Fed, analysis of the Fed’s daily tactics more appropriately begins with the case in which there are no reserve requirements (i.e., maintenance period time does not exist) in order to consider intraday time and the payments system only. In this case, banks’ desired levels of Fed balance are limited to what is necessary to meet expected needs for settlement of payments, as there is no need to hold any more or less than this amount. Banks with undesired excess balances lend them at virtually any positive rate since they do not earn interest otherwise; those with deficiencies for the day borrow them at nearly any cost to avoid overnight overdraft penalties. Banks continue to hold vault cash to meet customer withdrawals of currency. However, neither the vault cash nor the Fed balances “fund” bank expansion of loans/deposits. The fact that bank liabilities continued to grow after 1995 as Fed balances fell (figure 1) and while total vault cash remained roughly stable illustrates that neither is necessary to “fund” the creation of money.
In the absence of reserve requirements, the Desk’s temporary operations would accommodate the demand for Fed balances such that neither more nor less than this amount is in circulation on each day. The accompanying increased variability in the federal funds rate is due to the context established by working rules—overnight overdraft fees in the payments system risk policy, no interest paid on Fed balances, and the non-interest “costs” associated with borrowing at the discount window (discussed in note 12).  

The addition of reserve requirements is simply one possible avenue for reducing variability in the funds rate. With a reserve requirement substantially larger than desired vault cash holdings, banks must hold greater quantities of Fed balances. The larger Fed balance holdings reduce the likelihood of overnight overdrafts. When banks are also able to substitute balances across days within the maintenance period to meet requirements without risking overnight overdrafts, a total daily demand for Fed balances that on most days is less interest inelastic and more predictable—for the Desk’s purposes—reduces variability in the funds rate. Just as without reserve requirements, the greater quantities of Fed balances do not “fund” loan/deposit creation. Rather, the greater quantities of Fed balances and creation of maintenance-period time simply provide greater room for error for both the Desk and banks in managing daily Fed balances. If one were to find a stable “money multiplier” relationship in actual data of money and reserve aggregates, this is due to the Desk’s traditional practice of accommodating the period-average need rather than evidence that open market operations create reserves to “fund” expansion of bank balance sheets. 

A more direct method of reducing variability in the federal funds rate is to reduce the spread between the price charged for overnight overdrafts (federal funds rate plus 400bp prior to January 2003) and the price paid for Fed account deposits (currently zero bp), since it sets the range of variability. Canada, Great Britain, Norway, Sweden, Australia, and New Zealand, for example, have eliminated reserve requirements without the accompanying volatility in the overnight interest rate targeted by the respective central banks (Sellon and Weiner 1997; Underhill 2002). In each country, the central bank sets a lower limit on the overnight rate through payment of interest on reserve balances and sets an upper limit through establishment of a Lombard-type lending facility from which banks are able to borrow freely from the central bank at a rate set above the central bank’s targeted rate. The upper and lower limits are frequently set at plus and minus 25bp of the given central bank’s targeted overnight rate, respectively. As there is no reason for banks to lend at a lower rate than what they can earn on their reserve accounts, and no reason to borrow for a higher rate than the rate at which they can borrow from the central bank (assuming the central bank’s credit is provided with no additional regulatory “strings” or conditions attached and thus banks at risk of an overnight overdraft feel comfortable borrowing from the central bank at this penalty rate), the overnight rate remains within this range. Temporary open market operations—or a variant thereof—are used to target the overnight rate at the center of this range; tactics by indi-
individual central banks vary, including operations more than once per day or later in the day when settlement needs are greatest.

Such operating procedures may soon be the norm at the Fed, particularly given the Fed’s support for legislation to allow payment of interest on Fed balances and recent changes made to Regulation A (both discussed above) that remove the non-monetary costs of borrowing from the Fed when the threat of an overnight overdraft arises. However, that economists are only now recognizing the importance of the payments system in the implementation of monetary policy illustrates how the special case and the general case had been previously confused. Consistent with intraday timeliness in the Fed’s daily tactics, the primary objective of the Desk’s open market operations has never been to “increase/decrease reserves to provide for expansion/contraction of the money supply” but rather to maintain the integrity of the payments system through provision of sufficient quantities of Fed balances such that the targeted funds rate is achieved. Reserve requirements merely produce a more stable and less interest-inelastic demand for Fed balances on most days. Since the possible range of variability in the funds rate is the spread between the price the Fed charges for credit (plus any non-monetary costs such as those traditionally associated with the discount window) and the price it pays for Fed account deposits, simply reducing the spread can directly reduce variability.

