Volume 12, Number 3 ∽ April 2006
FEDERAL RESERVE BANK OF NEW YORK
www.newyorkfed.org/research/current_issues

Current Issues
IN ECONOMICS AND FINANCE
www.newyorkfed.org/research/current_issues

Alternative Arrangements for the Distribution of Intraday Liquidity

James J. McAndrews

In July 2006, the Federal Reserve will end its provision of free daylight credit to government-sponsored enterprises (GSEs), financial services corporations created by Congress to establish a secondary market in mortgages and other consumer loans. To meet their payments to investors, the GSEs can use a wide variety of alternative funding arrangements. While such arrangements can in theory distribute liquidity efficiently, a decline in the intraday funds in circulation following the Fed's move may lead to some slowing in payments by both the GSEs and commercial banks.

As part of its role in the nation's payments system, the Federal Reserve processes the principal and interest payments made through banks to investors in the debt- and mortgage-backed securities issued by government-sponsored enterprises (GSEs).[1] These payments range from roughly $30 billion on an average day to more than $80 billion on the two days a month when the housing GSEs—Fannie Mae (Federal National Mortgage Association) and Freddie Mac (the Federal Home Loan Mortgage Corporation)—make their payments to investors.[2] Currently, the Federal Reserve Banks provide free daylight credit for the principal and interest payments of the GSEs—that is, they advance the funds for these payments, at no cost, until the GSEs' accounts at the Reserve Banks are replenished later in the day.[3] In July 2006, however, the Federal Reserve plans to end the practice of providing daylight credit to the GSEs.[4]

This edition of *Current Issues* explores several alternative arrangements through which the GSEs could obtain daylight credit to fund their payments to investors. One set of approaches calls for the GSEs and other participants to use existing market arrangements such as correspondent banking, credit lines, and repurchase agreements to borrow the necessary funds. Another approach is to create explicit or implicit markets for intraday funds that would provide incentives for commercial banks to direct funds to the GSEs. Still other adaptations to the loss of daylight credit might involve the prefunding of principal and interest (P&I) payments or a change in the market conventions governing the time of settlements.

The discussion of funding alternatives is followed by a look at how the Federal Reserve's discontinuation of daylight credit to the GSEs will affect the cost and availability of intraday liquidity and the timing of payments for all participants in the payments system. Because the GSEs' P&I payments to investors are made early in the day to the commercial banks that hold the investors' accounts, the Fed's extension of credit to the GSEs indirectly increases the funds in circulation among banks and other market participants during the remainder of the day. With the

loss of this credit arrangement, this article argues, the amount of intraday funds in circulation is likely to decline, causing a rise in the average cost of intraday liquidity for commercial banks. Moreover, the GSEs that turn to market-based sources of funding will, of course, incur a cost for credit that the central bank had provided free of charge. The higher costs of intraday funding for both GSEs and banks will in turn likely lead to some delay in payments generally.

The paper's concluding section presents a method of evaluating the success of alternative funding arrangements following the July 2006 change in Federal Reserve policy. A finding that payment delays are no greater on the days of the housing GSEs' high P&I payouts than on other days would provide strong evidence that the market was distributing liquidity efficiently to the GSEs.

Providing Intraday Liquidity to the GSEs

Currently, the Reserve Banks—acting on behalf of the GSEs—pay out interest and principal on the GSEs' debt- and mortgage-backed securities at about 8:30 a.m. on the day that the interest is due or the securities mature. Because the accounts that the GSEs maintain at the Reserve Banks for the payment of their P&I obligations typically lack sufficient funds to meet these obligations until later in the day, the GSEs rely on daylight overdraft credit provided by the Federal Reserve. Over the course of the business day, the GSEs will receive, from the repayment of various investments, the funds necessary to cover their payouts. Nevertheless, there is clearly a mismatch in the timing of GSE outflows and inflows during the day.

Once the GSEs no longer use daylight credit from the Federal Reserve to make their P&I payments, the banking system will have to make alternative arrangements to overcome the mismatch in the timing of GSE payouts and receipts. These arrangements are examined in detail below. First, however, this article considers the specific problems—here termed *frictions*—to which the Fed's provision of daylight credit provided one solution, and that now must be addressed by the GSEs in some other way.

Frictions in the Provision of Liquidity

The frictions that such arrangements to distribute liquidity must overcome include a *search friction,* a *timing friction*, and an *incentive friction*.[5] While these frictions are not unusual in funding markets, they are likely to be magnified when liquidity must be distributed within a narrow intraday window. Given the high volumes and values of payments transferred intraday in modern large-value payments systems, timely and precise delivery is crucial in successfully circulating liquidity in sufficient amounts during the day.

Once the GSEs no longer use daylight credit from the Federal Reserve to make their P&I payments, the banking system will have to make alternative arrangements to overcome the mismatch in the timing of GSE payouts and receipts.

