

## **G-20 case study: United States**

### **Innovation and Structural Change in the U.S. Treasury Securities Market<sup>1</sup>**

With daily trading volume close to \$400 billion, the market for U.S. Treasury securities is one of the largest and most important financial markets in the world. The market is a keystone of U.S. financial markets and a critical component of the global financial system as well. Supported by the superior liquidity and safety of Treasury securities, public holdings at the end of 2002 had expanded to over \$3.2 trillion<sup>2</sup> as investors benefited from the secure store of value and reliable income stream that Treasuries offer.

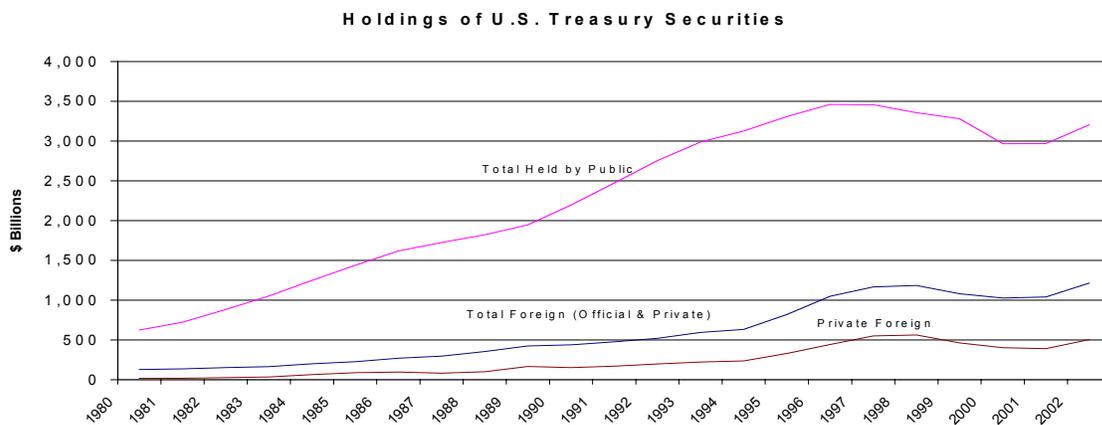
The importance of Treasury securities in global financial markets extends well beyond the Treasury market itself. U.S. Treasury securities have become the standard benchmark for pricing numerous other financial assets—both domestic and foreign. Treasuries also serve as collateral or as the reference asset for a host of transactions in other important related financial markets, including particularly those for repurchase agreements and other Treasury-based derivative instruments. In addition, because of the liquidity and depth of the U.S. Treasury market, it is a focus of attention as a source of information about market participants' reactions to breaking news concerning the U.S. and global economy, as well as views of economic prospects and policy going forward. And, of course, Treasury securities markets are central to the implementation of U.S. fiscal and monetary policy.

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<sup>1</sup> This paper was prepared for the G-20's project on: "Globalization: the role of institution building in the financial sector." The material on the four market innovations addressed in this paper was provided by Kenneth D. Garbade of the Federal Reserve Bank of New York.

<sup>2</sup> This figure includes foreign official holdings.

Given these attributes and the fact that U.S. Treasuries have been unencumbered by restrictions on purchase or sale by non-residents for quite some time, it is not surprising that they are held abroad—by both private and official holders—in substantial volume. As such, Treasury securities serve as an essential component of effective risk management for increasingly global portfolios. In addition, for many official holders, changes in their U.S. Treasury positions are a key element in the implementation of foreign exchange intervention vis-a-vis the dollar.



The chart above provides a snapshot of how holdings of U.S. Treasury securities have expanded in recent years, highlighting their very rapid growth up to about 1997. The emergence of federal budget surpluses in the late 1990s interrupted that trend for several years, but more recently public holdings of U.S. Treasuries have been on the rise once again. Trading volume has increased even more dramatically in recent years (roughly 20-fold since 1980); volume continued to accelerate even during the recent pause in the growth of holdings. As the chart shows, increases in foreign holdings (both private and official holdings) have been an important part of the overall expansion of the market since 1990. In fact, they have roughly tripled in size, while overall public holdings grew by only about 50 percent over the same period. This very rapid growth of

foreign Treasury holdings was part of the powerful general demand by non-U.S. residents for claims on the United States during this period, fueled largely by the high real returns generated by the U.S. economy. Increased foreign holding of claims on the United States is, of course, the financing counterpart of the U.S. current account deficit (just as increased holding of claims on the U.S. government is the financing counterpart of the federal deficit). In that sense, increased foreign holdings supported the spillover of U.S. final demand into demand for foreign products that helped sustain growth abroad.

When broken down by reported nationality of the holder, it is apparent that U.S. Treasury securities are very widely dispersed. Even allowing for some inevitable inaccuracy in the identification of the nationality of the ultimate beneficiary holder because of certain features of the reporting process, Japan stands out with nearly \$350 billion, followed by China where holdings have risen rapidly in recent years to almost \$100 billion.<sup>3</sup> In this breakdown, Hong Kong holds another large share, close to \$45 billion, and other Asian countries (Taiwan and South Korea) are prominent as well with slightly less. Not surprisingly, given that it is the location of a major global financial center, holdings reported for the United Kingdom, at about \$50 billion, make up another very large amount.

Foreign residents tend to hold U.S. Treasuries in somewhat different proportions among the range of available maturities. Historically, foreign holders have tended to favor longer-term issues and hold relatively smaller amounts of bills, and that preference appears to have become somewhat more pronounced in recent years. By 2002, the foreign share of Treasury bonds in total outstandings had reached 43 percent overall, with some very high national concentrations in certain maturities. From time to time, recognition among market analysts of the existence of such large concentrations of foreign holdings has prompted concern about potential instability should these holdings

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<sup>3</sup> These estimates are for holdings at the end of June 2002.

be sold rapidly into a declining market. Such worries seem to have been largely unfounded, as the great depth and liquidity of Treasury markets generally has absorbed brief bouts of heavy foreign sales with no striking increase in volatility or other anomalies, and certainly none that merited policy attention. It is possible, of course, that in any globally integrated market such as that for U.S. Treasuries, asymmetric shocks may be transmitted quickly from one financial system to another and—depending on circumstances—may have with strong effects on the market that could present a policy challenge. But, in general, a broader, more open financial market is beneficial in that it facilitates more efficient pricing and tends to absorb such shocks with less volatility and disturbance of the real economy.

In this regard, a noteworthy aspect of the market for U.S. Treasury securities is that it is now globalized to the extent that it is possible to trade Treasuries essentially on a 24-hour basis. The secondary market for Treasuries is not exchange-based, but instead involves over-the-counter trading among a large number of brokers and dealers, many with world-wide branches. Treasury securities are traded essentially continuously during open the trading hours that the brokers and dealers have established in the three largest global financial markets—New York, London, and Tokyo—with trading available in many smaller financial markets as well. Understandably, the share of global trading in New York is by far the largest (close to 95 percent), but the shares of trading in London and Tokyo are not insignificant (roughly 3-1/2 and 1-1/2 percent, respectively), and they have been on an expanding trend in recent years. Bid-ask spreads tend to be larger in foreign markets, and volatility is somewhat higher, but overnight prices in foreign markets appear to be unbiased predictors of opening prices in New York. This suggests that foreign markets are efficient, effectively pricing in effectively any information in the economic news or other developments that occur during U.S. overnight hours—and, thus, performing an important function in smoothing the operation of the overall market.

The material that follows focuses on several key structural changes in U.S. Treasury markets that were particularly critical in its successful development and which allowed it to grow to its current global prominence. The material is divided into several sections (chapters) that are concentrated on four specific innovations:

- Treasury note and bond auctions
- The Federal Reserve book-entry system
- The Federal Reserve's securities lending program
- Tri-party and GCF repos

Detail is provided in each chapter on the institutional and economic context in which these innovations occurred, along with an assessment of their effects. All of the steps taken have in common that they ultimately served to help the markets for Treasury securities function more smoothly and efficiently. But, as the discussion reveals, the process of identifying the market's needs and implementing appropriate change was not always smooth and direct—a certain amount of trial and error, including some failures are evident from the record. Nonetheless, the detailed story should help show how the U.S. Treasury market reached its present state, it and may provide useful lessons for policy makers seeking to develop their national debt markets further and to move them toward greater efficiency.

## I. The Institutionalization of Treasury Note and Bond Auctions, 1970-1975

Summary: Between 1970 and 1975, Treasury successfully institutionalized regular auction sales of notes and bonds. Treasury's success in doing so was surprising: two prior attempts had failed and the third attempt came at a time when fixed income securities prices were becoming more volatile. That Treasury even made the third attempt testifies to the significance of Friedman's criticism of fixed-price offerings, as well as to the recognition by Treasury officials that the prospective gains from reducing issuance costs merited a third try. The success of the third attempt also speaks to the desirability of government introducing a novel activity more or less gradually, so that private market participants have an opportunity to develop the infrastructures needed to support the activity. And finally, both Treasury and the marketplace benefited from Treasury's willingness to learn from its set-backs and its willingness to "tweak" the details of the auction process to enhance efficiency.

The U.S. Treasury faces two inflexible constraints on its debt management policies: it has to raise enough new cash to finance the deficit, and it has to refinance its maturing debt.<sup>4</sup> Since 1976, Treasury has satisfied both requirements with auction sales of bills, notes, and bonds. Prior to 1970, however, Treasury did not generally auction either notes or bonds. (It did auction bills, more or less as it does today.) Instead, it raised new cash in fixed-price subscription offerings and it refinanced maturing debt with subscription offerings and fixed-price exchange offerings.

The substitution of a market-driven auction process for fixed-price offerings between 1970 and 1975 materially enhanced the efficiency and liquidity of the Treasury market and contributed to Treasury's ability to finance the deficits of the late 1970s, 1980s, and early 1990s. However, it was not obvious in the early 1970s that auction sales would succeed: Treasury had tried twice before – in 1935 and 1963 – to institutionalize regular auction offerings of long-term bonds. Both attempts had failed.

This chapter surveys the evolution of the modern Treasury auction process from 1970 to 1975. Section 1 describes fixed-price offerings of notes and bonds before 1970.

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<sup>4</sup> Baker (1979, pp. 176-179).

Section 2 describes how bills were auctioned. Section 3 summarizes the debate about whether to extend the auction process to coupon-bearing securities – a debate that had been going on sporadically since the 1930’s and more intensely since the late 1950s. Section 4 describes the unsuccessful 1963 attempt to auction long-term bonds to competing syndicates of securities dealers. Section 5 relates the successful introduction of auction sales of notes and bonds in the early 1970s, and section 6 describes how Treasury “fine-tuned” the auction process in the mid-1970s. Section 7 concludes.

## 1. Fixed-Price Offerings Before 1970

Prior to the fall of 1970, Treasury sold notes and bonds for cash in subscription offerings and it sometimes refinanced maturing notes and bonds by offering to exchange new notes and bonds for the maturing securities.<sup>5</sup> This section describes the two types of offerings and identifies their shortcomings.

### *Subscription Offerings*

In a subscription offering, Treasury set the maturity date, coupon rate, and offering price of a new issue, announced how much of the security it wanted to sell, and invited public subscriptions at the specified price. It typically announced that it would accept all subscriptions for amounts below some stated threshold and that it would allocate the remaining notes or bonds to larger subscribers in proportion to the amounts sought.

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<sup>5</sup> Treasury was unable to issue bonds between 1965 and 1971 because of a statutory ceiling of 4-1/4% on the coupon rate on a bond. During that period it issued only bills and notes.

Prior to July 1967, Federal law defined a note as a coupon-bearing security maturing in less than five years, but Congress subsequently amended the definition to mitigate the effects of the ceiling on a bond’s coupon rate. Between July 1967 and March 1976, notes had a maximum maturity of seven years. Since March 1976, notes have had a maximum maturity of ten years. See U.S. Treasury (1968, p. 14 and 1977, p. 22).

Beginning in 1960, Treasury sometimes refinanced maturing debt by issuing new debt in one or more subscription offerings and using the proceeds to redeem the maturing debt. These operations were called “cash refundings.” See Gaines (1962, pp. 174-176) and Banyas (1973, pp. 8-10 and 27-30). The subscription offerings in a cash refunding were not different from the subscription offerings used to fund a budget deficit.

For example, on July 31, 1968, Treasury announced that it would sell about \$5.1 billion of 5-5/8% notes maturing on August 15, 1974 at a price of 99.62 percent of principal.<sup>6</sup> The subscription books were open for only a single day, on August 5, and the notes were to be issued on August 15. Treasury said that it would fill all subscriptions for \$250,000 or less and that it would fill larger subscriptions on a pro rata basis. Following the close of the offering, Treasury announced that it had received subscriptions for \$23.5 billion (4.6 times the amount offered) and that subscriptions in excess of \$250,000 would be allotted 18% of the amount subscribed for, subject to a minimum allocation of \$250,000.<sup>7</sup>

Before setting the terms of an offering, Treasury officials consulted with a variety of market participants, including banks, insurance companies, and securities dealers, to assess the prospective demand for notes and bonds of different maturities and to identify the yield needed to sell a given amount of a particular issue.<sup>8</sup> (Roosa (1952, p. 217) remarked that in setting the yield on a new issue, Treasury had to take into account “not only the current level of market yields but also the weight which the new security will add to the particular sector of the market in which it is being placed...”) As a matter of convention, Treasury set the coupon rate on a new issue to the nearest 1/8<sup>th</sup> of a percent below the intended offering yield and reduced the offering price below 100 to “fine tune” the yield to the desired level.<sup>9</sup> A Treasury official observed that a debt manager

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<sup>6</sup> Federal Reserve Bank of New York (“FRBNY”) Circular No. 6194, July 31, 1968, and Circular No. 6196, August 2, 1968.

<sup>7</sup> FRBNY Circular No. 6199, August 7, 1968.

<sup>8</sup> Gaines (1962, pp. 156-157 and 165) describes the consultative process. See also the detailed description in Committee on Government Operations (1956).

<sup>9</sup> See Banyas (1973, p. 7) and Gaines (1962, p. 82) (non-par pricing “has the advantage of enabling the Treasury to adjust its effective rate of interest more precisely to the prevailing market than is possible on par offerings”). Prior to World War II, Treasury was required to sell bonds at par and notes at not less than par (Cecchetti, 1988, p. 1119). This precluded fine-tuning bond offerings and made it difficult to fine-tune note sales (because investors were sometimes reluctant to purchase notes at a premium [Banyas, 1973, p. 7]). Legislation enacted at the beginning of World War II allowed Treasury to sell bonds at prices other than par and to sell notes at a discount (Banyas, 1973, p. 7). The first non-par bond offering came in June 1958, when Treasury offered to sell 26-year 11-month 3-1/4% bonds at a price of 100-1/2 (FRBNY Circular No. 4605, May 29, 1958, see also U.S Treasury, 1959, p. 24 and Hallowell and Williamson, 1961, p. 82). The first discount note offering came in January 1959, when Treasury offered to sell 16-month 3-

“succeeded perfectly in his pricing effort if the volume of subscriptions ... just cover[ed] the amount ... offered.”<sup>10</sup>

Drawbacks to Subscription Offerings. Friedman (1960, p. 65) characterized the process of setting the terms of a subscription offering as “crystal gazing and plain guesswork.” In setting terms, Treasury bore the risk of misjudging market demand. If it set the offering yield too low, the issue would be undersubscribed and the offering would fail. The risk of a failed offering was compounded by the possibility that, due to unforeseen events or disclosure of new information on the state of the economy, market yields might rise between the time Treasury announced a new issue and the time it opened the subscription books – usually an interval of several days to a week.<sup>11</sup>

To limit the likelihood of an under-subscribed offering, Treasury added a premium to contemporaneous market yields when it set the terms of an offering.<sup>12</sup> Friedman (1964, p. 513) noted that this sometimes led to unduly generous yields. The yield premiums on new issues led, in turn, to substantial over-subscriptions and low allotment ratios. (Cecchetti (1988, pp. 1117-1118) reports that the average allotment ratio between 1932 and 1940 was 15.4%.) Over-subscriptions and low allotment ratios were clear signs that Treasury was “giving away” yield at taxpayer expense.

Subscriptions were inflated further by the rational response of an investor to the prospect of receiving fewer notes or bonds than desired: if you want \$10 million of notes

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1/4% notes at a price of 99-3/4 (FRBNY Circular No. 4684, January 8, 1959, see also U.S. Treasury, 1960, pp. 22-23).

<sup>10</sup> Baker (1976, p. 147).

<sup>11</sup> Faced with the prospect of an under-subscribed offering, officials sometimes pressured banks and dealers to take up the slack. See “The Under-subscribed Loan,” *New York Times*, September 1, 1935, p. 8 (reporting that “voluntary subscriptions [to a 1931 Treasury bond offering] did not cover the full amount, and official pressure had to be applied to the larger banks to make up the deficiency”) and “Bids Fall Short on U.S. Bond Issue,” *New York Times*, August 2, 1973, p. 49 (reporting that “heavy official pressure had been applied to dealers [to increase their subscriptions] on some issues in 1969-70”).