The Liquidity Effect in the Federal Funds Market

The vast literature on the liquidity effect in the federal funds market has examined how increases in reserves affect the federal funds rate (e.g., Strongin 1995; Hamilton 1997; Bernanke and Mihov 1998; Einarsson and Marquis 2002). Alternatively, others have recently investigated whether open market operations are even necessary to carry out changes to the FOMC’s target rate, a situation they have labeled the “announcement effect” since a public announcement of the target change is sufficient for the rate to change (e.g., Demiralp and Jorda 2000, 2002; Thornton 1999, 2001; Taylor 2001). Through application of the different event sequences in the Fed’s daily tactics, this section defines a liquidity effect as a change to Fed balances sustained throughout a maintenance period to generate a change in the federal funds rate. Shorter-term, temporary operations that “nudge” the rate closer to the targeted rate on a given day or “signal” a change in the FOMC’s target to federal funds market participants are unrelated to a liquidity effect.

There are several reasons to be cautious when investigating whether a liquidity effect exists or not. First, one must be careful not to confuse reserves with Fed balances; only Fed balances could be related to a liquidity effect, since vault cash is unrelated to the federal funds market. When using changes (or “unanticipated changes,” as discussed in note 15) to non-borrowed reserves (NBR, or reserves less borrowings from Fed Banks) as a proxy for exogenous open market operations, one must recognize that only the Fed balance portion of NBR is relevant to the federal funds market. Second, changes to NBR have historically been made endogenously in response to banks’
demand for Fed balances rather than exogenously, regardless of the Fed’s operating target (discussed in the next section on the monetary base). Third, the deviations in the federal funds rate from the FOMC’s target in bi-weekly, monthly, or daily data (except on days that the FOMC’s target changes) are related to the Desk’s management of seasonal, maintenance period, and intraday time, rather than to the stance of monetary policy.

Fourth, and most important, in identifying whether there is a liquidity effect or an announcement effect one needs to distinguish between operations intended to carry out a change in policy and those made in an attempt to balance the supply of Fed balances with the demand. When the Desk does intervene to increase or decrease Fed balances, even if the intervention occurs on the day of an FOMC rate change, the intervention could have been made in accordance with the already existing period-average or intraday need and would thereby be unrelated to a liquidity effect since the operation would have occurred regardless. In the presence of reserve requirements (i.e., maintenance period time), event sequences in the Fed’s daily tactics imply that the way to know if monetary policy implementation involves an announcement effect or a liquidity effect is to determine whether or not the Desk alters its estimates of the period-average need. If re-estimates do occur, then changes to the targeted rate are effected through shifts in the supply of Fed balances along a downward sloping demand curve (i.e., a liquidity effect). Otherwise, there is no need to change Fed balances to move (and sustain the move) from one target to another (i.e., an announcement effect).

The Desk does not make its estimates of the period-average need public, which makes it difficult to verify statistically whether a liquidity or an announcement effect is at work. However, Sandra Krieger, head of domestic reserves management and discount operations at the Desk, makes it clear that an announcement effect is at work:

> The conventional textbook view is that the Trading Desk buys and sells securities in response to policy easings and tightenings [i.e., the liquidity effect]. From the Desk’s perspective, however, the supply-demand balance is primarily a function of the demand for required balances, which is almost completely insensitive to small changes in policy. Consequently, any change in the [FOMC’s] target has virtually no effect on excess supply or demand in the funds market [i.e., the period-average need]. (Krieger 2002, 74; emphasis added)

The Desk will at times engage in temporary operations in order to “nudge” the federal funds rate in the desired direction, including days that the target is changed. But these are unrelated to a liquidity effect.