Search Friction

The search friction refers to the efforts that would be necessary for both a payor (the party that intends to send a payment to some other party) and potential liquidity providers to make contact with one another and to determine the right amounts of liquidity to transfer to the payor's accounts. Suppose a payor did not have sufficient funds in its account and also lacked access to credit provided by the central bank. It would then have to borrow the amount of the payment before sending it. Because the payor would not necessarily know which other party had sufficient funds in its account, it would have to search for such a benefactor.

[1]Government-sponsored enterprises are financial services firms created by the U.S. Congress to provide low-cost financing to homebuyers, students, farmers, and other groups of borrowers. The GSEs have established secondary markets in loans to these groups by pooling the loans and converting them to tradable securities.

[2]See Betsy Irwin-McCaughey, Paul Agueci, Jane Buyers-Russo, and Kevin Caffrey, "Federal Reserve Policy Change," panel discussion at the Securities Industry Association's Operations Update Conference, New York, New York, November 18, 2005, available at <http://www.sia.com/opsupdate2005/pdf/FedReservePanel.pdf>.

[3]The provision of daylight credit by a central bank may obviate the need for any market-based mechanism for the provision of intraday funding. Various economic models have explored certain conditions in which the provision of daylight credit can be consistent with efficiency. It is not the case, however, that all central banks have provided such credit.

[4]The Board of Governors of the Federal Reserve System announced the policy change in September 2004. (See Board of Governors of the Federal Reserve System [2004] and the press release at <http://www.federalreserve.gov/boarddocs/press/other/2004/20040923/default.htm>). The change reverses a 1994 decision granting the GSEs a temporary exemption from fees on daylight overdrafts resulting from the Reserve Banks' release of principal and interest. The new rule aligns the treatment of the GSEs with that of other institutions that do not have access to the Federal Reserve's discount window. Note that while the Federal Reserve's policy change will also affect certain international organizations, the impact on the GSEs is the principal focus of this article.

[5]This account of frictions assumes an environment in which the central bank provides no daylight credit.

Timing Friction

The timing friction refers to the operational difficulty of delivering funds at the precise time of the day that they are needed. Even if parties overcome the search friction and agree on a specific amount of funds to be delivered, how can the borrower be assured of the receipt of the funds at a particular time? If the liquidity provider is a commercial bank, it may have operational difficulties, or experience delays for other reasons. In that case, the borrower would simply have to wait for the delivery of the funds, an outcome that would defeat the point of the arrangement.

Incentive Friction

In a competitive market, a robust price discovery process typically ensures that incentives are properly aligned for both sides of the market. If prices fall to excessively low levels, for example, suppliers reduce the amount offered. By contrast, if prices are too high, other providers can enter bids that undercut the current providers, thereby keeping prices in check.

> The frictions that arrangements to distribute liquidity must overcome include a *search friction*, a *timing friction*, and an *incentive friction*.

Achieving such balanced incentives, however, may not be easy when providing daylight credit. First, the potential profit in providing credit intraday is small because the duration of such loans is so short. Lending $1 billion overnight at a 4 percent interest rate yields approximately $111,000 in earnings, but lending it for an hour at the same rate would yield only $4,600. Given that the processing costs for arranging the delivery and return of funds are probably higher for an intraday loan than for an overnight loan while the risks may be roughly similar, it may not be profitable for potential lenders to enter the market at low interest rates.

Second, the way that intraday funding is currently distributed relies heavily on market participant behavior that is influenced more by custom than by price signals. For example, the GSEs make their principal and interest payments to many commercial banks early in the morning, and the commercial banks return investments of GSEs (along with the earnings on those investments) to them later in the day. The GSEs may simply rely on a change in the sequence of payments (even though it imposes costs on the commercial banks) in which the banks return investments first and the GSEs make their principal and interest payments later in the day. In other words, the GSEs could choose to delay payments if they would otherwise face a high cost of borrowing funds intraday.

Alternative Funding Arrangements

The GSEs could use a number of methods to make large payments once they no longer use the daylight credit provided by the Federal Reserve Banks. Some of these methods are "price-mediated"—that is, the GSE would pay a price for the use of the funds early in the day and return the funds to the lender later in the day. Others are non-price-mediated; they require a change in practice but no fee for the temporary use of funds. This section assesses these alternative arrangements, giving particular attention to how effective each is in overcoming the frictions outlined earlier.

Non-Price-Mediated Arrangements

Prefunding payments. One option for the GSEs would be to prefund their payments by holding funds on deposit overnight at the Federal Reserve. An important advantage of prefunding is that it eliminates search and timing frictions because the GSEs would not need to rely on others to fund their payments.

This option is, however, a costly one. By holding funds overnight in a non-interest-bearing account, a GSE would lose the earnings it could realize from lending or otherwise investing the funds at a rate close to the federal funds rate—the rate at which banks lend their surplus balances to one another in the federal funds market. For example, using a recent day's value of P&I payments, one could calculate that holding the full amount of the next day's P&I payments overnight would cost a GSE roughly $12 million at a fed funds rate of 4 percent. This loss of overnight earnings would represent a significant incentive friction.