<sup>12</sup> See, for example, “Treasury Offers \$100,000,000 Issue in Financing Test,” *New York Times*, May 27, 1935, p. 1 (“under the policy of selling [Treasury] bonds at [fixed prices] it has been necessary for the Treasury so to gauge the market’s appetite as to assure the success of an offering, with the result that the interest rate usually has been slightly above the market”) and Gaines (1962, p. 184) (“... the rate of interest selected should be somewhat above current market rates...”).

and you think you are going to get 50% of what you ask for, then you should ask for something closer to \$20 million. This introduced a novel risk for dealers and other market participants trading an issue after the close of the subscription books but before Treasury announced the results of an offering. They had to judge the autogenous over-subscription as well as the underlying demand for the issue.<sup>13</sup>

And, in a practice known as “free-riding,” some market participants would subscribe for new issues and then seek to sell their allotments quickly at a premium to the subscription price. This practice was widely criticized because it hindered direct sales of new issues to final investors and was believed to contribute to price volatility.<sup>14</sup>

### *Exchange Offerings*

In an exchange offering, Treasury set the maturity dates and coupon rates on one or more new notes and/or bonds and invited the public to exchange one or more designated maturing issues for the same principal amount of the new securities.<sup>15</sup> (An offer might also provide for a small cash payment for accrued interest or because of an off-market coupon.) Treasury typically announced that it would accept all tenders.<sup>16</sup> By the late 1950s, a large fraction of Treasury notes and bonds matured in mid-February,

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<sup>13</sup> See, for example, the commentaries on the subscription offering of 6-year notes in August 1968 in “Credit Markets,” *New York Times*, August 6, 1968, p. 48 (subscriptions heavier than anticipated, dealers reduce expectations of allotment ratio from 30% to 20%) and in “U.S. Notes Sold for \$5.44 Billion,” *New York Times*, August 8, 1968, p. 47 (dealers reduce expectations of allotment ratio further to 10%, actual ratio turns out to be 18%).

<sup>14</sup> See “New Bond Bids Treble Offering,” *New York Times*, May 31, 1935, p. 25 (“... a profit has usually been realized by those who speculate in Treasury bond offerings, as [the bonds] usually have commanded a premium in the open market immediately after their sale”), Childs (1947, pp. 389-393), Gaines (1962, pp. 171-172 and 293), and Friedman (1960, p. 64 and 1964, p. 513).

<sup>15</sup> Treasury introduced the option for a holder to choose any of several alternative issues in February 1953, when it offered to exchange either a 1-year certificate of indebtedness or a 5-year 10-month bond for maturing debt (FRBNY Circular No. 3942, February 2, 1953). In February 1955, Treasury broadened the menu of new securities to include a long-term bond (FRBNY Circular No. 4192, January 27, 1955). Treasury’s actions followed Roosa’s suggestion (1952, p. 234) that “Treasury might ... be able to vary its offering arrangements, and perhaps minimize the risks of miscalculating investor response in some situations, by using a package offering of several issues, thereby spreading the impact of a given operation over several sectors of the market.” See also Hallowell and Williamson (1961, p. 82).

<sup>16</sup> Treasury accepted all of the debt tendered in every exchange offering between 1953 and 1960 (Gaines, 1962, p. 169).

mid-May, mid-August, or mid-November.<sup>17</sup> Exchange offerings to refinance these issues were commonly called “mid-quarter refundings.”

For example, in July 1970 Treasury faced the imminent maturity on August 15 of \$5.6 billion of publicly-held notes and bonds. On July 28, Treasury offered to exchange either of two new notes: a 7-3/4% 3-1/2-year note maturing February 15, 1974, or a 7-3/4% 7-year note maturing August 15, 1977, for the maturing securities.<sup>18</sup> The subscription books would be open for three days, from August 3 to August 5. Following the close of the offering, Treasury announced that public investors had tendered \$4.8 billion (85%) of the maturing securities and had redeemed the balance (\$0.8 billion). In exchange for the maturing debt, investors subscribed for \$3.0 billion of the 3-1/2-year notes and \$1.8 billion of the 7-year notes.<sup>19</sup>

To finance “attrition,” or cash redemption of unexchanged securities, Treasury sometimes announced a cash subscription concurrently with an exchange offering. For example, when Treasury announced the August 1970 exchange offering, it also announced that it would sell \$2.75 billion in 7-1/2% 18-month notes at a price of 99.95 “to pay for the August 15 maturities not exchanged and to raise new cash.”<sup>20</sup> At other times Treasury’s cash balances were large enough to fund the redemption of unexchanged securities.

Differences Between Exchange Offerings and Subscription Offerings. Although broadly similar, there were two important differences between exchange offerings and

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<sup>17</sup> FRBNY Circular No. 4663, November 18, 1958 (noting that over 80% of marketable, coupon-bearing Treasury debt maturing within ten years would mature in February, May, August, or November: “For some time, the Treasury has been working toward scheduling its maturities on these quarterly dates to reduce the number of times each year its financing will interfere with other borrowers . . . and to facilitate the effective execution by the Federal Reserve of its monetary policy.”) and Federal Reserve Bank of Richmond (1961, p. 5) (“By scheduling the maturities of its [notes and bonds] on the four dates of February 15, May 15, August 15, and November 15, the Treasury is setting up a pattern of refundings which will limit its future entries into the market to fixed times.”).

<sup>18</sup> FRBNY Circular No. 6582, July 29, 1970, and Circular No. 6583, July 31, 1970.

<sup>19</sup> FRBNY Circular No. 6591, August 19, 1970.

<sup>20</sup> FRBNY Circular No. 6582, July 29, 1970.

subscription offerings. First, only the holders of the designated maturing securities could acquire new securities in an exchange offering. Among other things, this meant that the market price of a maturing security reflected its value as an exchange option as well as its value as a claim to repayment of principal. It was not unusual for a maturing security to trade at a negative yield if an exchange offer was particularly generous.<sup>21</sup>

Second, holders of maturing securities usually had a choice of any of several new securities, where the choice made by one investor did not affect what other investors could obtain. For example, in the August 1970 exchange offering, investors could have opted for as much as \$5.6 billion of the 3-1/2-year note (and none of the 7-year note), or as much as \$5.6 billion of the 7-year note (and none of the 3-1/2-year note). Treasury was prepared to accommodate either extreme, as well as any intermediate outcome. Thus, an exchange offer was not equivalent to a set of fixed-size subscription offerings.

Drawbacks to Exchange Offerings. In setting the terms of an exchange offering, Treasury bore the risk that it might set the yields on its new issues too low and that investors might choose to redeem an unexpectedly large fraction of the maturing debt. This could expose Treasury to a cash flow crisis as it scrambled to meet investor demands for cash redemption.<sup>22</sup> And as with subscription offerings, the risk of misjudging the market was compounded by the potential for market yields to rise between the time Treasury announced the terms of an offering and the time the subscription books were open. To limit the risk of an unexpectedly high attrition rate,

<sup>21</sup> Cecchetti (1988) and Gaines (1962, p. 161, n. 6).

<sup>22</sup> On at least two occasions the Federal Reserve directly supported floundering exchange offerings. In November 1955, Treasury offered either a 1-year certificate of indebtedness or a 2-year 6-month note in exchange for \$12.2 billion of securities maturing on December 15 (FRBNY Circular No. 4286, November 25, 1955). When market conditions deteriorated sharply on the last day of the subscription period, the Federal Reserve purchased \$167 million of the certificates on a when-issued basis for the System Open Market Account (Hallowell and Williamson, 1961, p. 84). In July 1958, Treasury offered a 1-year certificate of indebtedness in exchange for \$16.3 billion of securities maturing on August 1 and called for redemption on September 15 (FRBNY Circular No. 4620, July 17, 1958). When market conditions became “disorderly” during the subscription period, the Federal Reserve purchased \$110 million of the maturing securities and it purchased \$1,090 million of the certificates on a when-issued basis (Hallowell and Williamson, 1961, p. 84).

Treasury added a premium to contemporaneous market yields when it set the terms of an offering.<sup>23</sup>

A second problem with exchange offerings was that holders of maturing issues were not “natural” buyers of new issues. Maturing issues were obviously short term, while new issues had substantially longer maturities. Accepting an exchange offer materially altered the risk exposure of the holder of a maturing issue. In any particular offering, some investors could be expected to be uninterested in such a sharp change in risk. Sophisticated holders who wanted cash sold their maturing debt, thereby capturing the exchange option value of the debt. This strategy, however, required the (costly) market-making services of securities dealers.<sup>24</sup>

Finally, because exchange offerings gave investors a choice of several different securities, Treasury lost direct quantitative control of the maturity structure of its debt.<sup>25</sup> It could try to induce investors to opt for more (or less) of a longer-term security by putting a higher (or lower) yield premium on that security relative to the yield premium on a shorter-term security, but there were obvious limitations to the precision of such indirect control.

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<sup>23</sup> Cecchetti (1988, p. 1117). Additionally, Hallowell and Williamson (1961, p. 82) state that Treasury introduced the option to choose any of several new issues specifically to limit attrition: “... Treasury runs less risk of attrition on an exchange with a choice, because all its eggs are not in one basket.” See also Roosa (1952, p. 234).

<sup>24</sup> Hallowell and Williamson (1961, p. 82) remark that “The rights to the long-term issue are likely to be largely in the hands of short-term investors and have to be transferred through the market to those who want them.” Gaines (1962, pp. 163-164) points out that, in practice, dealers bought maturing securities, sold the new securities for when-issued settlement, and covered their delivery obligations on the new securities by tendering the old securities in exchange for the new securities.

<sup>25</sup> See Gaines (1962, p. 79) (“In a very real sense, the maturity distribution of the debt was left in the hands of the investors.”). See also Gaines (1962, p. 174) (decision of investors in June 1958 to exchange \$7.4 billion out of \$9.6 billion of maturing debt for intermediate-term bond rather than 1-year certificate of indebtedness resulted in “over-issue” of bonds and precipitated a “disorderly market collapse”) and Federal Reserve Bank of Richmond (1961, p. 4) (in the June 1958 refunding, “holders of rights ... set the size of the respective issues, and ... took far more of the longer obligation than they wished for investment purposes only.”).

## 2. Treasury Bill Auctions Before 1970

Throughout the 1950s and 1960s, Treasury was auctioning bills even while it wrestled with the complexities of subscription and exchange offerings of notes and bonds. By 1970, Treasury was auctioning four different series on a regular basis. 13-week bills had been offered weekly since before World War II and weekly offerings of 26-week bills were added in December, 1958.<sup>26</sup> Year bills were first offered in March 1959 on a quarterly basis,<sup>27</sup> and then on a monthly basis beginning in August 1963.<sup>28</sup> Monthly offerings of 9-month bills were added in September 1966.<sup>29</sup>

Bill auctions before 1970 were much like the bill auctions of today. An investor could submit one or more competitive tenders or a single non-competitive tender. A competitive tender specified a bid price (as a percent of face amount) and the quantity of bills desired at that price. A non-competitive tender specified only a quantity (limited to some specified maximum amount) and agreed to pay the average accepted competitive bid.<sup>30</sup> Treasury accepted all non-competitive tenders for the full amount sought. Competitive tenders were accepted in order of declining bid price until the balance of the offering was accounted for. Tenders specifying prices in excess of the stop-out, or minimum accepted, price received the full amount sought and were invoiced at their respective bid prices. The remaining bills were distributed in proportion to the quantities sought among those who bid at the stop-out price.

<sup>26</sup> See, FRBNY Circular No. 4663, November 18, 1958. The first 26-week bill was the June 11, 1959 bill auctioned on December 8, 1958 (FRBNY Circular No. 4670, December 1, 1958, and Circular No. 4671, December 4, 1958).

<sup>27</sup> The first member of what was to become the year bill series was the January 15, 1960 bill auctioned on March 16, 1959 (FRBNY Circular No. 4715, March 19, 1959).

<sup>28</sup> See, FRBNY Circular No. 5356, July 16, 1963. The first monthly year bill was the August 31, 1964 bill auctioned on August 27, 1963 (FRBNY Circular No. 5374, August 21, 1963).

<sup>29</sup> The first 9-month bill was the June 30, 1967 bill auctioned on September 27, 1966 (FRBNY Circular No. 5871, September 21, 1966).

<sup>30</sup> Treasury first invited non-competitive tenders in May 1943 in an effort to broaden the distribution of bills during World War II (FRBNY Circular No. 2621, May 6, 1943). Consistent with the wartime program of capping bill yields at 3/8%, non-competitive tenders had to be entered at a fixed price of 99.905% of face amount. Following the abandonment of the wartime program in July 1947, the price on a non-competitive tender was set to the average accepted competitive price (FRBNY Circular No. 3230, July 3, 1947, and Circular No. 3231, July 3, 1947).

### 3. The Debate Whether to Auction Notes and Bonds

The argument for auctioning notes and bonds as well as bills was well-known by the early 1960s. Friedman (1960, pp. 64-65) had pointed out the practical difficulty of setting the yield on a new issue at a level where investors would buy the full amount offered but hardly any more. He recommended that Treasury eliminate both subscription offerings and exchange offerings and sell all of its marketable securities through regularly scheduled public auctions.<sup>31</sup>

The most extensive defense of Treasury's reliance on fixed-price offerings of coupon-bearing securities came in testimony by Secretary of the Treasury Robert Anderson before the Joint Economic Committee in 1959.<sup>32</sup> Anderson observed that bill auctions were "an efficient mechanism," that bills had been sold at auction since they were first introduced in 1929, and that Treasury had extended the auction method of sale to 26-week bills in late 1958 and to year bills in early 1959 when those series were introduced. He also acknowledged that auction offerings of notes and bonds would "relieve [Treasury] of a major responsibility in pricing and selling coupon issues" and noted that Treasury had introduced auction offerings of year bills to reduce the quantity of 1-year certificates of indebtedness that Treasury had to price. However, he went on to argue that notes and bonds were different from bills.

Anderson set forth several reasons why subscription and exchange offerings of notes and bonds were preferable to auction offerings. His analysis rested on the premise that many of the small banks, corporations, and individuals who subscribed to fixed-price offerings did not have the "professional capacity" to bid for notes and bonds in an

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<sup>31</sup> See also Eckstein and Kareken (1959), Carson (1959, p. 441) (auctions would relieve Treasury of responsibility for "determining an interest rate which will clear the market ... [and] eliminate attrition arising from inaccurate estimation of what the market will accept."), Goldstein (1962, p. 386) ("The auction technique ... has the virtue of freeing the Treasury from the task of having to set the effective yield on its obligations ...") and Baker (1976, p. 148) ("By auctioning securities, one element of possible misjudgment on the part of the debt manager is removed. By allowing the market to determine the average yield on the security, at least some of the dangers of an unattractive or an over-generous pricing are avoided.").

<sup>32</sup> Joint Economic Committee (1959a, pp. 1147-1161).

auction. Bills, in contrast, were bought “almost entirely in large amounts by professional investors who are thoroughly familiar with the money market on a day-to-day basis.” Lacking professional expertise, small investors were liable to either bid too high and pay too much, or bid too low and be shut out of an auction. They were, therefore, likely to avoid note and bond auctions altogether and to buy new securities in the secondary market.

Anderson suggested that the withdrawal of small investors from the primary markets for notes and bonds would have several adverse consequences:

1. Small investors would lose the opportunity to buy securities directly from the Treasury on the same terms as large investors.
2. Treasury’s ability to distribute its debt as widely as possible would be impaired. (Broad distribution was characterized as a “major objective” of Treasury debt management policy.)
3. Since relatively few market participants had the expertise to bid for notes and bonds, the auctions might not be competitive. Indeed, there might be so few bidders that auctions might fail from time to time. (Treasury viewed this as a particular risk for long-term bonds.)
4. Some notes and bonds would be purchased by sophisticated buyers “familiar with bidding techniques” who submit bids – sometimes known as “underwriting” bids – at relatively low prices on the chance that they would be accepted. This could lead to a net increase in financing costs when interest rates were rising and credit was not readily available.

He concluded that “the present practice of offering [notes and bonds] at prices and interest rates determined by the Treasury ... result[s] in an effective distribution of new ... issues at minimum cost to the taxpayer.”

Anderson also pointed out that Treasury had tried auctioning long-term bonds in 1935. As described in more detail in Appendix A, between late May and mid August, 1935, Treasury auctioned \$200 million of 13-year bonds and \$300 million of 25-year bonds in five auctions of \$100 million each. The auctions were generally successful, but investor and dealer dissatisfaction with the auction process, as well as the failure of a \$100 million auction offering of 4-year Treasury-guaranteed Federal Farm Mortgage Corporation bonds in late August 1935, cooled Treasury's enthusiasm for the auction method.

Responding to Anderson's analysis, Friedman (1960, pp. 64-65) noted that the analysis implicitly assumed that notes and bonds would be auctioned the same as bills: in a multiple-price format, where a successful tender is invoiced at its bid price.<sup>33</sup> (The 1935 bond auctions had used this format.) He claimed that the multiple-price format established a "strong tendency for the [primary] market to be limited to specialists,"<sup>34</sup> and suggested that small investors would be more willing to participate if Treasury adopted a single-price format, where all accepted tenders pay the stop-out price, because unsophisticated bidders would not have to worry that they might pay prices in excess of the prices paid by more informed bidders.<sup>35</sup>

Following Friedman's suggestion for single-price auctions, Treasury faced a choice among three methods for selling securities: subscription sales (already used for notes and bonds), single-price auctions, and multiple-price auctions (already used for bills). Friedman's principle point was that subscription sales were inferior to either of the

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<sup>33</sup> See also Friedman's testimony before the Joint Economic Committee. Joint Economic Committee (1959b, pp. 3023-3026).

<sup>34</sup> Friedman (1960, p. 64).