If the rate does not move quickly to the new target, the Desk might supply more or fewer reserves on a particular day in order to make it move. However, the Desk’s average supply-demand imbalance over a maintenance period [i.e., the period-average need] would be the same as it was before. So if the Desk reacts on a particular day by supplying more or fewer reserves than it otherwise would have (if the rate had been trading at the target), the chances are that actions on subse-
quent days will be just that much smaller or larger. (Krieger 2002, 74; emphasis added)

Operations intended to provide a “nudge”—rather than being a liquidity effect—are thus trivial, since they must be either offset or made within the context of the existing period-average need. An increase or a decrease inconsistent with the period-average need would come up against a demand for Fed balances that is virtually interest inelastic, since banks require at least enough Fed balances to meet reserve requirements and payment needs and virtually nothing beyond this amount. Similarly, operations intended to send a “signal”—which the Desk engaged in prior to 1994 in order to “signal” a new target rate to federal funds market traders (see, for example, Feinman 1993)—are analogous to a “nudge” since they must also be offset given the inelasticity of the demand for Fed balances across the maintenance period.

When one begins analysis by considering the case without reserve requirements, as suggested in the previous section, it is clear that there is no liquidity effect. In this case, banks only need to meet payment needs and there is no period-average need. The daily demand for Fed balances is almost perfectly inelastic with respect to the funds rate. Each day the Desk simply supplies Fed balances in order to remove any imbalance between the quantities demanded and supplied; imbalances result in substantial variation in the funds rate. The addition of reserve requirements simply provides the Desk more room for error in targeting the overnight rate by providing slightly more elasticity in the demand for Fed balances on a given day, while the demand for Fed balances remains virtually perfectly interest inelastic across the maintenance period. As in countries without reserve requirements, providing an upper and lower limit to the rate through a Lombard-type lending facility and interest payments on balances held in Fed accounts can reduce variability in a more direct manner; in this case there is clearly no liquidity effect since the change in the targeted rate can be effected by simply moving the upper and lower limits up or down together.

To summarize, it is meaningless to talk of the Desk as supplying money or reserves in order to reduce rates through a liquidity effect. Because of the inelastic demand for Fed balances across the maintenance period, an increase or decrease in Fed balances inconsistent with the period-average need would simply lead to wide swings in the funds rate. Changes in the target are carried out through announcement or signaling (or changing the upper and lower limits in other countries). The temporary operations that generate both “signals” and “nudges” are offset if they are inconsistent with the existing period-average need. The assumption that the Desk can exogenously increase the quantity of Fed balances to move the supply of Fed balances along a downward-sloping demand curve is tied to the fallacious belief that banks can do something with Fed balances beyond meeting reserve requirements and payment needs. This point is related to the Fed’s ability to control the monetary base, to which we now turn.
Control of the Monetary Base

Though the Fed has traditionally set an interest rate target, some research promoting the possible use of reserve and/or monetary base targets in future monetary policy continues (e.g., Anderson and Rasche 2001b; McCallum 1999). This section examines the possibilities for control over the monetary base within a very short period of time such as the maintenance period and explains why control over the monetary base is only possible indirectly through an interest rate target.

The monetary base is defined as the sum of currency and reserves, where reserves are equal to Fed balances plus vault cash. As already discussed, vault cash is purchased from District Fed Banks by banks as they anticipate currency withdrawals by the non-bank public. Vault cash and—consequently—currency are therefore supplied endogenously by the Fed in response to the actions of banks and the non-bank public. When the Desk offsets the reduction in its Fed balance liabilities through permanent operations, the Fed’s balance sheet (both assets and liabilities) has increased by the amount of the change in vault cash. Both the action of supplying vault cash as banks approach the District Fed Banks to purchase it and offsetting the accompanying reduction in Fed balances through permanent operations are necessary for maintaining the integrity of the payments system. Because vault cash and currency—which together make up around 97 percent of the monetary base—are necessarily supplied endogenously in response to the needs of banks and the non-bank public, direct and exogenous control over the monetary base within a short period of time can occur only if short-term control over the quantity of Fed balances—which are currently only about $20 billion, or 3 percent of the monetary base—is possible.