> A second option for GSEs that can no longer overdraw their P&I accounts at the Reserve Banks is simply to delay making payments until they receive sufficient incoming payments to cover their outlays.

Moreover, this approach, used alone, might be especially disruptive for the Federal Reserve because the amounts of the GSEs' P&I payments vary considerably across days, from a low of $30 billion to a high of $80 billion. If the GSEs were to hold sufficient amounts in their accounts overnight to cover the next day's payments, the Federal Reserve, other

things equal, would have to conduct additional market operations to offset the effect of this method of funding on banking system reserves.

Delaying payments. A second option for GSEs that can no longer overdraw their P&I accounts at the Reserve Banks is simply to delay making payments until they receive sufficient incoming payments to cover their outlays. Of course, the GSEs must expect to receive such payments for this method to work.

As a solution to the GSEs' funding problems, delaying payments does not fully address the search and timing frictions identified earlier; it is essentially a passive approach that relies on other parties to fund the payor's account. Nor does delaying payments address the incentive friction satisfactorily, because the payor is not providing good incentives for others to fund its account.

The Federal Reserve and market participants, acting on the recommendation of an industry work group, are implementing operational changes that will allow the GSEs to make partial payments of their P&I obligations throughout the day.

Delay can, however, be reduced if the payor makes partial payments as funds come into its account. In this way, the funds can be recirculated more frequently, working to quicken the settlement of related payments. Note that the Federal Reserve and market participants, acting on the recommendation of an industry work group, are implementing operational changes that will allow the GSEs to make partial payments of their P&I obligations throughout the day.[6]

Changing market conventions. A third option for distributing liquidity intraday would involve a change in the conventions governing the timing of various payments. Participants in a payments system, in principle, agree on the time of day when payments are to be made. For example, funds borrowed overnight through repurchase agreements are customarily returned in the morning, while funds borrowed overnight in the interbank federal funds market are typically repaid in the afternoon. When the agreement on timing is common to all participants in the payments system—as in these examples—it can be described as a market convention or a marketwide arrangement; when the agreement is made between the two individual parties to a trade, it can be described as a bilateral arrangement.

A change in the conventions regarding the timing of settlements (or, alternatively, a change in the settlement time agreed to by the parties to a specific trade) can affect the way payments are funded during the day. For example, if the funds lent out through a federal funds trade were to be returned *early* in the morning, then the lenders would have access to their funds sooner and could make payments with the proceeds of these repayments. Of course, the borrowers that returned the funds earlier would then have a smaller amount of funds early in the day. Although the outcome would depend on the payments to be made on a particular day and on the party making those payments, a change in the timing of marketwide repayments would clearly affect the circulation of liquidity. In particular, if the lenders in the overnight markets had large payments to make on a particular day, early return of overnight borrowing might lead to earlier settlement of these payments.

As a solution to intraday liquidity problems, a change in the timing conventions governing the settlement of various transactions could address both the timing friction and the incentive friction. With a shift in the timing of fed funds returns generally, those lenders that needed to make payments early in the day would be reasonably confident of having more funds to do so. In addition, market interest rates might adjust to reflect additional costs that such a change would occasion, thereby minimizing any incentive problems. A change in the timing of settlements would not, however, address the search friction because the change would be a marketwide, rather than a bank-specific, phenomenon. Banks that needed additional funding would still have to search for appropriate counterparties.

A final change in market practices that could increase the circulation of liquidity more generally would be a move by several parties—including the Federal Reserve System perhaps—to make use of various queuing and liquidity-savings mechanisms in payments systems.

For the GSEs in particular, another solution to intraday liquidity problems would be to change the time at which

[6]See <http://www.frbservices.org/Wholesale/CM-2005/CM-247.pdf> for a description of these changes and <http://www.frbservices.org/Wholesale/FedwireSecuritiesPSR.html> for additional information on the policy and operational changes.

they sell debt. If they were to sell notes (the duration of which is usually more than one day) early in the morning, these sales could provide a source of funding early in the day for their principal and interest payments. Another convention that the GSEs could change is their practice of concentrating most of their P&I payments on specific days. Were they to spread their P&I payments across the days of a month, liquidity demands on any one day would be significantly reduced.

At present, there is no large active market for intraday borrowing and lending among banks. . . . Market instruments could, however, be adapted to offer the GSEs a means of funding their intraday payments.

A final change in market practices that could increase the circulation of liquidity more generally would be a move by several parties—including the Federal Reserve System perhaps—to make use of various queuing and liquidity-savings mechanisms in payments systems.[7] These mechanisms could automatically match the inflow and outflow of payments to an account, so that the market's liquidity could be circulated quickly, speeding the settlement of payments.