<sup>35</sup> Friedman (1960, p. 64) also suggested that a multiple-price format gives market specialists "a strong incentive to collude with respect to the bids submitted." This precipitated a series of papers on whether Treasury dealers actually did collude, including Brimmer (1962), Goldstein (1962), Friedman (1963, 1964), and Rieber (1964a,b).

two auction alternatives.<sup>36</sup> He recommended the single-price auction format in lieu of the multiple-price format for notes and bonds primarily to counter Treasury's claim that small investors would not participate in auction offerings of notes and bonds<sup>37</sup> and only secondarily because he believed it would generate more revenue than the multiple-price format. The subsequent development of the applied literature on Treasury auctions has generally focused on whether Treasury would derive more revenue by auctioning a security in a single-price format or a multiple-price format, rather than on the merits of auction offerings relative to subscription offerings.<sup>38</sup>

#### **4. The 1963 Syndicate Auctions**

Reluctant to offer longer-term notes and bonds in public auctions, but unable to justify the inefficiencies of fixed-price subscription and exchange offerings, Treasury tried a middle way in 1963. Emulating contemporary market practice in the sale of municipal and power company bonds, it twice offered long-term bonds in all-or-none auctions to syndicates of securities dealers, where the winning syndicate was required to reoffer the bonds to public investors on a fixed-price basis. Treasury hoped that moving the locus of bond pricing from Treasury officials to the members of the syndicate that tendered the best bid would enhance the efficiency of the primary market for Treasury bonds without jeopardizing what it saw as the benefits to small investors of a fixed-price offering. It characterized the new program as a "trial" intended to "explore the

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<sup>36</sup> Friedman (1964, p. 513) ("The [fixed-price] method now used to sell long-term securities ... makes the Treasury's cost ... appreciably higher than it would be under either alternative method of bidding.").

<sup>37</sup> Friedman (1960, p. 65) ("... Treasury's published objections to using the auction method for long-term securities all derive from the assumption that the [multiple-price] technique would be used and would be met fully by the [single-price] technique." As noted earlier in the text, Treasury's objections were generally matters of small investor participation in the primary market and ability to purchase Treasury securities directly from Treasury on the same terms as sophisticated professionals.)

<sup>38</sup> See Tsao and Vignola (1977), Reinhart (1992), Simon (1994), Malvey, Archibald, and Flynn (1995), and Malvey and Archibald (1998).

practicality” of syndicate auctions for selling bonds “at the lowest possible interest cost” and “without adverse effects on the markets for other long-term securities.”<sup>39</sup>

The first offering of \$250 million of 30-year bonds on January 8, 1963 attracted bids from four syndicates; the second offering of \$300 million of 31-year bonds on April 9 attracted three bids. As described in more detail in Appendix B, the bidding was extraordinarily competitive. In both cases, less than a basis point separated the yield on the winning bid from the yield on the third best bid. Treasury stated that the results of the first auction were “highly satisfactory” and indicated its belief that the auction “provided the base for the potential development of an important new instrument for debt management.”<sup>40</sup> After the second auction it characterized the syndicate auction technique as providing an “effective method through which the Treasury can utilize the skills and judgment of the principal participants in the securities markets throughout the country – both to determine a price that is closely related to current supply and demand conditions in the market and to develop facilities for the broadened distribution of long-term Government securities at attractive prices to investors.”<sup>41</sup>

The first offering was also a success for the members of the winning syndicate: the public reoffering sold out within a matter of hours. The second offering, however, was not so well received. More than half of the issue remained unsold when the winning syndicate finally disbanded in late April. Market participants suggested that a third auction offering of long-term bonds would produce a wider dispersion of bids than the first two offerings and that participating syndicates were certain to try to protect themselves by building larger underwriting spreads into their bids.<sup>42</sup> Robert Roosa, the Under Secretary of the Treasury for Debt Management, remarked that the next auction

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<sup>39</sup> FRBNY Circular No. 5224, September 14, 1962.

<sup>40</sup> FRBNY Circular No. 5282, January 8, 1963.

<sup>41</sup> FRBNY Circular No. 5322, April 9, 1963.

<sup>42</sup> “Reception is Cool to U.S. Bond Issue,” *New York Times*, April 14, 1963, sec. 3, p.1 and “U.S. To Try Again on Underwriting,” *New York Times*, April 21, 1963, sec. 3, p. 1.

offering was “a long time” away.<sup>43</sup> In the event, Treasury never again sold securities through a syndicate auction.

## 5. A Renewed Effort to Auction Coupon-Bearing Securities

After the demise of the 1963 attempt, Treasury had twice tried to institute regular auction offerings of long-term bonds and had twice failed. Nevertheless, Friedman’s basic criticism, that subscription and exchange offerings were inefficient, remained.<sup>44</sup> By the middle of 1970, the issuance costs of fixed-price offerings were rising as a result of higher and more volatile interest rates.<sup>45</sup> Treasury decided to try, for a third time, to auction coupon-bearing debt on a regular basis. This time, however, it took a page from its experience with bill auctions in 1958 and 1959: it first auctioned short-term notes, then progressively longer notes, and finally auctioned long-term bonds only after several years of successful auctions of shorter-term debt. This sequential approach gave dealer firms an opportunity to develop the risk management and sales programs needed to support auction bidding.

### *The November 1970 Refunding*

The November 1970 refunding got off to an unexceptional start when Treasury announced on October 22 that it was prepared to exchange either a 3-1/2-year note or a 5-year 9-month note for \$6.0 billion of Treasury securities maturing on November 15 held by public investors.<sup>46</sup> Following the close of the subscription books on October 29, Treasury announced that investors had tendered \$5.3 billion of the maturing securities, leaving \$0.7 billion to be redeemed in cash. However, rather than announcing that it

<sup>43</sup> “Bond Syndicate Being Broken Up,” *New York Times*, April 26, 1963, p. 47.

<sup>44</sup> See, for example, “Auctioning U.S. Debt,” *New York Times*, February 19, 1969, p. 61 (“There would appear to be no reason . . . why [Treasury] obligations of any maturity could not be sold at auction.”) and “Friedman Expecting New Money Rein by the Reserve,” *New York Times*, June 11, 1970, p. 65 (reporting Friedman’s view that “Treasury should change to issuing all its financing through open auction instead of attempting to pre-assess market rate”).

<sup>45</sup> Baker (1979, p. 204).

<sup>46</sup> FRBNY Circular No. 6623, October 22, 1970, and Circular No. 6625, October 23, 1970.

would finance the attrition with a subscription offering, Treasury surprised the market by announcing that it would auction \$2.0 billion of 6-3/4% 18-month notes.<sup>47</sup>

The auction was held on November 5 and followed closely the bill auction format familiar to market participants. (In light of the failure of the syndicate auction scheme seven years earlier, Treasury was careful to remind participants that it wasn't proposing anything particularly novel: "the use of the auction method of sale represents an adaptation of the technique used successfully for many years in marketing Treasury bills" and "bidding and other procedures [will] follow very closely the standard procedures used in regular Treasury bill auctions."<sup>48</sup> ) Auction participants could submit one or more competitive tenders or a single non-competitive tender (limited to \$200,000) that was guaranteed to be filled at the average accepted competitive bid. Competitive tenders had to specify a bid price of at least 99.76 and were accepted in order of declining price until all of the notes were accounted for or all of the tenders filled.<sup>49</sup> Tenders specifying bid prices in excess of the stop-out price received the full amount sought and were invoiced at their respective bid prices. The remaining notes were distributed among those who bid at the stop-out price in proportion to the quantities sought. Treasury characterized the auction as a "test," part of a "continuing effort ... to develop more efficient debt management techniques."<sup>50</sup>

On November 6, Treasury announced that it had received tenders for \$5.2 billion of notes (2.6 times the amount offered), including non-competitive tenders for \$0.5 billion. It accepted bid prices ranging from 100.93 (to yield 6.09%) down to a stop-out

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<sup>47</sup> FRBNY Circular No. 6629, October 30, 1970.

<sup>48</sup> FRBNY Circular No. 6629, October 30, 1970, and Circular No. 6631, November 2, 1970.

<sup>49</sup> Treasury limited bids to not less than 99.76 to preclude the possibility that different blocks of the notes might be taxed differently and would therefore not be fungible with each other. (This had happened when Treasury reopened the 3-7/8% note of August 13, 1965 in April, 1964. See Banyas [1973, p. 8].) The original issue discount (OID) rule in effect at the time provided that if a fixed-income security was issued at a discount to principal value in excess of the number of full years to maturity times .25, the discount would be taxed as ordinary income rather than as a capital gain. An 18-month note has one full year to maturity, so the OID threshold was 99.75.

<sup>50</sup> FRBNY Circular No. 6629, October 30, 1970.

price of 100.69 (to yield 6.26%), where there was a 32% allocation. The average accepted competitive price was 100.76 (to yield 6.21%).

### *Subsequent Early Auctions*

Treasury followed up its successful auction of 18-month notes with additional auction offerings, but the auction method was, initially, used sparingly and only to sell short-term notes. This contrasts sharply with the 1935 attempt, where five issues of 13- and 25-year bonds were auctioned in a 2-1/2 month interval, and with the 1963 attempt, where two auctions of long-term bonds came only three months apart. As shown in Table I.1, the second auction offering was for \$2.25 billion of 16-month notes and took place in June 1971, more than seven months after the first auction. The third offering was an auction of \$2.50 billion of 18-month notes in August 1971 to finance attrition on the mid-quarter exchange offerings.

After the August 1971 refunding, Treasury stepped up the frequency and increased the maturities of its auction offerings, selling a 5-year 2-month note at the end of August, a 3-year 4-month note in October, and a 15-month note in November. By the end of 1971, it had conducted six successful auctions for \$12.75 billion of notes maturing in as much as 5 years. The Under Secretary of the Treasury for Monetary Affairs, Paul Volcker, characterized the extension of auction sales to short- and intermediate-term coupon-bearing debt as a “striking innovation” in debt management: “I cannot claim that the approach has yet been fully tested in adversity, but I can say it has met or surpassed every expectation so far, to the advantage of the Treasury and the market. I am confident it will pass further testing with larger amounts and longer maturities.”<sup>51</sup>

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<sup>51</sup> “Proposals on Reform of Debt Management Offered by Volcker,” *New York Times*, March 8, 1972, p. 57.

*Pushing the Envelope*

In 1972 and 1973, Treasury continued to expand its use of auction sales. It auctioned mid-quarter refunding issues for the first time, it began to auction 2-year notes on a regular basis, and it announced an auction sale of long-term bonds. (Table I.2 shows auction offerings in 1972.)

Mid-quarter Refunding Auctions. In the spring of 1972 Treasury found itself with ample cash balances and a need to refinance only \$2.4 billion of notes maturing on May 15. Rather than undertake an exchange offering, it announced that it would pay down \$700 million of the notes and refinance the balance with auction sales of \$1.25 billion of 1-year notes and \$500 million of 9-year, 9-month bonds.<sup>52</sup> This was the first time Treasury auctioned securities in a mid-quarter refunding, and it was the first time since 1963 Treasury auctioned a bond.

2-Year Note Auctions. In October 1972, Treasury auctioned \$2.0 billion of 2-year notes in the first of what it said would be regular quarterly offerings at that maturity.<sup>53</sup> This was the first series of regular note offerings to be auctioned from inception.

Long-term Bond Auctions. In late 1972, Treasury announced the first auction offering of long-term bonds since 1963: \$625 million of 6-3/4% 20-year bonds. The bonds were also the longest-maturity bonds Treasury had sold since 1965. Treasury characterized the offering as part of its continuing effort “to finance the public debt responsibly, in a manner neither inflationary nor disturbing to the market,” and “to reestablish a viable market for long-term Treasury obligations.”<sup>54</sup>

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<sup>52</sup> FRBNY Circular No. 6933, April 27, 1972.

<sup>53</sup> FRBNY Circular No. 7013, October 5, 1972.

<sup>54</sup> FRBNY Circular No. 7071, December 27, 1972, and U.S. Treasury (1973, p. 21).

Treasury adopted a single-price auction format for the 20-year bond auction, observing that, “[t]his procedure will provide an incentive to bid at prices sufficiently high to be sure of awards, while also assuring each bidder that, if he bids at a price within the range of accepted prices, he will be awarded bonds at the same price as every other bidder,” and that its use of the single-price format “continues Treasury’s search for the most efficient means of marketing ... securities.”<sup>55</sup> In response to complaints that the single-price format would deprive dealers of an opportunity to buy bonds slightly cheaper than other auction participants, a Treasury official pointed out that “The objective is to encourage widespread and confident bidding,” and to achieve a “broader distribution of our securities. We’re appealing to a type of investor who will be able to bid what he thinks the bond is worth to him without worrying about whether somebody else may get it cheaper.”<sup>56</sup>

The auction of 20-year bonds on January 4, 1973, attracted \$1.7 billion in tenders (2.6 times the amount offered).<sup>57</sup> As shown in Table I.3, over the next 15 months Treasury offered long-term bonds in single-price auctions in five mid-quarter refundings, even though the single-price format remained unpopular with dealers.<sup>58</sup>

## 6. Fine-tuning the Auction Process

By mid-1973, auction sales of notes and bonds had effectively replaced subscription and exchange offerings. The last mid-quarter refunding to rely on exchange offerings was in February 1973 and Treasury had not made a subscription offering since August 1970. However, the form of the auction process did not remain unchanged,

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<sup>55</sup> FRBNY Circular No. 7071, December 27, 1972.

<sup>56</sup> “Prices of Treasury Bonds Decline in Light Trading,” *New York Times*, December 29, 1972, p. 39.

<sup>57</sup> FRBNY Circular No. 7076, January 5, 1973.

<sup>58</sup> See, for example, Kaufman (1973, pp. 169-170) (The single-price format “provides no incentives to U.S. Government securities dealers to help in the distribution process and instead of creating a wide institutional following, it probably confines institutional support to a few that are large in size. The use of competitive syndicate bidding or regular auctions are probably the most effective ways to achieve broad institutional participation in the long-term U.S. Government market.”)

evolving first in response to the only outright failure of a Treasury auction offering, then to simplify and enhance the efficiency of the process.

### *Auction Failure*

The first set-back in Treasury's third try at auctioning coupon-bearing securities on a regular basis came in the August 1973 refunding. To refinance \$4.7 billion of maturing notes and bonds held by the public, Treasury announced on July 26 that it would auction \$2.0 billion of 7-3/4% 4-year notes, \$500 million of 7-1/2% 20-year bonds, and \$2.0 billion of 35-day bills.<sup>59</sup>

Fixed income securities prices declined sharply in late July, 1973. Between July 16 and July 30, the discount rate on 3-month bills rose from 7.85% to 8.23%, the yield on 5-year notes rose from 7.21% to 7.80% and the yield on 20-year bonds rose from 7.21% to 7.56%.<sup>60</sup> On July 31, Treasury received tenders for only \$2.1 billion of its new 4-year notes, barely more than the amount offered. It accepted all bids above 99.01, the lowest price it had said it would accept, and 75% of the bids at 99.01. On the following day the auction of 20-year bonds failed: Treasury received tenders for only \$240 million of the bonds. It accepted all of the tenders submitted at or above 95.05, the lowest price it had said it would accept. The unfilled balance of the offering was sold to "Government Accounts."<sup>61</sup>

### *Response to Failure*

Remarkably, the failure of the August 1973 bond sale did not deter Treasury from continuing to auction securities, but it did lead to some important changes in Treasury auction procedures.

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<sup>59</sup> FRBNY Circular No. 7193, July 25, 1973, and Circular No. 7194, July 26, 1973.

<sup>60</sup> Federal Reserve Statistical Release H.15, Selected Interest Rates, various dates.

<sup>61</sup> FRBNY Circular No. 7201, August 2, 1973, and "Bond Prices Drop in Gloomy Market," *New York Times*, August 1, 1973, p. 51. The lowest prices Treasury said it would accept were marginally above the OID thresholds of 99.00 for a 4-year note and 95.00 for a 20-year bond. See also Baker (1976, p. 148).

Immediately after the failure, Treasury began to announce the coupon rate on a forthcoming issue after the announcement of the issue itself and closer to the time of the auction. For example, on August 20, 1973, Treasury announced that it would auction \$2.0 billion of 2-year 1-month notes on August 24, but it didn't announce the coupon rate on the new notes until August 22.<sup>62</sup> This reduced (but did not eliminate) the likelihood that Treasury would offer another bond with a substantially off-market coupon.<sup>63</sup>

Treasury continued to delay coupon announcements on new notes and bonds until September 1974, when it replaced bidding in terms of price (on a security with a specified coupon) with bidding in terms of yield (on a security with no specified coupon).

In the new yield auction framework, competitive bidders were asked to specify a bid yield rather than a bid price. Tenders were accepted in order of increasing yield until all of the securities not taken by non-competitive bidders were accounted for. Following the auction Treasury set the coupon rate at the highest rate – in increments of 1/8% – that gave an average price on the accepted competitive tenders not in excess of par. Each accepted tender was then invoiced at its own bid yield. Non-competitive tenders were invoiced at the average accepted competitive price. Treasury remarked that, “The new bidding method will permit pricing close to par and eliminate the risk of setting a coupon which, because of a change in the market between the coupon announcement date and the auction date, would result, on the one hand, in a price so far above par as to discourage bidders or, on the other hand, result in a price so low that the sale would have to be canceled...”<sup>64</sup>

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<sup>62</sup> FRBNY Circular No. 7213, August 20, 1973, and Circular No. 7215, August 22, 1973.

<sup>63</sup> Treasury had delayed announcing the coupon rate on a new note once before. It delayed announcing the coupon on the 5-year, 2-month note auctioned in August 1971 because of turbulent market conditions following announcement of wage and price controls and suspension of the international gold convertibility of the dollar by President Nixon on August 15. See FRBNY Circular No. 6791, August 26, 1971, Circular No. 6794, August 27, 1971, and U.S. Treasury (1972, p. 21).

<sup>64</sup> FRBNY Circular No. 7456, September 16, 1974. See also Carson (1959, p. 441) and Baker (1976, p. 148, 1979, p. 206).

In the first yield auction in September 1974,<sup>65</sup> Treasury received \$3.2 billion of tenders (including \$0.6 billion of non-competitive tenders) for \$2.0 billion of 2-year notes. It accepted bids ranging from a low yield of 8.20% up to a stop-out yield of 8.39%.<sup>66</sup> The average accepted bid was 8.34% so the coupon was set at 8-1/4%.<sup>67</sup>

### *The End of Single-Price Auctions*

In mid 1974, Treasury switched from a single-price format to a multiple-price format for its long-term bond auctions.<sup>68</sup> Treasury did not state any reason for making the change.<sup>69</sup> Following the change, all marketable Treasury debt was auctioned in a common, multiple-price, format.