Changes to the quantity of Fed balances, however, occur endogenously in response to the total demand for Fed balances, which itself is determined by how the non-bank public varies its deposit holdings—which affects reserve requirements—or how payment settlement needs evolve. If the Desk does not supply the full amount of desired Fed balances within the maintenance period, the rest is supplied to banks either at a penalty rate for reserve requirement deficiencies (as set forth in Regulation D) or via borrowing from the Fed’s primary lending facility. To do otherwise would be inconsistent with maintenance period timeliness, as it would lead to wide swings in the federal funds rate (this fact similarly limits the Desk’s ability to initiate liquidity effects). On a daily basis, to not provide sufficient quantities of Fed balances—either through open market operations or borrowings—would have similar effects on the federal funds rate and could threaten the smooth functioning of the payments system. Consequently the Fed’s ability to affect deposits (i.e., the money supply) occurs not through changes to Fed balances or reserves but through changes in retail interest rates brought about by changes in the targeted federal funds rate; a change to deposits changes required reserves, which alters banks’ demand for Fed balances. Empirical evidence suggests, moreover, that a change in deposits induced by a change in interest rates does not occur within a span of time as
short as the maintenance period but rather after a significant time lag\textsuperscript{18, 19} (e.g., Tarhan and Spindt 1983; Meulendyke 1988).

To use the 1979–1982 period—during which the Desk targeted aggregate reserves—as an example, reserve targets could be achieved only across maintenance periods and occurred indirectly through changes in the federal funds rate. The total quantity of Fed balances supplied within a maintenance period was given by the demand for Fed balances during that period, rather than exogenously by the Fed or the Desk. When the quantity of Fed balances supplied by the Desk’s operations was insufficient to accommodate banks’ demand for Fed balances during the period, the federal funds rate would be bid up while banks would go to the discount window to borrow the rest. The increase in the federal funds rate was expected to affect future money supply growth and thereby affect both required reserves and total Fed balances in later periods. This process is verified by Ann-Marie Meulendyke, former open market operations manager and senior economist at the Desk, who writes that

\begin{quote}
[t]he Trading Desk began by computing a target for total reserves (TR). . . . If TR were off target, BR [Fed balances borrowed at the discount window] would have to adjust.

Higher (lower) borrowing (at the discount window) would induce a higher (lower) Federal funds rate, which would slow (speed up) future growth in money and RR [required reserves] and would allow BR to decline (increase) (and bring TR to its targeted level). (Meulendyke 1988, 394–395)
\end{quote}

When one again begins analysis with the Fed’s fundamental obligation to maintain the integrity of the payments system and first considers the case in which reserve requirements are absent, it is clear that short-term exogenous control over the quantity of Fed balances is not possible. Without reserve requirements, the Desk obviously cannot target a quantity of Fed balances different from that which is necessary to settle payments; attempts to set a lower (higher) quantity simply lead to large increases (decreases) in the federal funds rate as banks are forced into overnight overdrafts (forced to hold unwanted balances that earn no interest). The quantity of Fed balances is unrelated to deposits; when banks expand deposits, they need only have access to enough Fed balances—by simply holding such quantities or by borrowing them from other banks or from the Fed—to meet any increase in payment settlement needs. The only short-term tool available to the Fed when there are no reserve requirements is an interest rate target.

When reserve requirements are introduced, the quantity of Fed balances and deposits becomes related through the required reserve ratio; however, because Fed balances do not fund deposit creation, the direction of causation runs from deposits to Fed balances, not vice versa as is assumed by the money multiplier. Fed-induced changes to the quantity of Fed balances are possible only through changes to the overnight rate—that is, through a change in the interest rate that affects deposit expansion and thereby changes required reserves and the demand for Fed balances. As described in the
previous two sections, because reserve requirements serve primarily to improve the efficiency of interest rate targeting by providing a more predictable demand curve for Fed balances, setting an upper and lower limit on the federal funds rate through a Lombard-type lending facility and payment of interest on Fed balances provides a more direct method of interest rate targeting.