Bilateral Price-Mediated Arrangements

Other options for GSEs in need of daylight credit would involve payment for the temporary use of funds. At present, there is no large active market for intraday borrowing and lending among banks, in part because most banks have access to daylight overdrafts from the Fed. Market instruments could, however, be adapted to offer the GSEs a means of funding their intraday payments. Consider first some bilateral arrangements—funding solutions that would be worked out between two individual parties.

Correspondent banking. Correspondent banking offers one price-mediated means of accommodating the funding needs of GSEs and other institutions that lack access to daylight overdrafts. Currently, some banks rely on correspondent banks to oversee and meet their intraday liquidity needs because they are prohibited from borrowing from the Federal Reserve during the day or because they do not want direct responsibility for managing a Federal Reserve account. The GSEs could avail themselves of the same arrangement, although the payments that the GSEs typically make to investors may be too large for any one correspondent bank to wish to assume. Large payments could be spread among a number of banks; still, it is doubtful that correspondent banking alone could meet the full general need for intraday liquidity.

Lines of credit. GSEs could also make use of bilateral funding arrangements that rely on lines of credit. The borrower would pay a fee for the option to draw down its intraday line of credit, and anytime it drew on this credit, it would pay an additional fee for the use of the funds intraday. Lines of credit can support an efficient price-setting mechanism if there is sufficient competition among potential lenders in the market. Moreover, the option-like features and combination of fixed- and variable-price components that are characteristic of credit lines make this a useful instrument for accommodating volatile borrower needs. Credit lines are quite similar to correspondent banking, but they differ in one respect: in the correspondent banking alternative, the correspondent bank chooses the timing of the payments, while in the credit line alternative, the payor chooses when to draw down the line of credit and when to make its payments.

Issuance of notes. Another option would be for the GSEs to issue "discount notes" in the morning. These notes would be auctioned off to buyers with the assurance that the GSEs would issue the notes early, in exchange for a simultaneous delivery of the funds used to purchase the notes. A potential advantage of this method is that sales of the notes would be settled in the Federal Reserve's Fedwire Securities Service, which settles the sales by delivering the securities, in this case the discount notes, at the same time that the funds are paid to the issuer of the security. In this way, the issuer of the security, such as a GSE, can determine the time at which the exchange occurs.

Correspondent banking offers one price-mediated means of accommodating the funding needs of GSEs and other institutions that lack access to daylight overdrafts.

Of all the funding alternatives available to the GSEs, those that most directly target the search friction are correspondent banking, credit lines, and the issuance of discount notes. A GSE that establishes a long-lasting or recurring relationship with another party will not have to search for

[7] See Johnson, McAndrews, and Soramäki (2004) for a discussion of these arrangements.

funding on the day it is required. The timing friction is largely overcome as well: the correspondent banking option delegates the timing to the correspondent bank, and the line of credit and discount note options allow the GSE to specify the timing of the funds receipt.

Potential problems with these arrangements lie in the incentive friction. If only a few banks offer such intraday services, and if such services are relationship-based, competition may not succeed in the market, and the outcome may fall short of full efficiency. In addition, in markets such as the GSE market, where the amounts to be paid vary significantly from day to day, a wider set of providers might be necessary to achieve an efficient flow of funds.

A market for intraday funds. GSEs and other payors that choose not to use correspondent banking or credit line options can rely more directly on existing market mechanisms to meet their funding needs. A market for intraday funds can be operated in an essentially bilateral fashion, as in the case of the overnight federal funds market and some dealer-driven or over-the-counter markets. Such a market can support a competitive outcome if the price-discovery process is sufficiently robust, that is, if borrowers can easily obtain price quotations. In addition, for the timing friction to be overcome, the clearing and settlement of the market would have to be reliable, so that the funds would be delivered quickly and would be easily identifiable upon receipt. It may be possible to achieve this in the intraday context, although it is likely that achieving robust price discovery and reliable clearance and settlement arrangements is more difficult in the intraday market than in the overnight market because of the greater search and timing frictions present there.

> Were [intraday repurchase agreements] available, the GSEs could deliver securities early in the day in exchange for funds . . . and return those funds later in the day.

Marketwide Price-Mediated Arrangements

Organized multilateral markets offer a third set of options for allocating scarce liquidity on an intraday basis. These markets can be thought of as auctions combined with a method of clearing and settling trades.

Intraday repurchase agreements. One market-based method of obtaining intraday funding would involve the use of repurchase agreements. In a repurchase agreement, or "repo," the party seeking to borrow funds delivers securities, typically U.S. Treasury bonds, to another party in exchange for the needed funds. The borrower agrees to repurchase the securities at a later date for a higher price. The arrangement is essentially a collateralized loan, in which the return of funds is secured by bonds and the excess of the repurchase price over the sale price constitutes the interest paid on the loan.