### *Removal of Restrictions on When-Issued Trading*

When-issued, or “WI,” trading is exactly what the name suggests: trading in a security before it has been issued. Secondary market transactions in outstanding Treasury securities typically settle on the business day after the trade date, when sellers deliver securities to buyers and receive payment.<sup>70</sup> WI transactions, on the other hand, settle on the issue date of a security (which may be several days or even weeks after a trade is negotiated) because the security is not available for delivery at any earlier date.

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<sup>65</sup> FRBNY Circular No. 7458, September 17, 1974.

<sup>66</sup> FRBNY Circular No. 7466, September 25, 1974.

<sup>67</sup> Treasury continued to auction re-openings of existing issues with bidding in terms of price until early 1983 (see, for example, the re-opening of the 8-1/2% bond of May 15, 1999 in the November 1974 mid-quarter refunding [FRBNY Circular No. 7493, October 30, 1974]), when – for the sake of consistency with market trading conventions – it began to use yield bidding in re-openings as well as first-time issues. The first re-opening auction conducted in terms of yield was the sale of \$3.5 billion of the 10-3/8% bond of November 5, 2012, in the February 1983 refunding (FRBNY Circular No. 9446, January 27, 1983).

<sup>68</sup> The reopening of the 8-1/2% bond of May 15, 1999, in August 1974 (FRBNY Circular No. 7429, July 31, 1974, and Circular No. 7431, August 2, 1974) was the first auction of a long-term bond to use the multiple-price format.

<sup>69</sup> Baker (1979, pp. 205-206) discusses in some detail the decision to adopt a single-price format in 1973 but does not comment on why Treasury abandoned that format in mid 1974. Two papers (Tsao and Vignola, 1977 and Simon, 1992) examined whether Treasury received more aggressive bids in the six single-price auctions or the ten multiple-price auctions of long-term bonds held between February 1973 and August 1976. Neither comments on why Treasury abandoned the single-price format.

<sup>70</sup> Fleming and Garbade (2002) describe how transactions in outstanding Treasury securities settle.

Beginning with the first auction of Treasury notes in 1970 and continuing until early 1975, Treasury effectively precluded WI trading in notes and bonds prior to the close of bidding. Bidders were required to agree “not to buy or sell, or to make any agreements with respect the purchase or sale or other disposition of any securities of this issue at a specific rate or price, until [after the auction close].”<sup>71</sup> The restriction continued a similar restriction on WI trading in connection with subscription offerings that dated back to 1940.<sup>72</sup> Treasury did not generally prohibit WI trading in bills prior to the close of an auction.<sup>73</sup>

Market participants found pre-auction WI trading in bills useful for two reasons. First, public dissemination of the discount rate at which a new bill was trading in the WI market provided important information about the market’s collective appraisal of the prospective value of the bill and likely enhanced the efficiency of the bidding process. A 1992 study pointed out that WI trading “reduces uncertainties surrounding Treasury auctions by serving as a price discovery mechanism. Potential competitive bidders look to when-issued trading levels as a market gauge of demand in determining how to bid at an auction.”<sup>74</sup> Additionally, pre-auction WI sales facilitated distribution of a bill. The 1992 study remarked that WI trading “benefits the Treasury by ... stretching out the actual distribution period for each issue ...”<sup>75</sup>

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<sup>71</sup> Tender for 6-3/4% Treasury notes dated November 16, 1970 and due May 15, 1972. See also FRBNY Circular No. 6629, October 30, 1970.

<sup>72</sup> The December 11, 1940 offering of 3/4% 5-year notes was the first subscription offering to require that a subscriber certify that “no arrangements have been or will be made for the sale or other disposition of this subscription, or of the securities which may be allotted thereon, prior to the closing of the subscription books;...” (tender form for 3/4% notes, series B-1945, National Defense Series, dated December 18, 1940, due December 15, 1945). The restriction subsequently appeared on some, but not all, subscription offerings of coupon-bearing securities during World War II. Childs (1947, pp. 373, 375-376, and 391-392) recounts the origins of the restriction. Treasury did not make any subscription offerings from 1946 to 1951 and it did not explicitly impose the restriction in connection with any subscription offerings from 1952 to 1958. However, the restriction appears on every subscription offering beginning with the January 1959 offerings of 3-1/4% 16-month notes and 4% 21-year bonds.

<sup>73</sup> However, Treasury did prohibit WI trading in tax anticipation bills beginning with the November 14, 1958 offering of 214-day tax anticipation bills.

<sup>74</sup> Department of the Treasury et. al. (1992, p. A-6).

<sup>75</sup> Department of the Treasury et. al. (1992, p. 9).

In early 1975, Treasury removed the restriction on pre-auction WI trading in notes and bonds in the course of revising its offering circulars to eliminate “obsolete” provisions.<sup>76</sup> This was an important step in enhancing the efficiency of auction bidding and broadening the distribution of new issues.<sup>77</sup>

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<sup>76</sup> The characterization of the restriction on WI trading as “obsolete” appears in a Treasury statement reprinted in FRBNY Circular No. 8147, July 15, 1977. The last offering to contain the restriction was a sale of 2-year notes in February 1975 (FRBNY Circular No. 7569, February 11, 1975). The first offering that did not contain the restriction was a reopening of the 7-3/4% notes of November 15, 1981 in March 1975 (FRBNY Circular No. 7579, March 5, 1975).

<sup>77</sup> Treasury reimposed the restriction on pre-auction WI trading of notes and bonds in July 1977, “after monitoring the development and expansion of trading in Treasury securities prior to the actual auctions, and in some cases, prior even to the announcement of an offering...” and after concluding that when-issued trading “does not contribute to the efficient marketing of new ... issues and may, in fact, facilitate undesirable speculative activity in Treasury securities” (FRBNY Circular 8147, July 15, 1977). However, greater volatility of interest rates after October 1978 and a rapidly growing federal deficit led to renewed suggestions from the dealer community that pre-auction WI trading should be permitted to facilitate price discovery and new issue distribution (private communication, Mark Stalnecker, Deputy Assistant Secretary for Federal Finance, 1981-82). Treasury removed the restriction a second time in August 1981, characterizing it as “an unnecessary regulation which is believed to hinder the efficient adjustment of market prices to announcements of Treasury financing” (FRBNY Circular 9128, August 17, 1981).

## II. Origins of the Federal Reserve Book-Entry System

Summary: From start to finish, the process of dematerializing Treasury securities took two decades, beginning with the inauguration of the Government Securities Clearing Arrangement in 1966 and ending with the last issue of registered securities in 1986. Dematerialization was motivated by the growing cost and manifest risk of safe-keeping and transferring bearer securities, including especially two significant exogenous shocks: the loss of \$7.5 million of bearer Treasury securities at the Federal Reserve Bank of San Francisco in 1963 and the “insurance crisis” of 1970-71, but it was facilitated by the availability of appropriate data processing and communication technologies and it required significant reshaping of the legal and regulatory environment. By the mid-1980s, the Federal Reserve book-entry system provided a structure that could, and would, be scaled up to accommodate, at low marginal cost, a growing Treasury debt and an expanding volume of trading in Treasury securities. It is difficult to imagine that the Treasury market could have remained as liquid as it was – or that it could have become as liquid as it has - had it remained attached to promises printed on paper.

Conceptually, a Treasury bond is a promise of the United States government to pay interest periodically and principal at maturity. Until 1966, the government’s promises were evidenced by “definitive” bonds: engraved certificates setting forth the promises in writing. However, starting in 1966 Treasury bonds began to dematerialize into “book-entry” securities: collections of bits and bytes in computer memories and data storage devices. The end result, two decades later, was a far more efficient Treasury market with sharply lower operating costs.

This chapter reviews the origins and early evolution of the system most closely associated with the dematerialization of definitive Treasury securities: the Federal Reserve’s book-entry system. (A second, separate, book-entry system, TreasuryDirect, played an important role in the final phase of the dematerialization process in 1986.) Section 1 lays the foundation by describing the ownership and transfer of definitive Treasury securities prior to 1966. Section 2 identifies the costs of safe-keeping and

transferring definitive securities. Section 3 describes the origins of an important early-stage book-entry system: the Government Securities Clearing Arrangement sponsored by the Federal Reserve Bank of New York. Section 4 describes the early years of the larger, System-wide, book-entry system. Section 5 concludes.

## **1. Ownership and Transfer of Definitive Treasury Securities**

Definitive bonds came in two forms: bearer and registered. (Outside of residual amounts of a handful of issues due to mature by the end of the decade, neither form exists today.) This section describes the two forms, explains why secondary market transactions were not usually settled with registered bonds, and explains how they were settled with bearer bonds.

### *Bearer Bonds*

A bearer bond consisted of a “corpus,” or main body, reciting the government’s promise to pay principal and interest, and a series of detachable coupons, each of which was a claim to an interest payment on a specific date. The government’s promises ran to whomever held the bond, i.e., to the bearer. Bearer bonds were issued in a variety of principal amounts, including \$1,000, \$5,000, \$10,000, \$100,000, and \$1,000,000. An investor could effect a denominational exchange by tendering, for example, one \$100,000 bond and requesting ten \$10,000 bonds.

Since Treasury had no way of knowing who held a bearer bond when a payment on the bond came due, it could not disburse the payment on its own initiative: it had to wait until the holder asserted a claim. To claim an interest payment, a holder would detach the appropriate coupon and send it (through the banking system) to a Federal Reserve bank for collection.<sup>78</sup> When the bond matured, the holder asserted his claim for

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<sup>78</sup> 31 CFR 306.38 (January 1, 1966). Federal Reserve banks act in their capacity as “fiscal agents” of the U.S. Treasury when they pay interest on Treasury bonds. Treasury has used the twelve district Federal Reserve banks as its fiscal agents since 1916. The agency functions of the Reserve banks include accepting, holding, transferring and paying out government deposits, making interest payments on

payment of principal by sending the corpus for collection.<sup>79</sup> Thus, the bond's corpus and coupons were tangible and direct manifestations of the bondholder's claims to the payments of principal and interest promised by the government. The bondholder could transfer ownership of the claims by physical delivery of the engraved certificate.<sup>80</sup>

### *Registered Bonds*

A bond was said to be registered if the government's promises to pay principal and interest ran to a person whose identity was recorded with the Treasury. There was an engraved certificate associated with a registered bond, on the face of which the name of the registered owner appeared, but it served primarily as a device for effecting change in the ownership of the bond.

To convey a registered bond to a new owner, an investor had to instruct Treasury to change the registration record of the bond. This was done by inscribing the re-registration instructions on the back of the bond and sending it to Treasury.<sup>81</sup> Upon receipt, Treasury would change its records and issue a new certificate to the new owner.

Treasury's records were the locus of a bondholder's claims to the payments on a registered bond. Because it knew the name and address of the owner, Treasury could send checks for periodic interest payments directly to the owner on its own initiative, without requiring tender of coupons.<sup>82</sup> It could have done the same for the principal payment, but instead required tender of the certificate as a way to recover matured certificates.<sup>83</sup>

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government debt, issuing and redeeming government debt, providing for denominational exchanges of government debt, and safe-keeping collateral pledged against government monies held by private depository institutions. Ringsmuth and Rice (1984, pp. 4-8) and Federal Reserve Bank of New York (1922).

<sup>79</sup> 31 CFR 306.25(a) (January 1, 1966).

<sup>80</sup> 31 CFR 306.2(b) (January 1, 1966).

<sup>81</sup> 31 CFR 306.40 (January 1, 1966).

<sup>82</sup> 31 CFR 306.37(a) (January 1, 1966).

<sup>83</sup> 31 CFR 306.25(a) (January 1, 1966).

*Advantages and Disadvantages of Bearer and Registered Bonds*

Bondholders could hold bonds in either bearer or registered form, and they could change from one form to the other at no direct cost. Each form had advantages and disadvantages.

Bearer bonds were easily transferred from one owner to another, but because possession was tantamount to ownership they had to be kept safe from loss, destruction, and theft. (Treasury would not replace a lost or stolen bearer bond until after it had matured and some additional time had elapsed during which the bond had not been presented for payment.<sup>84</sup>) Institutional owners either maintained their own security vaults or contracted with commercial banks for custodial services. Similarly, an owner conveying a bearer bond to a new owner had to provide secure transportation of the bond, whether the bond was being sent across the street or across the country.

Holder of bearer bonds, or their custodial agents, also had to clip and send in for collection the coupons on the bonds. This was a remarkably time-consuming and expensive undertaking for banks that provided custodial services and that had to clip and collect coupons from many thousands of bonds.<sup>85</sup>

Matters of safe-keeping, transport, and payment were much simpler for registered bonds. The bonds were not tangible manifestations of bondholder claims and could be replaced if they were lost, destroyed, or stolen,<sup>86</sup> so it was less important to provide secure safe-keeping and transportation for the bonds. Additionally, Treasury paid interest on the bonds without requiring tender of coupons. However, changing the record of ownership of a registered bond was time-consuming and Treasury did not allow transfers during the 30 days preceding an interest payment.<sup>87</sup>

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<sup>84</sup> 31 CFR 306.107(b) (January 1, 1966).

<sup>85</sup> Manypenny (1986, pp. 29-30).

<sup>86</sup> 31 CFR 306.107(a) (January 1, 1966).

<sup>87</sup> Manypenny (1986, p. 68) and 31 CFR 306.15(b) (January 1, 1966).

*Treasury Bills*

A Treasury bill is a promise of the United States government to pay a specified amount – the “face amount” of the bill – on a specified maturity date. Definitive bills were never issued in registered form, only in bearer form. Like bearer bonds, bills were available in a variety of denominations (an investor could effect denominational exchanges on demand), had to be presented for payment, and had to be protected against loss, destruction, and theft.

*Settling Purchases and Sales of Definitive Treasury Securities*

Prior to 1966, as now, investors valued Treasury securities for their liquidity as well as for their creditworthiness. They were willing to pay higher prices for, and accept lower returns on, Treasury securities compared to other highly rated fixed income securities with less liquid secondary markets because they knew they would not have to search extensively to identify an economically acceptable bid when they wanted to sell.

Most institutional investors kept their Treasury bonds, particularly short- and intermediate-term bonds, in bearer form so they could be delivered quickly in the event of sale. (Treasury bills were never available in registered form precisely because there was so little demand for a short-term security that could not be transferred quickly.) Large commercial banks in New York, Chicago, and other financial centers maintained secure vaults where they kept their own bills and bonds and the securities of their customers, including customers who were dealers in Treasury securities. Secondary market transactions in bills, as well as a large fraction of bond transactions, were settled by transferring bearer securities from one bank to another – most commonly within New York, but also between geographically remote banks. Secondary market trading of registered bonds was much less common because re-registration was so time-consuming and inconvenient.

Settling a Transaction with a Transfer Between Two New York Banks.

Transferring bearer securities from one New York bank to another to settle a sale was neither cheap nor quick. The process started when a seller ordered its custodial bank to deliver securities to another custodial bank for deposit to a buyer's account. The seller's bank removed the securities from the seller's account (literally taking engraved certificates out of a file), verified the count, and packaged the securities for delivery. A messenger, possibly armed but usually not (then as now, anonymity was pretty good protection on the streets of Manhattan), carried the securities to the buyer's bank, handed them over at a delivery window, and received a receipt and possibly a check for payment. (Payment could also be affected by a separate transfer of funds from the buyer's bank to the seller's bank.<sup>88</sup>) The buyer's bank counted the securities, verified the count, and finally added the securities to the buyer's account (literally placing the certificates in a file assigned to the buyer). Vollkommer (1970, p. 5) estimates that the whole process took at least two hours.

Inter-City Transfers. With one important exception, transferring bearer securities between cities was even slower and more expensive, because of the time and cost of shipping the securities – typically by registered mail or armored carrier.

The exception was when securities needed to be shipped between cities in which Federal Reserve banks or branches were located. In that case the securities could be moved by a “CPD transfer.”<sup>89</sup> Suppose, for example, Irving Trust Company (a major

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<sup>88</sup> Vollkommer (1970, p. 5) and Hoey and Vollkommer (1971, p. 23).

<sup>89</sup> CPD transfers are described by Smith (1956, ch. 9), Vollkommer (1970, pp. 28-31 and 41-44), Hoey and Vollkommer (1976, pp. 2-4), and Ringsmuth and Rice (1984, pp. 8-9). The terminology derives from the fact that prior to 1941 the Commissioner of Public Debt had to be notified of and approve every wire transfer of a Treasury security (Smith, 1956, p. 93). The CPD transfer facility was established in July 1921 for certificates of indebtedness and notes to facilitate the development of a national market for those securities (Smith, 1956, p. 87). It was extended to bills shortly after they were introduced in 1930 (Smith, 1956, pp. 87-88) and to bonds in 1948 (FRBNY Circular No. 3306, February 5, 1948 and Circular No. 3310, February 20, 1948). The extension to bonds was delayed by the perception that market participants bought bonds as long-term investments rather than as a secondary source of liquidity and that trading in bonds was much less active compared to trading in bills, certificates, and notes (Smith, 1956, p. 87).