In conclusion, the only short-term tool available to the Desk is an interest rate target, while direct changes to the monetary base are necessarily endogenous and primarily result from the public’s desire to hold currency. These conclusions follow from an understanding of timeliness in the Fed’s daily tactics, which illustrates that (1) vault cash—and therefore currency—is necessarily supplied endogenously by the Fed, (2) Fed balances are used only to meet payment needs and reserve requirements and therefore do not constrain or fund deposits, and (3) supplying more or fewer reserve balances than the quantity desired would lead to wide swings in the federal funds rate and could threaten the integrity of the payments system. The conclusions are obvious when analysis begins with the Fed’s obligation to the payments system and recognizes that reserve requirements merely improve the predictability of the demand for Fed balances. Finally, it is important to note that while the components of the monetary base are not under the direct control of the Fed or the Desk, this does not mean that monetary base (or aggregate reserves) targets are not possible (even though they may not be desirable), as the 1979–1982 period illustrated. However, the mechanism through which such targets can be achieved is through the effects of changes to the federal funds rate upon bank liabilities. Unfortunately, the federal funds rate—or any other interest rate—is widely known to be an imperfect and imprecise instrument for control over the expansion of bank liabilities, an extreme example of which are the near zero interest rates in Japan that for a period of years accompanied decreased bank lending (Yamaguchi 2002).

**Conclusion**

This paper illustrated how an institutionalist approach to thinking about real world systems, and about time in particular, can be applied to the Fed’s daily tactics in the federal funds market. Henry and Wray wrote, “One must construct a concept of time that . . . is consistent with and limited by the characteristics of the (process) under investigation” (1998, 2); later, they added, “[A]n explicit concept of a unit of time is necessary in the development of economic theory to analyze and evaluate the behavior of a monetary economy” (8). Several papers by Hayden have explained how time, timeliness, and working rules can be defined and incorporated into research according to their relationship to the system under investigation in order for research to be relevant to real world systems and useful for policy.

In the Fed’s daily tactics, there are three different “units” of time—or, to use Hayden’s term, event sequences—that are created by working rules for which the Desk achieves timeliness: seasonal, maintenance period, and intraday. As Commons illus-
trated the importance of understanding the balance of liabilities and rights in “governing” behavior, so does the Fed promote different responses by banks in the federal funds market through its manipulation of the balance of prohibitions and permissions within seasonal, maintenance period, and intraday event sequences. The threat to timeliness related to the proliferation of retail sweep accounts and caused by the consequent combination of reduced Fed balances (itself the consequence of reactions by banks to Regulation D) and the Fed’s payments system risk policy was later reduced primarily through changes to certain working rules (such as to Regulation D in 1998 and to Regulation A in 2003) and closer attention to intraday time by banks and the Desk even as other working rules (such as the payments system risk policy) remained unchanged.21

The paper illustrated how an understanding of time, timeliness, and working rules in the implementation of monetary policy can be used to inform research in monetary economics. The substantial reduction of required reserves in the United States—to such an extent that they are now essentially voluntary (Anderson and Rasche 2001a)—has made it clear even to many neoclassicals that there is no causal link running from Fed balances to the money supply; had they recognized the Fed’s fundamental obligation to the payments system and to intraday time, they would have known this long ago. Consideration of maintenance-period time and intraday time also enables one to understand that there is no liquidity effect in the federal funds market and illustrates the endogeneity of the components of the monetary base within short periods of time. Influence over the monetary base or monetary aggregates occurs only indirectly through an interest rate target, as endogenous money proponents have argued for years.

The conclusions regarding the liquidity effect and control over the monetary base—and the related fact that Fed balances do not fund or constrain loans—are quickly revealed when analysis begins with intraday time and first considers the case in which reserve requirements are absent. The suggestion in this paper that research on the Fed’s daily tactics emphasize the fundamental role of the payments system is consistent with and complementary to several other research programs, such as the Circuitistes, Chartalism, endogenous money, and Minskian analysis of financial fragility, all of which emphasize payment flows between governments, banks, firms, and households.