Currently, the shortest term for a loan executed through a repurchase agreement is overnight. Given the improvements in electronic information, however, the technology that would allow intraday repos to accommodate the allocation of intraday funding seems within reach. Were such a financial instrument available, the GSEs could deliver securities early in the day in exchange for funds (which commercial banks might obtain by means of daylight overdrafts from the Fed) and return those funds later in the day, at which time the securities would be returned to them. If such a market was sufficiently competitive and attracted enough participants on both sides, it could be a very effective tool for distributing liquidity.[8]

An implicit intraday market for funds. Other market arrangements that could help to distribute funds would involve the redesign of a typical federal funds purchase and repayment. In a *designated-time return of a fed funds purchase*, the return of the funds would occur at a specified time, say 8:30 a.m. Such an instrument would be useful to the GSEs (and the market generally) by allowing the GSEs to continue lending in the overnight market on the day before large P&I payments, confident that the funds they lent out would be returned to them in time to make their P&I payments. This arrangement would also have the advantage of reducing the GSEs' demand for funding from other parties.

> Other market arrangements that could help to distribute funds would involve the redesign of a typical federal funds purchase and repayment.

Interestingly, some early-return fed funds are already used in the marketplace, with the interest rate shaved slightly from the usual fed funds purchase. Consequently, this instrument is familiar to many market participants.

[8]While intraday repos could be conducted on a bilateral basis between the borrower and lender, there are strong economies in multilateral arrangements in which the timing of returns is governed not by the individual participants but by the return of the repos by all parties.

A *designated-time delivery of a fed funds sale* would resemble an ordinary fed funds sale, except that the delivery of funds would occur at a specified time, say 8:30 a.m. This instrument could provide the means for the GSEs to borrow the funding needed on the day of the P&I payments.

Should a GSE, having purchased funds using an early morning designated-time fed funds sale, find itself with excess funds late in the day, it could sell (regular) fed funds in the market sometime later in the day, thereby recycling the funds to the rest of the market. The combination of a purchase of early-delivery fed funds and a sale later in the day of regular fed funds creates a synthetic intraday funds market. The difference in interest rates between the early-delivery market and the regular market would be a measure of the intraday premium on funding for the GSEs.

Settlement of the designated-time legs of these [fed funds sales] could occur through the National Settlement Service.

These designated-time fed funds instruments could overcome the timing friction by centralizing the clearing and settlement of the trades. In this arrangement, the delivery of funds might occur as follows: The organizer of the central marketplace could gather bids from both sides of the market or, alternatively, could auction the needed amounts of early contracts submitted by the GSEs (or other potential parties that need funds at the designated time for settlement). The auctioneer could then prepare a list of confirmed trades for settlement. Settlement of the designated-time legs of these transactions could occur through the National Settlement Service (NSS)—a system in which a settlement agent, acting on behalf of participants in a settlement arrangement, submits an electronic settlement file to the Federal Reserve Banks. The Federal Reserve Banks will post each of the debit entries and subsequently each of the credit entries, usually within minutes of the file submission.

A marketwide auction would also eliminate both the search and the incentive frictions. Parties on both sides of the market would engage in the auction, and prices would adjust to competitive bids.

The arrangement does, however, have some costs. First, it would need to meet the risk management requirements of the Federal Reserve Policy on Payments System Risk and to satisfy the Fed's rules relating to the use of the NSS.[9] An auctioneer that acted as a settlement agent and presented a list of transactions to be settled to the NSS would need to have made some provision for the inability of participants to settle their obligations in a timely manner. Second, since banks that borrow in the designated-time-delivery market and then sell fed funds later in the day have an expanded balance sheet overnight, they may face increased capital charges on their assets (that is, their loans to others).[10]

An explicit intraday market for funds. A final option for meeting the liquidity needs of GSEs and other institutions would be the creation of an explicit intraday market for funds. Such a market would rely on a designated-time delivery of funds in the morning. The afternoon return of funds could be arranged as a designated-time return or simply required by the close of Fedwire. The market would solicit competitive bids to lend funds for a time during the day.

An explicit intraday market for funds would have an important advantage over an implicit market: it would avoid the overnight expansion of balance sheets that arises when banks buy and sell overnight fed funds on the same day. However, to support an explicit market, market participants would need to build infrastructure that would support the processing functions for an intraday market (for example, calculation of interest, accounting entries to the general ledger, and same-day return of the transaction).