New York clearing bank for nonbank dealers in Treasury securities in the 1960s) wanted to transfer bearer bonds to Bank of America (BoA) in San Francisco to settle a sale of the bonds from a dealer clearing through Irving to a custodial customer of BoA. On instructions of the dealer, Irving would withdraw the bonds from its customer's account and deliver them to the Federal Reserve Bank of New York (FRBNY) with instructions to have the bonds credited to the Federal Reserve Bank of San Francisco (FRBSF) for the account of BoA and for the beneficial ownership of BoA's customer. (The transfer from Irving to FRBNY was a conventional intra-city transfer.) FRBNY would add the bearer bonds to the inventory it held as a fiscal agent of the Treasury and send a wire notice to FRBSF that it should remove a comparable quantity of the same bearer bonds from the stock that FRBSF held as fiscal agent and deliver the bonds to BoA. (The private wire system used to send messages between Federal Reserve banks is described in Appendix D.) Upon receipt, BoA would add the bonds to the buyer's account. (The transfer from FRBSF to BoA was another conventional intra-city transfer.) Irving could request delivery of the bonds to BoA against payment (in which case FRBSF would debit BoA's reserve account for the invoice price and advise FRBNY to credit Irving's reserve account for the same amount) or it could ask for delivery free of payment (in which case it would arrange some other way for BoA to pay for the bonds).

CPD transfers transformed bearer securities in one city into a like amount of bearer securities in another city without physically transporting the securities, essentially eliminating the geographic separation of buyers and sellers located in different cities.<sup>90</sup> However, CPD transfers did nothing to reduce the costs of transferring bearer securities within a city, and they did nothing to reduce the costs of safe-keeping bearer securities.

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<sup>90</sup> Registered securities could not be wired between Federal Reserve banks.

## 2. The Costs of Safe-keeping and Transferring Bearer Securities

Before examining how the Federal Reserve's book-entry system emerged after 1965, it will be useful to summarize briefly the costs that provided the economic rationale for the system:

- Safe-keeping bearer securities required vault space to store the securities and trustworthy workers to clip coupons.
- Bills and bearer bonds were apt to be lost or stolen, so custodians had to insure themselves against loss.
- Transferring bearer securities was costly because it required repetitive counting and re-counting of securities being prepared for delivery or received from sellers, and because it incurred the risk of loss or theft of securities in transit.

By the mid-1960s, the costs of safe-keeping and transferring bearer Treasury securities were becoming so large that market participants began to seek better ways of establishing and transferring ownership of the government's promises. The growth in costs was attributable to two factors shown in Table II.1: an increase in the total amount of marketable Treasury debt outstanding and the concentration of that increase at short and intermediate maturities.<sup>91</sup> Short- and intermediate-term debt tended to be held by investors who valued liquidity because they had relatively volatile cash needs and who bought and sold securities more frequently than investors who bought bonds.

The growth in the quantity of marketable Treasury securities outstanding, as well as the growth in trading in those securities, meant that more securities were held in bearer form, more securities were held in bank vaults, and more securities were being transferred from owner to owner. However, expanding vault space was uneconomic in many cities (due to the high price of real estate in central business districts) and there were few scale economies in clipping coupons and delivering bonds.

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<sup>91</sup> Vollkommer (1970, p. 15) also comments on the high turnover rate of clerical staff and the difficulty banks and other financial institutions had filling clerical vacancies in the 1960s.

The growth in trading in marketable Treasury securities also began to generate a rising incidence of settlement fails.<sup>92</sup> The relatively long time required for an intra-city delivery, and the even longer time required for an inter-city delivery, limited the ability of custodial banks to redeliver, or “turn around,” definitive securities more than once or twice a day. Since every transaction had to be settled individually (there were no netting schemes in place like those implemented later by the Government Securities Clearing Corporation – see Fleming and Garbade (2002)), market participants sometimes found themselves saddled with delivery obligations that they could not fulfill because they had not yet received securities due from unrelated purchases.<sup>93</sup> Settlement fails were expensive for sellers (because sellers were not paid until they made delivery) and exposed both buyers and sellers to the risk of loss following a counter-party failure. This led to an increasing diversion of valuable human resources to limit and cure fails.<sup>94</sup>

### **3. The Government Securities Clearing Arrangement**

In the mid-1960’s the Federal Reserve Bank of New York participated in a disproportionate fraction of all CPD transfers because many of the largest Treasury dealers, and many of the largest custodial banks, were located in New York. FRBNY ran a large and expensive “operations” department, receiving bearer securities for wire

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<sup>92</sup> Hoey and Vollkommer (1971, p. 21) (pointing out “the nearly unmanageable volume of work that inevitably brings with it the loss of essential controls of securities due to and due from the institution concerned, and thus creates conditions for the “fails” that can result in losses of both funds and financial stability.”)

<sup>93</sup> Settlement fails began to affect the liquidity of the Treasury market in 1969, when a sharp increase in fails led dealers to decline to enter into transactions for same-day settlement with other than their best customers (Vollkommer, 1970, p. 11). The manager of the Federal Reserve’s System Open Market Account expressed concern that further degradation of the settlement process might leave dealers reluctant to trade with the Fed for same-day settlement and thus might impair the ability of the Fed to achieve its monetary policy objectives. His concerns provided the impetus for the Federal Open Market Committee to approve a modest securities lending program. Federal Open Market Committee (1969a, pp. 79-85, 1969b, pp. 94-97, 1970). See also FRBNY Circular No. 6321, April 17, 1969, for further evidence of Federal Reserve concern with Treasury fails.

<sup>94</sup> The cost to a seller of not getting paid was offset by the gain to the buyer from being able to earn interest on the invoice price until the actual delivery date, so the direct consequence of a fail was a wealth transfer rather than a social cost. The resources devoted to avoiding and curing fails were genuine social costs.

transfer to buyers elsewhere in the nation and delivering bearer securities pursuant to wire transfers from sellers outside of New York. As the volume of trading in Treasury securities rose, the bank had a clear self-interest in innovative arrangements that would reduce its operating costs, as well as an institutional interest in arrangements that would reduce the operating costs of its member banks.<sup>95</sup>

During the winter of 1964-65, FRBNY proposed a novel netting arrangement for CPD transfers. During a business day it would allow a bank to request (by teletype) CPD transfers without simultaneously requiring receipt of the securities to be transferred. It would maintain a record of the bank's requests, as well as of the messages that it received from other Federal Reserve banks requesting CPD deliveries of securities to the same bank. At about 3 p.m. FRBNY would compute the net transfers in each outstanding Treasury issue and request that the bank settle up by delivering or receiving bearer securities.<sup>96</sup> This scheme, called the "Government Securities Clearing Arrangement" (GSCA), was viewed as likely to reduce deliveries of the bearer securities required to settle CPD transfers by as much as 80%.<sup>97</sup> It was, for all practical purposes, an intra-day book-entry system. Two FRBNY officials later noted that, "The establishment of the [GSCA] represented a major departure from the time-honored principle that transfers of Government securities required physical delivery to the purchaser, or his agent, of the

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<sup>95</sup> Hoey and Vollkommer (1971, p. 24) (FRBNY "greatly concerned about the cost ... to itself and to the commercial banks in New York City, entailed in the physical receipt and delivery of U.S. Government securities.") and Davis and Hoey (1973, p. 122) ("From time to time [FRBNY had] considered various proposals to reduce the substantial volume of Government securities that are delivered daily to and from the Bank ... in connection with interdistrict telegraphic transfers of [Treasury] securities ...").

<sup>96</sup> FRBNY made end-of-day deliveries to banks with a credit balance by drawing on the inventory of bearer securities that it held as a fiscal agent of the Treasury (Vollkommer, 1970, p. 33 and Hoey and Vollkommer, 1971, p. 24). A bank with an obligation to deliver securities to FRBNY was essentially running an overdraft in its securities account at FRBNY. See Ringsmuth and Rice (1984, p. 21) and Hoey and Vollkommer (1971, p. 24) for remarks indicating the possibility of such overdrafts. A bank had to agree that, as long as it ran an overdraft in a security, it would retain possession of enough of the same security in bearer form to settle the overdraft (Clearing Agreement Providing for Transfers of U.S. Government and U.S. Agency Securities, August 4, 1967, paragraph 5). The running intra-day record of transfers, and the computation of the final settlement amounts, was manual prior to the installation in 1971 of the Sigma V computer noted in the appendix. Davis and Hoey (1973, p. 126).

<sup>97</sup> Vollkommer (1970, p. 32), Hoey and Vollkommer (1971, p. 24), and Davis and Hoey (1973, p. 122).

pieces of paper representing ownership.”<sup>98</sup> After a trial program in the second half of 1965, the GSCA was officially inaugurated in January 1966.

The GSCA initially included only Morgan Guaranty Trust Company and Irving Trust, but by the middle of the year six other banks had joined.<sup>99</sup> The six additional banks were motivated to join by FRBNY’s decision in August 1966 to allow banks to “redirect” incoming securities to other participating banks.<sup>100</sup> This was a crucial innovation because it allowed a bank to use book-entry credits to settle a delivery obligation to another bank. One Fed official noted that, “This was believed to be the first time that Government securities had been transferred between member banks in New York City without physical delivery ...”<sup>101</sup> The ability to redirect securities expanded the GSCA from a scheme for netting CPD transfers on a bank-by-bank basis into a scheme for netting transfers across banks as well. Subsequently, the GSCA was expanded to accommodate more general transfers of book-entry credits, new issue take-downs, and denominational exchanges.<sup>102</sup>

The GSCA was important primarily because it reduced some of the costs of transferring ownership of Treasury securities. The GSCA was never a full-fledged book-entry system because accumulated credits and debits were typically eliminated every afternoon by physical delivery of bearer securities.<sup>103</sup> Thus, the GSCA did little to reduce

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<sup>98</sup> Hoey and Rassnick (1976, p. 178).

<sup>99</sup> The other banks included Bankers Trust Company, Manufacturers Hanover Trust Company, First National City Bank, Chemical Bank, Chase Manhattan Bank, and Bank of New York. There were, ultimately, twelve banks in the GSCA, including also Franklin National Bank, Marine Midland Trust Company, National Bank of North America, and United States Trust Company. Vollkommer (1970, p. 34), Third Amendment to Revised Clearing Agreement Providing for Transfers of U.S. Government and U.S. Agency Securities, as Amended (February 5, 1971), Debs (1972, p. 179), and Hoey and Rassnick (1976, p. 177)

<sup>100</sup> Vollkommer (1970, p. 34).

<sup>101</sup> Vollkommer (1970, p. 34).

<sup>102</sup> Davis (1967), Vollkommer (1970, pp. 46-48).

<sup>103</sup> If a bank failed to deliver securities required to settle its position at the end of a business day, FRBNY could charge the bank’s reserve account for the principal amount of the securities. If the bank failed to deliver the securities on the following business day as well, FRBNY could “buy in” the securities and charge the bank for the cost of the buy-in. Additionally, each participant in the GSCA was obliged to indemnify FRBNY for any loss arising from a settlement failure of another participant. Vollkommer (1970, p. 52), Debs (1970, p. 2), and Hoey and Rassnick (1976, p. 179).

the need for vault space or coupon clipping and it did not eliminate physical delivery of bearer securities. Nevertheless, the GSCA was important in a broader context because it gave the Federal Reserve valuable operating experience with an early-stage book-entry system. And, as noted in the next section, the GSCA played a key role in preserving the integrity of the secondary market for Treasury securities during the “insurance crisis” of 1970-71.

#### **4. The Federal Reserve Book-Entry System**

One of the most significant factors in the development of a full-scale Federal Reserve book-entry system during the mid and late 1960s was the prior experience that the district Federal Reserve banks had accumulated in safekeeping securities.

The familiarity of the Reserve banks with safekeeping practices was founded primarily on their need to hold securities pledged by member banks as collateral on discount window loans and against deposits of public monies, such as Treasury Tax and Loan balances. Additionally, the Reserve banks safekept unpledged securities owned by geographically remote member banks.<sup>104</sup> This service made the securities more readily accessible in the event a remote bank decided to pledge some of its securities as collateral against a discount window loan. On instructions from the member bank, the Federal Reserve bank would (physically) remove the securities from the member bank’s custodial account and place them in a pledged securities file, reversing the process when the pledge was terminated. (Federal Reserve banks did not safekeep securities owned by nearby member banks, because those banks could readily deliver securities from their own vaults to a Reserve bank as required and because of a lack of vault space at the Reserve banks.<sup>105</sup> ) The Federal Reserve Bank of New York had particularly deep safekeeping experience, because it safekept securities owned by the System Open Market Account

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<sup>104</sup> Cieurzo (1971) and Ringsmuth and Rice (1984, p. 10).

<sup>105</sup> Ringsmuth and Rice (1984, p. 11). Lack of vault space also kept Federal Reserve banks from safekeeping securities owned by customers of member banks. Ringsmuth and Rice (1984, p. 14).

and by foreign central banks, as well as securities in federal government accounts administered by the Secretary of the Treasury.<sup>106</sup>

Just as the CPD transfer facility gave Federal Reserve banks experience receiving and delivering Treasury securities, safekeeping securities gave the Reserve banks experience running vault facilities, hiring and retaining a trustworthy labor force, and clipping coupons. The Reserve banks were as acutely aware as any commercial bank of the high and rising costs of providing custodial services.

### *Origins of the Book-Entry System*

In mid-1963, following an embarrassing loss of \$7.5 million of bearer Treasury securities at the Federal Reserve Bank of San Francisco,<sup>107</sup> the Board of Governors of the Federal Reserve System asked the Conference of Presidents (of the Federal Reserve banks) to examine whether Treasury securities owned by member banks and safekept at Federal Reserve banks might be converted to a book-entry form.<sup>108</sup> The Board was interested in reducing the risk of lost or stolen securities, lowering the cost of clipping coupons and transferring securities, and relaxing the constraints imposed by limited vault space.

Pursuant to the Board's request, a subcommittee of the Committee on Fiscal Agency Operations of the Conference of Presidents examined the matter and concluded that a book-entry system was both practical and desirable.<sup>109</sup> The subcommittee reported that a lower risk of lost and stolen securities would be the most important benefit, but that

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<sup>106</sup> Cieurzo (1971).

<sup>107</sup> "\$7,500,000 Bonds Disappear at Bank," *New York Times*, March 28, 1963, p. 1, "If Lost Securities Were Stolen, Theft Was Biggest in History," *New York Times*, May 28, 1963, p. 58, "Loss of Securities Remains a Mystery," *New York Times*, May 30, 1963, p. 22.

<sup>108</sup> Letter dated June 11, 1963 from Merritt Sherman, Secretary, Board of Governors of the Federal Reserve System to Watrous Irons, Chairman, Conference of Presidents and President, Federal Reserve Bank of Dallas.

<sup>109</sup> Committee on Fiscal Agency Operations of the Conference of Presidents (1963).

a book-entry system would also reduce operating expenses by eliminating the need to clip coupons.

The Trade-off Between Breadth and Simplicity. Although the original Board inquiry was limited to Treasury securities owned by member banks, Fed officials recognized that Federal Reserve banks held securities for a variety of other parties. The economic benefits of a book-entry system would be greater the greater the volume of securities included in the system, so it was important to plan for the inclusion of such other holdings. In addition, there were substantial benefits to extending the system to securities owned by customers of member banks, including especially securities owned by nonbank dealers in Treasury securities.

The rationale for a broad-based book-entry system was offset, however, by the recognition that each additional category of security deposit and depositor would be encumbered with its own unique problems.<sup>110</sup> For example, a Federal Reserve bank acted in either of two capacities when it held Treasury securities. It acted in its individual capacity when it safekept member bank securities and when it held member bank securities pledged against discount window loans, but it acted as a fiscal agent of the Treasury when it held securities pledged against Treasury Tax and Loan balances. Additionally, it acted as a fiscal agent of the Treasury in issuing and redeeming Treasury securities and in paying interest on Treasury securities, three functions intimately associated with running a book-entry system. It was far from clear whether the Reserve banks would operate a book-entry system in their individual capacities or as fiscal agents of the Treasury. If they operated the system in their individual capacities and not as fiscal agents, they might be obliged to hold definitive Treasury securities in their vaults against book-entry security liabilities to member banks and others. This would clearly limit the attractiveness of operating a book-entry system. However, if they operated the

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<sup>110</sup> Debs and Guy (1965).

system as agents of the Treasury they would likely have to continue to safekeep, in their individual capacities, definitive securities owned by member banks and others – thereby defeating an important purpose of the book-entry system.<sup>111</sup>

A second problem involved the “perfection” of liens on Treasury securities by pledgees. Liens generally required expensive and time-consuming public filings in order to be fully effective, but possession of collateral by a pledgee was sufficient if the collateral was a security. Since the notion of “possession” of a book-entry security was unclear, some analysts speculated that a pledgee who wanted to perfect a lien on a book-entry security might have to make a public filing of the lien. Any such requirement would markedly reduce the attractiveness of a book-entry system for market participants.<sup>112</sup>

Finally, Treasury tax regulations governing the identification and calculation of capital gains and losses were premised on purchases and sales of individually identifiable definitive securities and were not compatible with a system of fungible book-entry securities. Development of a book-entry system would require some non-trivial restructuring of Internal Revenue Service regulations.<sup>113</sup>

### *The Initial Implementation*

Treasury and Federal Reserve officials decided to keep the initial implementation of a book-entry system limited in scope and relatively simple. The first version went into effect on January 1, 1968, and provided for just three categories of book-entry Treasury securities:

- 1) member bank securities held for investment (rather than for trading) and deposited with a Federal Reserve bank for safekeeping,

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<sup>111</sup> Debs and Guy (1965)

<sup>112</sup> Rassnick (1969, pp. 3-4), Rassnick (1971, pp. 613-614) (“[I]f a ... filing were necessary, the book-entry procedure would not have been feasible for the Federal Reserve.”), and Hoey and Rassnick (1976, p. 181)

<sup>113</sup> Rassnick (1969, p. 4) and Rassnick (1971, p. 614).

- 2) member bank securities pledged as collateral for a loan from a Federal Reserve bank, and
- 3) securities pledged by a bank as collateral against Treasury Tax and Loan balances and other similar federal government deposits.