Notes

1. A similar event occurred in 1992 when the required reserve ratio was reduced from 12 percent to 10 percent and required reserves on Eurodollars and time deposits were eliminated. Volatility in the federal funds rate was actually greater at that time than that influenced by retail sweep accounts in the mid to late 1990s (see Clouse and Elmendorf 1997).
2. There have been several other articles published on monetary policy at the zero-bound for interest rates, including Johnson et al. 1999, Hetzel 1999, Clouse et al. 2000, and Shirakawa 2001.
3. The original quote by Commons is from Commons 1995, 379; emphasis in original.
4. See Fullwiler 2001, chapter 4, or the Federal Reserve Bank of New York’s annual reports on open market operations for further details on temporary and permanent operations.
5. Because the Treasury requires banks to hold collateral against all tax and loan account balances, individual banks will contract to hold up to only a certain desired quantity. There is consequently a system-wide limit to total tax and loan balances that varies with banks’ abilities and/or desires to hold acceptable collateral.

6. Required clearing balances (RCBs) are balances banks voluntarily contract with their District Fed Bank to hold during the two-week maintenance period, in addition to holding legally required reserves. RCBs earn banks credits, at the rate of the targeted federal funds rate, which can be used to pay for payment services provided by the Fed. The quantity of RCBs banks will contract for is limited (though the upper limit varies with the targeted federal funds rate), since once credits earned are sufficient to pay for all payment services, holding additional RCBs entails an implied tax just as required reserves do.

7. There are a few technical adjustments made to total required balances through the carryover provision and “as of” adjustments. Banks are allowed to carry over a small portion of a surplus or deficiency in meeting requirements from one maintenance period to the next, though a bank may not carry over two deficits consecutively and any positive carryover not used in the following period is lost. Banks’ requirements may also be affected by “as-of adjustments”—corrections for errors that arise in the processing of varying types of transactions through reserve accounts—such as when a bank’s reserve account is subsequently adjusted downward after an over-crediting is discovered (Partlan et al. 1986, 29). The amount of the adjustment is calculated “as of” the point in time when the error occurred and can be problematic for banks and for the Desk if large adjustments occur late in the maintenance period (Partlan et al. 1986, 29; Federal Reserve Bank of New York 2002, 4).

8. A popular topic in the literature on bank behavior in the federal funds market has been the behavior of the federal funds rate throughout the maintenance period. Due to the ability of banks to meet reserve requirements with a period-average-reserve balance, one might expect the federal funds rate to have unpredictable changes throughout the period, following a martingale pattern as banks adjust their reserve holdings across days to take advantage of, and therefore eliminate, any predictable changes in the rate during the maintenance period. Despite its logical elegance, the martingale hypothesis has been unanimously rejected in econometric studies (e.g., Shiller et al. 1983; Campbell 1987; Hamilton 1996).

9. See Fullwiler 2001, chapter 4, for a review of literature on the behavior of the daily federal funds rate.

10. Actual daylight overdraft charges incurred are small. “The interest charge is levied with deductibles. For 10 hours each day, overdrafts valued at 10 percent of an institution’s risk-based capital are exempted from charge. In addition, any two-week total charge less than $25 is waved. Because of these deductibles, many institutions do not pay anything” for daylight overdrafts (Zhou 2000, 33). At the same time, the imposition of overdraft charges since 1994 has significantly reduced daylight overdrafts by encouraging banks to time outgoing payments such that they are financed by incoming payments (McAndrews and Rajan 2000).

11. There is a minimum charge on overnight overdrafts of $100 and higher charges if more than three overdrafts are run within a moving twelve-month period. Chronic overnight overdrafts can result in administrative controls and additional oversight (Clouse and Elmendorf 1997; Furline 2000).

12. The increased level and variability of the federal funds rate as banks are exposed to greater overnight overdrafts is more accurately stated as the result of the combination of the discouragement of overnight overdrafts in the payments system risk policy and the non-monetary “costs” associated with borrowing at the discount window set forth in Regulation A. Regulation A, prior to January 2003, required that banks exhaust all other sources of credit prior to visiting the discount window, while banks that repeatedly borrowed at the discount window were subject to increased oversight by the Fed. It is well known that banks have therefore avoided adjustment borrowing at the discount window whenever possible, particularly since the late 1980s. When banks at risk of incurring overnight overdrafts avoid both overnight...
overdrafts and delay covering the overdraft through borrowing at the discount window while continuing to search for other sources of funds, the federal funds rate can continue to rise. Therefore, a change to either the payments system risk policy (to reduce overnight overdraft changes and additional monetary costs discussed in the previous note) or Regulation A (to reduce the substantial non-monetary costs of borrowing) is sufficient to reduce deviations from the FOMC's target when overnight overdrafts become likely.