[9]Part I of the Federal Reserve Policy on Payments System Risk "applies to public- and private-sector payments and securities settlement systems that expect to settle a daily aggregate gross value of U.S. dollar-denominated transactions exceeding $5 billion on any day during the next twelve months. For purposes of this policy, a payments or securities settlement system is considered to be a multilateral arrangement (three or more participants) among financial institutions for the purposes of clearing, netting, and/or settling payments or securities transactions among themselves or between each of them and a central party, such as a system operator or central counterparty. In determining whether a particular arrangement meets this definition, the Board may consider, but will not be limited to, whether the arrangement exhibits one or more of the following characteristics: (1) a set of rules and procedures, common to all participants, that govern the clearing or settlement of payments or securities transactions, (2) a common technical infrastructure for conducting the clearing or settlement process, and (3) a risk management or capital structure where at least some losses would be borne by participants rather than the arrangement's operator, central counterparty or guarantor, or shareholders or owners." (Federal Reserve Policy on Payments System Risk, <http://www.federalreserve.gov/paymentsystems/psr/policy.pdf>)

For the Fed's rules on the use of the NSS, see <http://wpo.ny.frb.org:8080/National_Settlement_Service/settlement_service_menu.cfm>.

[10]Consider two situations: in the first, a bank borrows funds *intraday* to make a payment, then receives funds later in the day and repays its earlier borrowing; in the second, the bank borrows funds *overnight* to make a payment, receives funds later in the day, and lends out those funds overnight. In the second case, the return of the borrowed funds will finance the bank's own repayment of its overnight borrowing. In addition, when measured overnight, the bank's assets and liabilities are higher in the second case than in the first. If regulatory capital charges are applied to the bank's leverage or to the loans the bank has extended, the bank might face higher regulatory capital charges in the second case.

Overview of Marketwide Approaches

In all the marketwide approaches discussed in this section, the standard search friction is overcome by the auctions that establish prices and the pattern of borrowing and lending in each market. Nevertheless, the early-delivery markets may need to convene and clear much earlier than the conventional fed funds or repo markets.

The considerable changes from current market timing mean that the start-up phase for the designated-time markets could be quite difficult. And these changes are likely to magnify the problem of overcoming the incentive frictions that accompany participation in the market. One such incentive friction stems from high start-up costs; although many of these costs are presumably onetime charges, altering computer systems to accommodate an explicit intraday market would be extremely costly.

As noted earlier, the timing friction in these markets is addressed by settling the designated-time legs of the transactions through the National Settlement Service. By using the NSS, the early-funding provider binds itself to deliver at the designated time. The auction of the early deliveries would have to occur before the opening of the NSS and in time for the settlement agent to deliver to the Federal Reserve the settlement information on the associated early deliveries. This method of settling the trades would assure both sides that the funds would be transferred at the specific time. In both the designated-time-return fed funds transaction and the designated-time-delivery fed funds transaction, the "non-designated-time" leg of the transaction would be settled by conventional means.

Intraday Funding after July 2006

How will the availability and cost of intraday funding for payments system participants in general be affected once the Federal Reserve ends the GSEs' use of overdraft credit on their P&I accounts? Consider first the current situation. One can hypothesize that because the GSEs' principal and interest payments are made early in the day to the commercial banks that maintain investors' accounts, the Fed's extension of credit to the GSEs indirectly boosts the funds in circulation among banks and other market participants during the remainder of the day. This infusion of liquidity—especially on the days of high GSE payments—most likely makes banks less reliant on daylight credit from the Federal Reserve to meet their own intraday funding needs. Since the banks pay a fee on daylight overdrafts above a certain amount, the current arrangement entails savings for banks.

Once the Fed discontinues its provision of daylight credit to the GSEs, the overall amount of intraday funds in circulation is likely to shrink. As a consequence, the average cost of intraday liquidity for banks may well rise as banks make greater use of daylight overdrafts and incur the associated fees.

The increased cost of intraday credit is, in turn, likely to affect the timing of payments for market participants. The GSEs, facing new costs for their intraday funds, may be inclined to forgo borrowing and instead await incoming payments to cover their P&I outlays to investors. Similarly, commercial banks may respond to the higher likelihood of overdrafts by delaying some payments in the expectation that incoming payments will replenish their accounts and reduce their need to borrow.[11]

> {This analysis finds that} the current injection of free intraday liquidity on the days of high P&I payments induces the GSEs—and subsequently the banks—to make their payments more promptly. . . . The finding suggests that the Fed's discontinuation of daylight overdraft credit to the GSEs will lead to some degree of delay in payments generally.

To test the relationships posited between the amount of funds in circulation, the cost of credit, and the timing of payments, an empirical analysis can be conducted using data on Fedwire payments (see the box for a detailed description). In assessing how the GSEs' loss of free daylight credit will affect the timing of payments, this empirical analysis controls for a second reason that intraday funding might be costlier and payments delayed—the increased demand for funds by banks on days when they need to make a high aggregate value of payments.

The first hypothesis tested is that the average time of settlement for Fedwire payments occurs later in the afternoon on days of high aggregate payments. The reasoning underlying this hypothesis is that with the increased demand for intraday funds on such days, banks may choose to delay payments rather than incur overdraft fees. The second hypothesis tested is that the average time of settlement occurs earlier on days when the GSEs make high P&I

[11] There is a theoretical positive relationship between the intraday interest rate charged on daylight overdrafts, or charged for intraday borrowing more generally, and the delay in payments. As a higher intraday interest rate is charged, banks would send only their most time-critical payments and rely on incoming payments to fund their less time-critical payments.