A member bank had the right to deposit Treasury securities (in bearer or registered form) to its book-entry accounts, to withdraw securities (in bearer or registered form) from its accounts, to order a transfer of book-entry securities to a book-entry account of another member bank at the same Federal Reserve bank, or to order a CPD transfer of securities held in book-entry form.<sup>114</sup>

The matter of whether the Federal Reserve banks would operate the book-entry system in their individual capacities or as agents of the Treasury was resolved by allowing for *both* roles.<sup>115</sup> As a general matter, the Reserve banks would operate the system, issuing and redeeming book-entry securities and paying interest on those securities, as agents of the Treasury.<sup>116</sup> Additionally, the banks would hold, as agents of the Treasury, securities pledged against government deposits.<sup>117</sup> However, the Reserve banks were also authorized to hold, in their individual capacities, member bank book-entry securities as collateral on discount window loans,<sup>118</sup> and they may have been

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<sup>114</sup> Subpart O of Treasury Department Circular No. 300 (promulgated November 7, 1967, effective January 1, 1968), 17 CFR 306 (January 1, 1968), and FRBNY Operating Circular No. 21 (effective January 1, 1968). See also FRBNY Circular No. 6075, December 12, 1967.

<sup>115</sup> This “dual capacity” approach was first suggested by Debs and Guy (1965). See also the discussion of the dual capacity approach in Ringsmuth and Rice (1984, pp. 24-28).

<sup>116</sup> 31 CFR 306.115(a) (January 1, 1968) (defining a “Reserve Bank” as a “Federal Reserve Bank ... *acting as Fiscal Agent of the United States*” [emphasis added]), 31 CFR 306.116 (January 1, 1968) (authorizing issuance of book-entry securities), and 31 CFR 306.122 (January 1, 1968) (authorizing payment of interest on and redemption of book-entry securities).

<sup>117</sup> 31 CFR 306.117(a)(2) (January 1, 1968).

<sup>118</sup> 31 CFR 306.117(a)(1) (January 1, 1968) (book-entry procedure shall apply to Treasury securities deposited with a Reserve bank “as collateral pledged to a Reserve bank (*in its individual capacity*) for advances by it...” [emphasis added]). See also Ringsmuth and Rice (1984, p. 28) (Treasury regulations incorporated “dual capacity for securities held as collateral for advances by the Reserve banks.”).

authorized to safekeep member bank book-entry securities in their individual capacities.<sup>119</sup>

The initial implementation of the book-entry system accommodated only two types of pledgees: a Federal Reserve bank pursuant to a discount window loan, and the United States government pursuant to a deposit of public monies. The question of whether either type of pledgee had to make a public filing of a lien on book-entry securities was resolved by relying on the doctrine of Federal pre-emption of state law.<sup>120</sup> The Treasury regulation authorizing the book-entry system simply declared that no such filing was necessary and provided that a lien in favor of either pledgee could be perfected by making an appropriate entry in the records of the book-entry system: “The making of such an entry shall have the effect of a delivery of definitive Treasury securities in bearer form ... and shall effect a perfected security interest ... in favor of the pledgee, who shall be a holder.”<sup>121</sup>

Finally, the IRS ruled that a book-entry security in a member bank’s custodial account could be identified at the time it is sold by reference - in a written instruction of

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<sup>119</sup> The evidence on whether officials intended that a Reserve bank would act in its individual capacity or as an agent of the Treasury when it safekept unpledged member bank book-entry securities is ambiguous.

Ringsmuth and Rice (1984, p. 28) assert that a Reserve bank acted as an agent of the Treasury when it safekept unpledged member bank book-entry securities: “Securities were held for member banks ... exclusively as fiscal agents.” Supporting this appraisal, the language from FRBNY Operating Circular 21 (effective January 1, 1968) providing for discount window loan collateral accounts states that the Federal Reserve Bank of New York, in accepting securities for deposit to such collateral accounts, was acting in its individual capacity (securities deposited “as collateral for advances by this Bank, *in its individual capacity...*” [emphasis added]), while the language from the same circular providing for custodial accounts does not similarly state that the Bank, in accepting securities for deposit to such custodial accounts, would be acting in its individual capacity.

On the other hand, the language in the Treasury regulation authorizing custodial book-entry accounts, 17 CFR 306.117(a)(3) (January 1, 1968), tracks the language authorizing discount window loan collateral accounts, 17 CFR 306.117(a)(1) (January 1, 1968). The latter refers to securities “pledged to a Reserve Bank (*in its individual capacity*) for advances by it.” [Emphasis added.] The former refers to securities deposited “by a member bank ... for its sole account and in lieu of safekeeping of definitive Treasury securities by a Reserve Bank *in its individual capacity*.” [Emphasis added.] This suggests that if a Reserve bank maintained loan collateral accounts in its individual capacity, then it also maintained custodial accounts in its individual capacity.

<sup>120</sup> Rassnick (1969, pp. 3-4), Rassnick (1971, p. 614), and Hoey and Rassnick (1976, p. 181).

<sup>121</sup> 31 CFR 306.118 (January 1, 1968).

sale - to its purchase date and cost or to the serial number on the advice of transaction relating to its purchase that was forwarded to the member bank by its district Federal Reserve bank.<sup>122</sup> This ruling gave banks a way to identify and calculate capital gains and losses on transactions in book-entry securities held for investment purposes.

The Federal Reserve was unambiguous about the factors that motivated the development of the new system, as well as its view that the initial implementation was only a first step. In requesting public comment on a substantially similar earlier version of the system, the Federal Reserve Bank of New York had remarked that:<sup>123</sup>

The proposed book-entry procedure is designed to help the Treasury Department and the Federal Reserve Banks handle a large volume of Treasury securities through the use of modern high-speed data-processing equipment. Use of the new procedure should lead to increased efficiency in the handling and servicing of Treasury securities by the Federal Reserve Banks.

and it had noted that:

While the book-entry procedure will initially be applied only to Treasury securities held by Federal Reserve Banks for the purposes noted, it is hoped that the procedure may ultimately be extended to Treasury securities held for other purposes and depositors.

The New York Fed signaled the importance of the new system when it explicitly stated that, for the first time, it was prepared to safekeep (in its book-entry system) securities owned by member banks located in lower Manhattan.<sup>124</sup> Just as CPD transfers had eliminated distance as a significant factor in transferring Treasury securities, the book-entry system would eliminate vault space and coupon clipping as significant factors in holding Treasury securities.

The first fruits of the new system were modest: only \$2.6 billion of bearer bonds were converted to book-entry form at the Federal Reserve Bank of New York.<sup>125</sup> However, the system was soon expanded to include an additional \$16 billion of bonds held in accounts administered by the Secretary of the Treasury, for the Federal Reserve

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<sup>122</sup> Appendix to Subpart O of Treasury Department Circular No. 300 (promulgated November 7, 1967, effective January 1, 1968).

<sup>123</sup> FRBNY Circular No. 6022, August 21, 1967.

<sup>124</sup> FRBNY Circular No. 6075, December 12, 1967.

<sup>125</sup> Vollkommer (1970, p. 65).

retirement system, and for several supra-national agencies such as the International Bank for Reconstruction and Development and the International Monetary Fund.<sup>126</sup> As shown in Table II.2, by the end of 1968, the twelve Federal Reserve banks collectively had converted more than \$38 billion of Treasury securities to book-entry form.

### *The Second Implementation*

Eighteen months after the initial implementation of the Federal Reserve book-entry system, Treasury and the Federal Reserve banks extended the system in two important dimensions.<sup>127</sup> First, they provided that the system could be used for any Treasury securities deposited with a Federal Reserve bank for any purpose in an account maintained by the Reserve bank in its individual capacity and that the Reserve bank would continue to act in its individual capacity with respect to the book-entry securities in that account.<sup>128</sup> This clarified the ability of the Reserve banks to act in both their individual capacities and as agents of the Treasury, and enabled those banks to make the book-entry system available to state and local governments and foreign central banks, as well as for securities deposited in connection with the performance of an obligation under federal, state, or local law, such as collateral to secure deposits of trust funds in the commercial banking departments of member banks.<sup>129</sup>

Second, Treasury extended the scope of its pre-emption of state law on security interests to include *all* pledgees of book-entry Treasury securities, regardless of the identity of the pledgee.<sup>130</sup> This enabled the Federal Reserve Bank of New York to

<sup>126</sup> Rassnick (1969, p. 3), Vollkommer (1970, p. 66), and Cieurzo (1971). These accounts were separate from the three accounts specifically authorized in the initial implementation of the book-entry system and were authorized by 31 CFR 306.117(b) (January 1, 1968) (“The book-entry procedure may be applied to any Treasury securities ... for any other purpose under such terms and conditions as may be prescribed by the Reserve Bank with the approval of the Secretary of the Treasury.”)

<sup>127</sup> Subpart O of Treasury Department Circular No. 300 (promulgated June 13, 1969, effective July 15, 1969), and FRBNY Operating Circular No. 21 (effective August 1, 1969). See also FRBNY Circular No. 6379, August 1, 1969.

<sup>128</sup> 31 CFR 306.117(b) (July 15, 1969) and FRBNY Operating Circular No. 21, section 2(b) (effective August 1, 1969).

<sup>129</sup> Rassnick (1969, pp. 7-8).

<sup>130</sup> 31 CFR 306.118 (July 15, 1969).

include in the book-entry system securities held for the System Open Market Account.<sup>131</sup> In January 1970, \$56 billion of bearer securities held for the System Open Market Account were converted to book-entry form.<sup>132</sup>

As shown in Table II.2, by the end of 1970, the Federal Reserve book-entry system accounted for \$121 billion of Treasury securities, almost half of the \$248 billion of marketable Treasury debt outstanding. Virtually all of the securities formerly held in the vaults of the Reserve banks had been converted. Thus, the Federal Reserve had accomplished three of the objectives that it had identified in 1963: reducing the risk of misplacing securities that it held as custodian or pledgee, reducing the cost of clipping coupons, and relaxing the constraints imposed by limited vault space.

However, much remained to be done with respect to the fourth objective: reducing the risk and cost of transferring securities. Three important categories of Treasury securities remained entirely outside the book-entry system: securities owned by member banks for trading (rather than investment) purposes, securities held at member clearing banks for the account of nonbank dealers, and securities owned by other customers of member banks and safekept in member bank vaults.<sup>133</sup> Purchases and sales of securities in all of these categories were still settled with costly deliveries of bearer bonds. The delay in bringing dealer securities into the book-entry system was especially important because dealer transfers represented a large fraction of all transfers of Treasury securities.

In addition, banks in New York and other financial centers had generally declined to deposit Treasury securities owned for investment purposes in book-entry accounts because they believed the cost of complying with the IRS regulation governing the identification of securities in such accounts was excessive.<sup>134</sup> Relaxing the IRS

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<sup>131</sup> Rassnick (1969, pp. 7 and 10). Securities in the System Open Market Account are pledged against currency issues of the Federal Reserve banks.

<sup>132</sup> Vollkommer (1970, p. 67).

<sup>133</sup> Rassnick (1969, pp. 13-14), Debs (1970, pp. 13-16), and Vollkommer (1970, p. 70).

<sup>134</sup> Rassnick (1969, p. 9), Debs (1970, p. 10), and Vollkommer (1970, p. 68).

regulation could induce the banks to convert a significant quantity of securities to book-entry form.

*The Insurance Crisis and the Accelerated Expansion of the System*

Interest in further expansion of the Fed's book-entry system increased sharply in late 1970, when Continental Insurance Company, the primary writer of the "blanket bond" insurance policies that covered thefts of securities and related losses at banks, announced that it would severely restrict or terminate coverage in January 1971.<sup>135</sup> Continental's action came after a series of large and well-publicized losses of bearer Treasury securities, including \$13.2 million of bills from Morgan Guaranty Trust Company in October 1969.<sup>136</sup> John Carlock, the Fiscal Assistant Secretary of the Treasury, later estimated that about \$30 million in bearer Treasury securities were lost or stolen in 1969.<sup>137</sup> Continental's announcement threatened to place severe limits on trading in Treasury securities, because dealers and clearing banks could hardly bear (without insurance) the risk of losses of the magnitudes that had been occurring.<sup>138</sup>

The threat to the liquidity of the Treasury market infused the Federal Reserve and the Treasury with a renewed sense of urgency in expanding the Federal Reserve's book-entry system. Treasury announced that it would soon promulgate revised tax rules that would make it easier for banks and dealers to move their securities into the Fed's book-entry system, and the Federal Reserve said it would accelerate efforts to expand the system to include dealer securities.<sup>139</sup> In the closing days of 1970, Continental agreed

<sup>135</sup> Debs (1972, p. 180) (timetable for expansion of book-entry system "greatly accelerated" by the insurance crisis) and Ringsmuth and Rice (1984, pp. 15-16) ("The significance of the crisis was that it provided momentum which swept away resistance to the novelty of book-entry procedure[s]...").

<sup>136</sup> "Market Place," *New York Times*, October 30, 1969, p. 68. See also "Stolen Securities Master List Urged," *Journal of Commerce*, June 10, 1970, p. 1.

<sup>137</sup> "Small-Bond Thefts Up Sharply, Treasury Aides Tell Senate Unit," *New York Times*, June 11, 1970, p. 49.

<sup>138</sup> "Loss of Insurance," *New York Times*, December 6, 1970, section 3, p. 2 and Debs (1972, p. 180) (noting the risk that "major participants in the market would terminate operations, and the market would cease to function.")

<sup>139</sup> "Treasury Announces Move to Thwart Securities Theft," *New York Times*, December 21, 1970, p. 61 and "U.S. Help Readied for Bond Market," *New York Times*, December 23, 1970, p. 1.

that it would continue coverage until the beginning of April to give the Treasury and the Fed time to act.<sup>140</sup>

IRS action to facilitate the inclusion of member bank securities held for investment purposes, as well as dealer securities held for trading purposes, in the book-entry system came quickly. The IRS relaxed the identification rule for book-entry securities held for investment purposes on December 31, 1970,<sup>141</sup> and it published a rule facilitating the inclusion of trading account securities in a book-entry system on January 18, 1971.<sup>142</sup> During the first quarter of 1971, the Federal Reserve Bank of New York worked with the GSCA banks to bring dealer securities held for trading purposes into the book-entry system.<sup>143</sup> The initial effort to extend the system focused on the GSCA banks because those banks “were the most vulnerable to the problem of insurance coverage.”<sup>144</sup> By early August 1971, nine of the twelve GSCA banks had established a total of sixteen dealer and customer book-entry accounts and deposited \$3 billion of securities in the accounts.<sup>145</sup>

The expansion of the book-entry system to GSCA banks in 1971 allowed the New York Fed to acquire experience operating a system that included securities owned by

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<sup>140</sup> “Bond Insurance Sought in Talks,” *New York Times*, December 24, 1970, p. 29 and “Continental Insurance Reaches Interim Bond Pact With Banks,” *New York Times*, December 25, 1970, p. 47.

<sup>141</sup> Treasury Department Decision 7081, published in the Federal Register on December 31, 1971. The revised rule provided that a book-entry security in a member bank’s custodial account could be identified at the time it is sold by reference to its purchase date and cost or to a serial number assigned by the bank at the time it was purchased. The reference could be made either in a written instruction of sale or in a list supplied to the Reserve bank maintaining the book-entry record. See also Revenue Ruling 71-21, published in Internal Revenue Bulletin 1971-3, January 18, 1971.

<sup>142</sup> Revenue Ruling 71-15, published in Internal Revenue Bulletin 1971-3, dated January 18, 1971.

<sup>143</sup> FRBNY Circular No. 6718, April 26, 1971. (“Since December, this Bank has been working with the banks participating in the Clearing Arrangement, as well as the Association of Primary Dealers in U.S. Government Securities, with a view to determining general procedures for establishing the necessary new book-entry accounts and to integrating such accounts into the Clearing Arrangement. Such procedures have been agreed to, and the extended book-entry procedure is available to the twelve New York City banks participating in the Clearing Arrangement.”) See also FRBNY Circular No. 6976, July 21, 1972 (“During the past year, the [book-entry] program has been gradually extended to cover the securities held by [GSCA] banks (a) for account of their customers, including customers which are nonbank dealers in Government securities, and (b) as their ‘dealer’ inventory in those cases in which the bank is a primary dealer in Government securities.”)

<sup>144</sup> Debs (1972, p. 181).

<sup>145</sup> Debs (1971).

customers of member banks as well as securities owned by member banks themselves and was viewed “as a means of experimenting with the new procedures and developing a basic pattern of book-entry accounts that could accommodate the operations of all member banks.”<sup>146</sup> Additionally, it allowed the New York Fed to integrate its book-entry system with the CPD transfer facility that continued to lie at the heart of the GSCA.<sup>147</sup> Most importantly, outgoing CPD transfers could now be charged promptly to a bank’s book-entry account, and incoming transfers could be credited promptly, rather than settled with a physical delivery of bearer bonds at the end of the day.<sup>148</sup> (The Federal Reserve Bank of New York ultimately terminated the GSCA in December 1977 following continued integration of securities transfers and the book-entry system.<sup>149</sup>)

Expanding the book-entry system to include all Treasury securities held by all member banks for all of their customers took two more years, but the expansion was finally completed in March 1973.<sup>150</sup> As shown in Table II.2, the completion of the system architecture led to a gradual expansion in the fraction of marketable Treasury debt held in book-entry form to 65% at the end of 1973 and 78% at the end of 1975. By the end of 1980, almost 94% of marketable Treasury debt was held in book-entry form.

### *The Demise of Definitive Securities*

As more and more Treasury securities were converted to book-entry form in the mid-1970s, Treasury officials began to contemplate the complete elimination of

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<sup>146</sup> Debs (1972, p. 181). See also FRBNY Circular No. 6076, July 21, 1972 (“In the light of the operating experience with the first phase of the program during the past year, operating procedures and book-entry account patterns have been developed to serve as a basis for the extension of the [book-entry system] to all member banks throughout the country.”)