13. Another source of variability is the legislated structure of the banking industry in the United States—with its traditional preference for unit banking—which has complicated the Desk's ability to predict aggregate payment flows. Such prediction is much simpler when there are fewer banks involved in the settlement process, as is the case in Canada, for instance.

14. As discussed in note 11 regarding overnight overdrafts and in note 12 regarding discount window borrowing, it is the non-price costs accompanying each that enable the federal funds rate to rise almost without limit. The federal funds rate therefore could vary on a given day between zero and the rate that is equivalent to the non-price costs to traders in the federal funds market. Thus, daily peak federal funds rates were on some days significantly higher than that day's federal funds rate plus 400bp.

15. More precisely, the liquidity effect literature has examined the effects of an "unanticipated" change (generally an increase) in reserves in order to trace out the effects upon output and prices. The hypothesized distinction between "anticipated" and "unanticipated" changes to reserves is ignored for the purposes of this paper.

16. FOMC meetings have most often taken place on the second Tuesday of the maintenance period, on which days temporary operations are very likely regardless of the FOMC's actions due to the large demand for excess balances.

17. The rest of this section will abstract from the required clearing balances to increase simplicity. This does not change the results that are obtained later in the section. If anything, inclusion of required clearing balances makes short-term control over the monetary base more difficult because the Desk is obligated to supply enough Fed balances such that banks can hold at least the amount for which they have contracted with Fed Banks prior to the start of the maintenance period.

18. The lagged response of a change in deposits to a change in interest rates was recently confirmed by an (unnamed) District Fed Bank in comments regarding the proposed switch to lagged reserve accounting in 1998 when it noted that "deposits do not appear to respond to changes in cost within a time frame as short as the current, two week maintenance period" (Board of Governors 1998, 15070).

19. In an abstract sense, it is theoretically possible under contemporaneous reserve accounting—in which the computation period ends after the maintenance period begins—for the quantity of required reserves and thereby the demand for Fed balances to change within the maintenance period. However, because Fed balances do not fund the creation of deposits/loans, a change in the quantity of the former would not induce changes in the latter outside of the effect upon the price of credit. Thus, regardless of whether or not the maintenance period is lagged or occurs contemporaneously with the computation period, a Fed-induced change in required reserves is effected through a change in deposits that is itself in response to a change in the price of credit. Moreover, because the price of credit affects deposits only after a lag, the unnamed District Fed Bank quoted in the previous note points out that "the deposit adjustment mechanism . . . [is] essentially the same under both contemporaneous accounting and lagged accounting" (Board of Governors 1998, 15070). Hence, in either case, the Desk (or some combination of the Desk and the lending facilities operated by District Fed Banks) accommodates banks' demand for Fed balances.

20. The exceptions would be when the federal funds rate is already at zero or if the Fed were to pay interest on Fed balances. In either case, the Desk could raise the quantity of Fed balances without limit while the federal funds rate would remain at zero (in the former case) or at the rate paid on Fed balances (in the latter case).
21. It is interesting to note here that the very existence of retail sweep accounts arises from a 1994 Fed decision to allow First Union National Bank to restructure NOW accounts into two accounts—a NOW account, which is reservable, and a MMDA, which is non-reservable—and to “sweep” as much money as possible into the MMDA (O’Sullivan 1998). Further, the MMDA account itself was created by a provision in the Garn-St. Germain Act of 1982 designed to enable banks to offer a transaction account (limited to six withdrawals per month) not subject to either Regulation Q interest rate controls or Regulation D reserve requirements. Because the Garn-St. Germain Act prohibits reserve requirements on MMDAs they are classified as savings accounts; due to a provision in the Monetary Control Act of 1980, reserve requirements on savings accounts are set at zero.

References


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