Test of Hypotheses

I perform a test of two hypotheses regarding the timing of payments and the scarcity of intraday funding. According to the first hypothesis, the value-weighted average time of settlement depends in a positive way on the value of payments settled on a particular day. According to the second hypothesis, the average time of settlement is earlier on days of high GSE principal and interest payments, after controlling for the total value of payments settled.

The test is conducted using a regression analysis of Fedwire Funds Service payments from May 3, 1999, through March 31, 2005, a period that includes 1,485 days of Fedwire Funds Service activity. The analysis enables me to quantify the degree to which the average time of payment settlement depends on the total value of payments made and the value of GSE P&I payments.

I estimate the following regression equation:

$$\textit{Average time of settlement of Fedwire} = \textit{constant} + \beta_1(\textit{value of payments made on Fedwire}) + \beta_2(\textit{squared value of payments made on Fedwire}) + \beta_3(\textit{value of P\&I payments made by GSEs}) + \beta_4(\textit{squared value of P\&I payments made by GSEs}) + u_t.$$

If the results conform to expectations, $\beta_1 > 0$ and $\beta_3 < 0$—that is, the average settlement time on Fedwire occurs later in the afternoon on days of high payment values and earlier on days of high GSE P&I payments (given the Fed's early and free overdraft funding), after controlling for payment values. In addition, the estimated values of the coefficients β_2 and β_4 would reveal any nonlinear value-of-payment effects on payment timing.

The regression results are found in the table immediately below. The results show that on a day of average payment volume ($1.67 trillion)—by definition, a day that does not have high P&I payments by the GSEs—the average time of settlement on Fedwire is 3:09 in the afternoon.[a] On a day when the GSEs make high P&I payments ($80 billion), overall settlement occurs roughly five minutes sooner. These results are highly significant in a statistical sense.[b]

Average Time of Settlement for Fedwire Funds Transfers

Dependent Variable: Average Value-Weighted Time of Settlement

	Coefficient Estimates (In Minutes)
β_1: Value settled (trillions of dollars)	01:11:25* (00:08:36)
β_2: Value settled squared (trillions of dollars)	-00:18:28* (00:02:27)
β_3: P&I payments (billions of dollars)	-00:00:04* (00:00:01)
β_4: P&I payments squared (billions of dollars)	00:00:00 (00:00:00)
Constant	13:57:50* (00:07:34)
Calendar	Yes
Observations	1485
Adjusted R^2	0.366

Source: Federal Reserve Bank of New York.

Note: Standard errors are in parentheses.

*Significant at the 1 percent level.

[a]That calculation is as follows (with units expressed in minutes and percentages of minutes after 12:00 noon): 117.83 + 71.41 (1.67 trillion) - 18.46 (1.67 trillion)^2 - .067 (47 billion) = 182.45, or 3:02:27 p.m.

[b]In addition, I estimate the effect on payment speed when the sample is confined to parties other than the GSEs or their direct counterparties. This calculation measures the "knock-on" or indirect effect of the greater availability of liquidity on days of high GSE P&I payments. After accounting for the value of payments made by third parties, I find that third parties settle payments more quickly on days of high GSE P&I payments.

payments, after controlling for the total value of payments settled. The reasoning here is that the current injection of free intraday liquidity on the days of high P&I payments induces the GSEs—and subsequently the banks—to make their payments more promptly.

Tests of these two hypotheses show that they are not rejected. Payments are, on average, made later in the afternoon on days of high payment value. Moreover, payments are completed sooner on the days that the GSEs make high payments to investors, even after controlling for the total value of payments made on Fedwire. This latter finding offers support for a relationship between the Fed's provision of free daylight credit and the promptness of payments. By implication, the finding suggests that the Fed's discontinuation of daylight overdraft credit to the GSEs will lead to some degree of delay in payments generally.

Evaluating the Efficiency of Market Responses to the Policy Change

The first section of this article outlined an array of alternative credit arrangements—most market-based—that the GSEs could use individually or in combination to fund their

payments once they no longer use daylight credit from the central bank. How would such arrangements affect the cost and timing of payments? And how could their efficiency be evaluated?

If the private sector puts in place market-based arrangements that distribute liquidity efficiently, then a price will be established for intraday liquidity that is probably at or near the level of the Federal Reserve's daylight overdraft fee—the marginal cost of intraday funding to commercial banks.[12] All institutions, including the GSEs, would face the same price for intraday liquidity (albeit with adjustments for firm-specific risk).

Moreover, if the market accommodations to the policy change distribute liquidity efficiently, the payment activity of GSEs would not slow overall payment activity any more than would the payment activity of any other party. The reason is that, controlling for the aggregate value of payments settled, the market arrangements would efficiently intermediate daylight overdrafts of commercial banks to the GSEs. With all institutions facing the same price for intraday liquidity, the likelihood of delays in payments would be uniform across groups.