<sup>147</sup> Close integration began with the installation in early 1971 of the Sigma V computer noted in the appendix. Debs (1970, pp. 4-7 and 12-14, and 1972, p. 181).

<sup>148</sup> The New York Fed instituted “real-time” accounting for book-entry securities in early 1974 (Hoey, 1974).

<sup>149</sup> Powers (1977).

<sup>150</sup> Subpart O of Treasury Department Circular No. 300 (promulgated March 9, 1973, effective March 30, 1973), and FRBNY Operating Circular No. 21 (effective March 30, 1973). See also FRBNY Circular No. 7112, March 19, 1973.

definitive securities in new debt offerings.<sup>151</sup> In August 1976, Treasury announced that it would stop issuing bearer 52-week bills before the end of the year and that it would stop issuing bearer 13- and 26-week bills in 1977.<sup>152</sup> Treasury stopped issuing bearer bonds in September 1982 and it did not issue bearer notes after December 31, 1982.<sup>153</sup>

The final step in the dematerialization of Treasury securities came in August 1986, when Treasury announced that it had implemented a new book-entry system, TreasuryDirect, designed to accommodate retail investors, and that it would not subsequently issue notes or bonds in registered form.<sup>154</sup>

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<sup>151</sup> FRBNY Circular No. 7858, April 20, 1976 (reporting that Treasury and the Federal Reserve would “design and adopt an expanded book-entry system with the ultimate objective of completely eliminating the use of definitive securities in new public debt borrowings.”)

<sup>152</sup> FRBNY Circular No. 7939, August 20, 1976. The last bearer 52-week bill was issued on November 15, 1976 and matured on November 15, 1977. The last bearer 26-week bill was issued on May 26, 1977 and matured on November 25, 1977, and the last bearer 13-week bill was issued on August 25, 1977 and also matured on November 25, 1977.

<sup>153</sup> FRBNY Circular No. 9363, September 15, 1982. Manypenny (1986) examines the 1976-86 transition to a book-entry-only Treasury securities market.

<sup>154</sup> FRBNY Circular No. 10,058, July 17, 1986 and Circular No. 10,064, July 31, 1986.

### **III. The Federal Reserve's Securities Lending Program: An Institutional Innovation to Mitigate Settlement Fails**

Summary: The Federal Reserve initiated its securities lending program in 1969 to stem a rising tide of settlement fails in the Treasury market. The fundamental objective of providing a supplementary source of collateral to dealers who might otherwise fail to make deliveries has remained a core aspect of the program. The 1999 revision expanded the effective breadth of the program, replacing the “tap” borrowing process that characterized the original program with a competitive auction and making securities in the Federal Reserve’s portfolio more accessible to dealers financing conventional short positions. In addition to contributing to the reduction of settlement fails that arise in the normal course of trading, the Fed’s securities lending program has been valuable because it can be expanded quickly in times of crisis. It is doubtful that the Fed could have initiated a securities lending program from scratch in time to mitigate the settlement problems that followed in the wake of the terrorist attacks on the World Trade Center in 2001.

A settlement fail occurs when a seller does not deliver securities to a buyer on the date originally scheduled. Some fails are an inevitable by-product of trading; attributable in the first instance to miscommunication or operational problems. However, most fails occur when a dealer can not deliver securities because it failed to receive the same securities in settlement of an unrelated purchase. Such “daisy chain” fails can sometimes cascade, impairing market liquidity and distorting securities prices.

Daisy chain fails can be cured if a dealer can borrow the securities that failed to arrive and deliver the borrowed securities. (The dealer terminates the borrowing by returning the borrowed securities when it subsequently receives the securities that it purchased.) Concern over a rising tide of settlement fails in 1969 led the Federal Reserve to initiate a program to lend Treasury securities from its System Open Market Account portfolio. The Fed revised the program in 1999 by, among other things, introducing daily

auctions to make loan pricing a competitive process. The Fed’s securities lending program has since become an important part of the Treasury market; securities lending by the Fed averaged \$1.5 billion per day between April 1999 and the end of 2002.

This chapter describes the origin and subsequent evolution of the Federal Reserve’s securities lending program.<sup>155</sup> The first two sections set the stage. Section 1 describes how market participants borrow bonds on special collateral reverse repurchase agreements and collateralized loans, and it describes the characteristics of supply, demand, and equilibrium in the securities lending markets. Section 2 explains settlement fails and shows how a dealer can cure a fail by borrowing the securities needed to make delivery. Section 3 outlines the history of the Federal Reserve’s securities lending program, including both the origin of the program in 1969 and the 1999 revision. Section 4 presents some summary data that illustrate how dealers use the revised program. Section 5 concludes.

### **1. Borrowing Treasury Securities**

Dealers and others borrow Treasury securities primarily to deliver against short sales. A short sale is a sale of securities that the seller does not own and has to borrow to make delivery. A short sale may be executed in the belief that the price of a security will be lower in the future, in the course of putting on a “spread” trade (where one security is purchased and another sold short in anticipation of a change in the relative prices of the securities),<sup>156</sup> as a hedge against another position – such as a long position in corporate bonds or mortgage-backed securities,<sup>157</sup> or as a result of a dealer accommodating the purchase interests of a customer. The short seller returns the borrowed securities when it closes out its short position with an offsetting purchase.

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<sup>155</sup> This chapter draws extensively from Fleming and Garbade (2002, 2003).

<sup>156</sup> Spread trades are discussed in Garbade (1996, ch. 11).

<sup>157</sup> Fernald, Keane, and Mosser (1994) discuss hedging mortgage-backed securities with Treasury issues, Kambhu (1998) and Kambhu and Mosser (2001) discuss hedging interest rate options, and Garbade (1996, ch. 12) discusses hedging other Treasury securities

Treasury dealers commonly borrow Treasury securities with reverse repurchase agreements. To borrow a security on a reverse repo, a dealer buys the security from a holder (typically for same-day settlement) and simultaneously agrees to return the security to the seller at a higher price on a future date. The transaction is tantamount to borrowing securities against lending money. The counterparty executes a repurchase agreement, lending securities against borrowing money.

### *Incentivizing Holders to Lend Securities*

Institutional investors like pension funds and fixed income mutual funds own Treasury securities and are in a position to lend them to dealers. However, one might wonder why such an investor would want to borrow a dealer's money. The answer lies in the distinction between a general collateral repo and a special collateral repo.

A *general collateral* repo is a repurchase agreement in which the lender of funds is willing to accept any of a variety of securities as collateral. The lender is concerned primarily with earning interest on its money and having possession of securities that can be sold quickly and at reasonably predictable prices in the event of a default by the borrower. Interest rates on overnight general collateral RPs are usually quite close to contemporaneous rates on overnight loans in the federal funds market. This reflects the essential character of a general collateral RP as a device for borrowing and lending money.

A *special collateral* repo is an RP in which the lender of funds wants to borrow a particular security. The rate on a special collateral repo is commonly called a "specials" rate. Each Treasury security has its own specials rate. This reflects the essential character of a special collateral RP as a device for borrowing and lending securities, rather than borrowing and lending money.

The owner of a Treasury security that a dealer wants to borrow may not have any particular interest in borrowing the dealer's money, but can nevertheless be induced to

lend the security if it is offered an opportunity to borrow at a specials rate below where it can relend the same funds on a general collateral RP. For example, if the rate on a special collateral RP is 2% and the general collateral RP rate is 3%, then — as shown in Figure III.1 — an investor can earn a 100 basis point spread by borrowing money on the special collateral RP and relending the money on a general collateral RP.

*The Specials Rate for a Security and the “Specialness” of the Security*

The difference between the general collateral RP rate and the specials rate for a security is a measure of the “specialness” of the security.<sup>158</sup> If the demand to borrow a security is modest relative to the supply of the security available for lending, a borrower of the security will usually be able to lend its money at a rate no lower than about 15 to 25 basis points below the general collateral rate.

If the demand to borrow a security is strong, or if the supply of the security available for lending is limited, the specials rate for the security may be materially below the general collateral rate and the specialness spread correspondingly large. In this case a dealer borrowing the security has to sacrifice a significant portion of the interest that it could have earned from lending its money in the general collateral market. Conversely, a holder of the security will be rewarded with a “bargain” loan rate.

In cases of exceptionally strong demand, or exceptionally limited supply, the specials rate for a security can be driven to zero or nearly zero. Figures III.2 and III.3 show specials rates for “on-the-run,” or most recently issued, 5- and 10-year notes, respectively, from mid-July 1999 to the end of 2002. The figures show several instances of specials rates close to zero, including the period from late January to early February, 2001 for the 5-year note and the period from late April to early May, 2001 for the 10-year note. Other instances of extremely low specials rates have been documented by Cornell

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Duffie (1996), Keane (1996), Jordan and Jordan (1997), and Fisher (2002).

and Shapiro (1989), Jordan and Jordan (1997, pp. 2058-2059), and Fleming (2000, pp. 229-231).

Supply, Demand, and Equilibrium in a Specials Market. The specialness spread for a security is the economic price of, or fee for, borrowing the security. The spread fluctuates to balance the demand for borrowing with the supply available for lending. *Ceteris paribus*, a larger spread elicits greater supply because it offers a greater reward to owners of the security who borrow funds in the specials market (thereby lending the security) and relend the funds in the general collateral market.

A larger spread also reduces the demand for borrowing a security. We noted above that borrowing demand stems primarily from the need to finance short sales. *Ceteris paribus*, a larger specialness spread increases the cost of financing a short position and reduces the attractiveness of being short.

#### *Borrowing Bonds Directly*

Market participants also borrow Treasury securities by pledging collateral and paying a fee to a lender. This arrangement accommodates investors who can not borrow money (as is the case with some institutional investors) and thus can not lend securities on repurchase agreements. Pledging collateral and paying a fee to a securities lender is economically equivalent to reversing in the securities on a special collateral reverse RP and funding the money lent by borrowing money on a general collateral RP with the same counterparty. Consequently, the fee paid to borrow a security is typically about the same as the contemporaneous specialness spread for the security.

## **2. Settlement Fails**

Although relatively few transactions in Treasury securities fail to settle as originally scheduled, settlement fails do occur fairly regularly. During the interval from

January 1999 to the end of 2002, settlement fails in Treasury securities at dealers with a trading relationship with the Fed – so-called “primary” dealers – averaged \$11.2 billion per day. Figure III.4 shows the behavior of fails over that interval. The heavy volume of fails during the month following the terrorist attacks on the World Trade Center on September 11, 2001, is clearly visible. Repercussions from the attacks persisted until Treasury reopened the on-the-run 10-year note on Thursday, October 4, 2001.<sup>159</sup>

Fails occur for a variety of reasons. One source of fails is miscommunication. For example, a buyer and seller may fail to communicate the same details of a transaction to their respective operations departments. On the settlement date the seller’s back office may deliver what it believes is the correct quantity of the correct security and claim what it believes is the correct payment, but the buyer’s back office will reject the delivery if it has a different understanding of the transaction. If the rejection occurs late in the day, there may not be enough time for the parties to resolve the misunderstanding.

In some cases a seller or a seller’s custodian may be unable to deliver securities because of operational problems. In an extreme example, a computer problem at Bank of New York on November 21, 1985 prevented the bank from issuing instructions to Fedwire (the Federal Reserve’s book-entry and securities transfer system) to deliver securities from its custodial accounts. The bank was unable to resolve the problem until the following day. In the interim, it had to finance (at its own expense) the securities that it was unable to deliver. It borrowed in excess of \$20 billion from the Federal Reserve Bank of New York and incurred interest expenses of about \$5 million.<sup>160</sup>

Finally, and most commonly, a seller may be unable to deliver securities because of a failure to receive the same securities in settlement of an unrelated purchase. This can lead to a daisy chain of cumulative fails: A’s failure to deliver bonds to B causes B to fail

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<sup>159</sup> Fleming and Garbade (2002) discuss settlement fails in the Treasury market following the attacks of September 11 and the contribution of the reopening of the on-the-run 10-year note to the resolution of the fails problem.

<sup>160</sup> “A Computer Snafu Snarls the Handling of Treasury Issues,” *Wall Street Journal*, November 25, 1985, p. 58, Corrigan (1986), Sender (1986), and Volcker (1986).

on a sale of the same bonds to C, causing C to fail on a similar sale to D, and so on. This was an important reason for the persistence of a heavy volume of settlement fails in the weeks after September 11, 2001.

### *The Cost of a Fail*

Treasury market participants recognize that miscues and operational problems occur from time to time and have adopted the convention of allowing a failing seller to make delivery the next business day at an unchanged invoice price.<sup>161</sup> Settlement fails are not, however, costless.

The most important cost of a fail is that the seller loses the time value of the invoice price over the interval of the fail.<sup>162</sup> This implicit penalty (which can be quantified as the interest that could have been earned on the proceeds of the sale while the fail remained uncorrected) provides an incentive for a seller to avoid and cure fails. (There is an exactly offsetting benefit to a buyer who fails to receive securities and therefore does not have to pay for them as soon as originally scheduled: it can invest the invoice price until the securities arrive.<sup>163</sup>)

A fail also exposes both the buyer and the seller to replacement cost risk. The buyer faces the risk that the seller may become insolvent before settlement and that the price of the security may increase prior to the seller's insolvency. Conversely, the seller faces the risk that the buyer may become insolvent and that the price of the security may decline prior to the buyer's insolvency. The significance of replacement cost risk exposure may be small for a fail that does not last more than a few days, but it increases as a fail continues. Aged fails generally prompt market participants to step up their

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<sup>161</sup> Public Securities Association (1993, chapter 8, section C).

<sup>162</sup> This cost may be reimbursed by the buyer if the buyer's actions caused the fail (e.g., by improperly rejecting securities properly tendered by the seller), or by a third party if the third party's actions caused the fail (e.g., a custodian who failed to deliver securities pursuant to valid instructions from the seller).

<sup>163</sup> Stigum (1988, pp. 181-185) and DeGennaro and Moser (1990) describe the relationship between fails and dealer behavior.

monitoring of counterparties. The increased monitoring may start with nothing more than a phone call to identify whether there has been a misunderstanding, but it can escalate to credit reviews and requests for ad hoc mark-to-market price adjustments. Additionally, the net capital requirement for regulated brokers and dealers adopted by the Securities and Exchange Commission assesses capital charges for two types of aged fails.<sup>164</sup>

### *Avoiding and Curing Fails*

Fails attributable to miscues and operational problems are usually resolved as soon as the underlying cause is identified and corrected and rarely last for more than a day or two. Fails stemming from an inability to deliver securities because of a failure to receive the same securities can be more persistent but can – as illustrated in Figure III.5 – be cured (or avoided entirely) by reversing in, or borrowing directly, the securities needed for delivery. A market participant with offsetting fails is usually better off paying a borrowing fee or earning a specials rate below the general collateral rate on the money it lends out against reversing in the securities needed to make a delivery. The alternative is to fail and forgo interest altogether on the sale proceeds.

### *When Fails Can Become Chronic*

The incentive of a seller to borrow securities to avoid or cure a fail declines with the specials rate for the security. When the specials rate is near zero, a seller has little to gain lending money (at nearly no interest) to borrow the needed securities. This suggests, inter alia, that market participants may have little incentive to break a daisy chain when the specials rate for a security is near zero.

A specials rate near zero becomes increasingly likely when there is strong demand for borrowing a security. We pointed out in section 1 that demand for a security will be

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<sup>164</sup> 17 CFR 240.15c3-1(c)(2)(iv)(E) and 17 CFR 240.15c3-1(c)(2)(ix).

strong when there is substantial short interest in the security (due to hedging requirements or expectations of interest rate changes). Such short interest is usually concentrated in highly liquid on-the-run issues. This suggests why specials rates for on-the-run 5- and 10-year notes fall (see Figures III.2 and III.3) and fails rise (see Figure III.4) around mid-quarter refunding auctions, a time when market participants are actively engaged in taking positions based on their assessments of the relative values of different securities and the prospect for change in the level and shape of the yield curve.<sup>165</sup>

### **3. The Federal Reserve's Securities Lending Program**

The idea of a Federal Reserve securities lending program can be traced back to the 1950's. Ownership of intermediate- and long-term Treasury notes and bonds was migrating from banks to pension funds and other emerging classes of institutional investors and some of the new money managers were less than prompt in obtaining authorization to lend the investments that they managed. The shrinking stock of loanable securities led to a rising incidence of settlement fails. The fails problem in turn led to a decline in market liquidity as dealers became reluctant to accommodate customer purchase interests if they did not already have actual possession of the securities that customers wanted to buy.<sup>166</sup> Some market participants advanced proposals to allow dealers to borrow securities from the single largest owner of Treasury securities, the Federal Reserve's System Open Market Account (SOMA),<sup>167</sup> but none came to fruition until 1969.

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<sup>165</sup> See Garbade (1996, chapter 8).

<sup>166</sup> U.S. Treasury and Federal Reserve System (1959, pp. 23-24), Meltzer and von der Linde (1960, pp. 94-95), and Federal Reserve Bank of New York (1962).

<sup>167</sup> U.S. Treasury and Federal Reserve System (1959, pp. 23-24), Federal Reserve Bank of New York (1962, 1967), Federal Open Market Committee (1968a, pp. 95-99 and 1968b, pp. 70-81), and U.S. Treasury and Federal Reserve System (1969, p. 18).

### *The 1969 Program*

The spring of 1969 witnessed a sharp increase in fails. To deal with the problem, dealers began to stretch out delivery times and declined to enter into transactions for same-day settlement with other than their best customers.<sup>168</sup> The Manager of the System Open Market Account expressed concern that further degradation of the settlement process might leave dealers reluctant to trade with the Fed for same-day settlement and thus might impair the ability of the Fed to achieve its policy objectives. His concerns provided the impetus for the Federal Open Market Committee (FOMC) to approve a modest securities lending program.<sup>169</sup>

The 1969 program provided for lending Treasury securities on a demand, or “tap,” basis to primary dealers at a fixed fee of 75 basis points per annum for a term of up to three business days. The program was not intended to be an instrument of monetary policy and was designed to function without affecting the market for reserve balances. In particular, the Fed did not lend securities against borrowing money on repurchase agreements (which would have had the effect of draining reserves from the banking system). Instead, dealers had to collateralize their securities borrowings with other Treasury securities of comparable value.