Provided that the new market arrangements distribute intraday liquidity efficiently, the increased delay in payments should not be significantly greater on days of high GSE P&I payment activity than on days of low activity.

As this analysis shows, some slowing of payments for all market participants is likely to follow the Fed's policy change in July. Still, provided that the new market arrangements distribute intraday liquidity efficiently, the increased delay in payments should not be significantly greater on days of high GSE P&I payment activity than on days of low activity—controlling, of course, for the aggregate value of payments. This expectation provides a way to test the efficiency of the market accommodations to the Federal Reserve's discontinuation of overdraft credit to the GSEs.

If the market accommodations fail to circulate liquidity efficiently, then one would expect that on days of high GSE P&I payments, the GSEs might have difficulty accessing sufficient daylight credit to meet their obligations and would hence rely excessively on delay. The same test presented in the box would show that on these days, payments would settle significantly *later* in the day—rather than earlier, as suggested by this article's analysis of settlement time under the Fed's current policy. Conversely, if the new arrangements distribute liquidity effectively, the test would show that the average time of payment settlement is essentially the same on high P& I payment days as on other days.

Conclusion

The policy change prohibiting the GSEs from using daylight overdrafts to fund their P&I payments will likely bring about some significant changes in the cost of funding and the timing of payments for all participants on Fedwire. In particular, on days of high P&I payments, the elimination of the Fed's early-morning extension of credit to the GSEs may reduce the amount of funds in circulation, prompting banks to incur larger overdrafts or to delay payments until incoming funds are received.

This article presents a number of alternative arrangements by which the private sector might accommodate the GSEs' need for funds to flow into their accounts early in the day. Most of these methods involve borrowing in one form or another. Correspondent banking, explicit lines of credit, intraday repos, and explicit or implicit intraday markets appear to have the potential to overcome the frictions that are now surmounted by the provision of daylight overdrafts. Changes in certain market conventions may also assist in adjusting to the policy change.

To evaluate the efficiency of these alternative funding arrangements, this article proposes a simple empirical test. If, after the policy change is implemented, the value-weighted average time of payment settlement on Fedwire is not significantly later on high GSE P&I payment days than on other days (after controlling for the values settled), then one could infer that the market adaptations had been successful in distributing liquidity efficiently to the GSEs. If, however, days of high GSE P&I activity are days of especially slow settlement of payments, one would conclude that the market had not fully surmounted the frictions that banks face in distributing liquidity intraday.

By announcing in 2004 the plan to end the GSEs' use of free daylight credit, the Federal Reserve gave market participants a two-year interval in which to prepare for the change. Should the alternative arrangements for distributing liquidity prove effective, the market will have demonstrated that it can strengthen its overall management of the frictions affecting the intraday distribution of liquidity.

[12] Marginal cost is the incremental cost of additional borrowing.

References

Board of Governors of the Federal Reserve System. 2004. "Policy Statement on Payments System Risk." Docket no. OP-1182, September 23. Available at <http://www.federalreserve.gov/boarddocs/press/other/2004/20040923/attachment.pdf>.

Johnson, Kurt, James J. McAndrews, and Kimmo Soramäki. 2004. "Economizing on Liquidity with Deferred Settlement Mechanisms." Federal Reserve Bank of New York *Economic Policy Review* 10, no. 3 (December): 51-72.

Back Issues

Recent editions of *Current Issues* are available in html and pdf formats at **<http://www.newyorkfed.org/research/current_issues/>**.

Date	Title	Author(s)
February/March 2006	*A Leaner, More Skilled U.S. Manufacturing Workforce*	Deitz, Orr
January 2006	*Challenges Facing the New York Metropolitan Area Economy*	Orr, Topa
December 2005	*The Income Implications of Rising U.S. International Liabilities*	Higgins, Klitgaard, Tille
November 2005	*Intraday Trading in the Overnight Federal Funds Market*	Bartolini, Gudell, Hilton, Schwarz
October 2005	*The Evolution of Commuting Patterns in the New York City Metro Area*	Bram, McKay
September 2005	*Explaining Settlement Fails*	Fleming, Garbade
August 2005	*U.S. Jobs Gained and Lost through Trade: A Net Measure*	Groshen, Hobijn, McConnell
July 2005	*Trends in Federal Funds Rate Volatility*	Hilton
June 2005	*New York City Immigrants: The 1990s Wave*	Rosen, Wieler, Pereira

About the Author

James J. McAndrews is a vice president in the Payments Studies Function of the Research and Statistics Group.

Current Issues in Economics and Finance is published by the Research and Statistics Group of the Federal Reserve Bank of New York. Dorothy Meadow Sobol is the editor.

Editorial Staff: Valerie LaPorte, Mike De Mott, Michelle Bailer, Karen Carter
Production: Carol Perlmutter, David Rosenberg, Jane Urry