The 1969 program limited dealer borrowings in several respects. A dealer could not borrow more than \$50 million face amount of any single bill or more than \$10 million principal amount of any note or bond, and it could not borrow more than \$75 million of securities in aggregate.<sup>170</sup> Additionally, a dealer had to certify that it was borrowing to replace securities that a seller had failed to deliver and not to finance a short sale, and that

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<sup>168</sup> Vollkommer (1970, p. 11).

<sup>169</sup> Federal Open Market Committee (1969a, pp. 79-85, 1969b, pp. 94-97, 1970). See also Federal Reserve Bank of New York Circular No. 6321 (“Problem of ‘Fails’ in U.S. Government Securities Market,” April 17, 1969) for further evidence of Federal Reserve concern with Treasury fails.

<sup>170</sup> The lending limits were suspended briefly when Drysdale Government Securities, Inc. failed (“Short-Term Interest Rates Plunge as Fed Injects Reserves Due to Drysdale Problems,” *Wall Street Journal*, May 21, 1982, p. 45.), when Hurricane Gloria disrupted New York financial markets in 1985 (Federal Open Market Committee, 1985), and following the break in the stock market in 1987 (Federal Open Market Committee, 1987).

it had not been able to borrow the securities elsewhere. The certifications were intended to limit loans to a purpose – avoiding and curing settlement fails – closely associated with the execution of monetary policy and to limit the Fed’s role to that of lender of last resort.<sup>171</sup> The loan fee was set 25 basis points higher than the 50 basis point fee usually charged by private lenders at that time to further limit competition with those lenders and to reinforce the Fed’s position as a lender of last resort.

### *The 1999 Revision*

As a consequence of the growth in trading of Treasury securities and in the size and complexity of the securities lending market during the 1980s and 1990s, the Federal Reserve revised its lending program in April 1999. Dealer limits were increased substantially and an auction mechanism was introduced to make loan pricing and security allocation a competitive process. The certification requirements were eliminated, but loans were limited to a single business day to make the program relatively unattractive to dealers financing short sales for a purpose other than to accommodate customer purchase interests.<sup>172</sup>

At noon each business day the Fed offers to lend up to 65% of the amount of each Treasury security beneficially owned by SOMA, subject to an upper limit of the amount of an issue actually in SOMA’s account, i.e., not already out on loan. (As shown in Table III.1, the terms of the program have been modified several times since 1999. The text describes program provisions as of the end of 2002.) Primary dealers bid for a loan of a specific security by specifying the quantity desired (in increments of \$1 million) and a

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<sup>171</sup> In 1974 the FOMC discussed eliminating the certification requirements and allowing dealers to use the loan facility to finance short sales. The Committee ultimately chose to leave the requirements in place because elimination might be interpreted as facilitating the expression of bearish market sentiments and because retention would not have adverse consequences for the ability of the Fed to achieve its policy objectives. Federal Open Market Committee (1974, pp. 23-31).

<sup>172</sup> Federal Reserve Bank of New York (1999). Short sales to accommodate customer purchase interests are usually covered within a day or two and are commonly financed with overnight borrowings. Short sales executed as a hedge or as part of a spread trade are commonly financed with open or term borrowings.

loan fee (in increments of one basis point). The Fed imposes a minimum loan fee of 1% to deter dealers from borrowing securities from the Fed that are not on special and that are readily available from private lenders. Bids are accepted until 12:15 p.m.

After the close of an auction, loans are awarded to the highest bidders at their bid rates until all of the securities available for lending have been allocated or all of the bidders have been satisfied. Awards are subject to the limitations that a dealer can not borrow more than \$200 million of any single issue or more than \$1 billion of securities in aggregate. Within minutes of the auction close the Fed informs each participating dealer which of its bids were accepted and which were rejected. It also announces publicly the total amount lent of each security and the weighted average loan fee for each security.

#### *Why Dealers Borrow Securities from the Federal Reserve*

Dealers borrow securities from the Fed to satisfy late-appearing borrowing demands, to reduce their financing costs, and to earn arbitrage profits. Over-the-counter trading in securities loans and special collateral RPs begins at about 7:00 a.m. New York time and remains quite active until about 10:30 a.m. Liquidity declines after 10:30 as market participants begin to settle the day's commitments by delivering and receiving securities.<sup>173</sup> If a dealer determines late in the morning that it needs to borrow a security, it may not be able to locate an owner willing and able to deliver the required quantity on the same day. The dealer may then choose to submit a bid in the Fed's auction. The Fed purposely set the time of its auctions after the interval of greatest activity in the private

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<sup>173</sup> The late morning decline in liquidity became more pronounced during the second half of the 1990s, when dealers began financing their long and short positions earlier in the day following the imposition in 1994 by the Federal Reserve of charges for daylight overdrafts in the reserve accounts of depository institutions and the prospect that dealer clearing banks would pass on such charges to their customers (Federal Reserve Bank of New York, 1995, pp. 19-23). This prompted the Fed to advance the time at which it enters the market to supply reserves to the banking system by lending on overnight RPs. By 1999 the Fed was typically entering at 9:30 a.m. "to arrange its operations at a time of day when financing markets are more active and liquid." (Federal Reserve Bank of New York, 2000, p. 2.) Prior to 1997, the Fed usually entered the market at about 11:30 a.m. (Federal Reserve Bank of New York, 1997, pp. 4-5).

collateral markets to give dealers relatively late (in the day) access to a supplementary source of securities and to position the Fed as a lender of last resort.

Dealers also anticipate auction outcomes when they borrow and lend collateral earlier in the day. In particular, they seek to lend securities at specials rates lower than those consistent with expected auction loan fees (thereby attempting to earn arbitrage profits) and they abstain from borrowing needed securities at such rates (thereby attempting to reduce their financing costs). A dealer might, for example, lend a security (or abstain from borrowing a security) at a specials rate of 1% at 9:00 a.m. when the general collateral rate is 3% (i.e., at a specialness spread of 2%) if it believes it will be able to borrow the same security from the Fed for a fee of 1-1/4%. Thus, auction activity reflects earlier trading in the specials market as well as late-appearing borrowing needs.<sup>174</sup>

#### **4. Characteristics of Lending, April 1999 – December 2002**

Between April 26, 1999 (the first day of lending under the revised program) and December 31, 2002, the Federal Reserve conducted a total of 928 securities auctions. Dealers borrowed at least one Treasury security in 881 (95%) of the auctions.

Figure III.6 shows the number, and Figure III.7 shows the aggregate value, of securities borrowed each day. The only clearly anomalous sub-interval is the month between September 11 and the reopening of the on-the-run 10-year note on Thursday, October 4, 2001. The balance of the discussion in this section excludes this atypical interval.

Dealers borrowed an average of 4.1 different issues with an aggregate value of \$1.4 billion per auction in the 909 auctions held between April 26, 1999 and December 31, 2002 (excluding the interval from September 11 to October 5, 2001). Treasury notes

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<sup>174</sup> Fleming and Garbade (2003) examine the relationship between the over-the-counter collateral loan market and the Fed's securities loan auctions.

accounted for the bulk of their borrowings: 86.0% by value. Treasury bills accounted for 11.6%; bonds accounted for 2.4%. The distribution of borrowings across bills, notes, and bonds reflects the declining importance of bills and bonds in Treasury financing operations between 1999 and 2002.<sup>175</sup>

Dealer demand to borrow notes is fairly evenly distributed across the three series of notes that Treasury issued during the sample interval. 2-year notes accounted for 24.6% of the aggregate value of note borrowings, 5-year notes accounted for 40.7%, and 10-year notes accounted for 34.8%.

However, within each series of notes there was far greater demand to borrow on-the-run and first-off-the-run notes compared with more seasoned issues. Table III.2 shows that dealers borrowed on-the-run 2-year notes in 19.4% of the 909 auctions between April 26, 1999 and December 31, 2002 (excluding the interval from September 11 to October 5, 2001) and that they borrowed first-off-the-run 2-year notes in 12.5% of the auctions. The incidence of borrowing more seasoned 2-year notes was sharply lower. In aggregate, dealers borrowed an average of \$930 million on-the-run 2-year notes if they borrowed any at all, and an average of \$608 million first-off-the-run 2-year notes. Average aggregate borrowings of more seasoned 2-year notes was materially lower. Tables III.3 and III.4 show that dealer demand to borrow 5-year and 10-year notes followed a similar pattern. These findings are consistent with the observation that on-the-run and first-off-the-run notes are extremely liquid and, therefore, especially likely to be sold short by a dealer hedging a position or speculating on a change in the relative values of two securities. This, in turn, makes them in demand – and expensive – in the collateral markets.

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<sup>175</sup> The bill maturing March 1, 2001 accounts for 35.1% of all bill borrowings over the sample period. The bill was the last 52-week bill issued on a 4-week cycle before Treasury reduced the issuance frequency to every 13 weeks. The bill became quite expensive in the special collateral repo market (Fleming, 2000).

#### IV. Innovations in Dealer Finance: Tri-party and GCF Repo

Summary: Tri-party repo and GCF Repo are institutional innovations designed to suppress an ancillary feature of DVP repo contracts – collateral specificity – that results in economically important transaction costs in the general collateral repo market. Tri-party repo is used by dealers borrowing from institutional lenders; GCF Repo is used in inter-dealer trading. Both innovations delay the time when collateral is assigned to a lender (thereby preserving borrower delivery options while the securities Fedwire is open) and both provide for daily morning reversals of loan balances and collateral (thereby restoring borrower control over collateral while the securities Fedwire is open). Additionally, GCF Repo supports net settlement of inter-dealer transactions and allows more liquid repo trading than is feasible with trade-by-trade settlement. By suppressing collateral specificity, GCF Repo reduces the transaction costs associated with inter-dealer DVP repo trading and gross trade-by-trade settlement.

A repurchase agreement (“repo” or “RP”) is a loan cast as a sale of securities combined with an agreement to repurchase the same securities at a higher price on a later date. Repurchase agreements are crucial to the efficient allocation of capital in the U.S. Treasury market. They provide a low-cost way for dealers to finance their marketmaking and risk management activities and they simultaneously provide a vehicle for mutual funds, corporations, and municipalities to lend surplus cash safely. The importance of the RP market is suggested by its immense size: dealers with a trading relationship with the Federal Reserve Bank of New York – so-called “primary” dealers – reported financing a total of \$2.48 trillion in Treasury and other fixed-income securities with RPs at the end of 2002.<sup>176</sup>

Repurchase agreements come in a variety of flavors. The best-known is deliver-versus-pay, or “DVP,” repos, where the borrower initially delivers securities to the lender

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<sup>176</sup> *Federal Reserve Bulletin*, April 2003, p. A27, Table 1.43, “U.S. Government Securities Dealers, Positions and Financing.” The repo financing is the sum of lines 33 and 34 for the column headed December 25, 2002.

against payment of the principal amount of the loan and where the lender subsequently redelivers the securities back to the borrower against payment of interest and repayment of principal. Although widely used, DVP repos impose several economically important transaction costs on borrowers and lenders. The costs arise from the requirement that a borrower and lender have to agree on the identity of the securities that they will deliver and redeliver, respectively. Since lenders frequently have no economic interest in the specific identity of the securities, the transaction costs constitute a net loss.

This chapter describes two institutional innovations; tri-party repo and GCF Repo, designed to overcome some of the transaction costs associated with DVP repos.<sup>177</sup> Section 1 reviews the structure of repurchase agreements and section 2 identifies the transaction costs that are of present interest. Sections 3 and 4 describe the innovations designed to overcome those costs. Section 5 concludes.

## 1. Repurchase Agreements

A repurchase agreement is similar to a secured loan. As illustrated in Figure IV.1, a dealer can borrow \$10 million overnight at an interest rate of 3% per annum by selling Treasury securities worth \$10 million and simultaneously agreeing to repurchase the same securities the next day for \$10,000,833 ( $10,000,833 = 10,000,000 + \frac{1}{360} \cdot 3\%$  of \$10,000,000). The proceeds of the initial sale is the principal amount of the loan; the excess of the repurchase price over the sale price is the interest paid on the loan. Importantly, the lender has possession of the dealer's securities during the term of the loan. If the dealer defaults on its repurchase obligation, the lender can sell the securities and use the proceeds to satisfy its claim for repayment.

A *general collateral* repurchase agreement is a repo in which the lender is willing to accept any of a variety of Treasury and other related securities as collateral. The class of acceptable collateral might be limited to Treasury securities maturing in less than ten

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<sup>177</sup> This chapter draws extensively from Fleming and Garbade (2003).

years, it might include all Treasury securities, or it might extend to Federal agency as well as Treasury securities. The lender is concerned primarily with earning interest on its money and having possession of assets that can be sold quickly with minimal transaction costs in the event of a default by the borrower. Interest rates on overnight general collateral RPs on Treasury securities are usually quite close to rates on overnight loans in the federal funds market. This reflects the essential character of a general collateral RP as a device for borrowing and lending money.<sup>178</sup>

In the “textbook” description of a general collateral RP, the dealer and lender negotiate directly between themselves the principal amount, term, and interest rate of the loan, as well as the class of acceptable collateral. The negotiations take place early in the day, usually before 9:30 or 10 a.m. Sometime before 11 a.m. the dealer identifies to the lender the specific securities within the agreed-upon class of acceptable collateral that it intends to deliver.<sup>179</sup> The dealer delivers the securities to the lender against payment of the principal amount of the loan before the 3:30 p.m. close of Fedwire, the Federal Reserve’s book-entry and securities transfer system.<sup>180</sup> At the close of the RP the lender delivers the securities back to the dealer against repayment of principal and payment of interest at the negotiated rate. Because the settlements at both the start and close of the repo involve a delivery of securities against a payment of funds, the textbook example of a repo is frequently identified as a deliver-versus-pay (DVP) repo.

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<sup>178</sup> A *special collateral* repurchase agreement is an RP in which the lender of funds is seeking to borrow a particular security. It is, consequently, a device for borrowing and lending securities rather than borrowing and lending money. The rate on a special collateral RP can be materially below the general collateral repo rate and is sometimes zero or close to zero. Special collateral RPs are discussed in Duffie (1996), Keane (1996), Jordan and Jordan (1997), and Fisher (2002).

<sup>179</sup> The Bond Market Association recommends that borrowers advise lenders by 11 a.m. of the collateral they will be delivering (Bond Market Association, 1998, adding section I.3 to Bond Market Association, 1996).

<sup>180</sup> Fleming and Garbade (2002) describe the details of delivery and payment through Fedwire.

### *Inter-dealer Trading*

In addition to borrowing funds from institutional lenders to finance securities positions, some dealers also make two-way markets in general collateral repurchase agreements, quoting offer rates at which they are prepared to lend money as well as bid rates at which they are prepared to borrow.<sup>181</sup> From time to time these repo dealers transact amongst themselves to adjust their net borrowings, and the term structure of their net borrowings, to desired levels. Inter-dealer trading is important because it enhances the liquidity of the broader repo market, just as inter-dealer trading in Treasury securities enhances the liquidity of the broader Treasury market.<sup>182</sup>

Repo dealers do not negotiate and settle repos directly with their competitors. Instead, they use inter-dealer brokers (“IDBs”) to disseminate their bids and offers anonymously and they settle their transactions through the IDBs and through the Fixed Income Clearing Corporation (“FICC”).<sup>183</sup>

Settlement of the starting leg of an RP that is arranged by a broker between two FICC members goes through the broker. As shown in the top panel of Figure IV.2, the borrowing dealer delivers its securities to the broker against payment of the principal amount of the borrowing and the broker redelivers the securities to the lender against payment of the same principal amount. This more costly, two-step, settlement process is necessary to preserve the mutual anonymity of the borrower and lender.<sup>184</sup>

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<sup>181</sup> Dealers actually quote bid rates for (borrowing) collateral against lending money and offer rates for (lending) collateral against borrowing money. We reverse the bid and offer conventions for expositional clarity.

<sup>182</sup> See Boni and Leach (2001), Dupont and Sack (1999), Fleming (1997), and Garbade (1978a, b).

<sup>183</sup> FICC is a wholly-owned subsidiary of The Depository Trust & Clearing Corporation (“DTCC”), which also owns The Depository Trust Company. The Government Securities Division of FICC is the successor to the Government Securities Clearing Corporation (“GSCC”), which was acquired by DTCC in January 2002. GSCC was organized in the late 1980s to simplify the settlement process for U.S. Treasury and Federal agency securities, to reduce the volume of Fedwire transfers, and to mitigate risk arising from counterparty exposures in the government securities market.

<sup>184</sup> The broker’s role in settling the starting leg of an RP was made possible by GSCC’s decision in mid-1996 to guarantee broker payment and delivery obligations (discussed in Fleming and Garbade [2002]).

Settlement of the closing leg of an inter-dealer RP goes through FICC. FICC nets the settlement obligations of each of the three parties; the borrower, the lender, and the broker, with other obligations of each of those parties to receive and deliver the same securities on the termination date of the RP. The broker drops out of the settlement process because its obligations net to zero. In the simple case where the borrower and lender have no other obligations to receive or deliver the same securities on the same day, the lender delivers the securities that collateralized the RP to FICC against payment by FICC of the principal and interest on the borrowing and FICC delivers the securities to the borrower against payment of the same sum. This is shown in the lower panel of Figure IV.2. When the borrower or lender have other, off-setting obligations to receive or deliver some of the same securities on the same day, settling the closing leg of the RP through FICC is less costly than settling through the broker because of the efficiencies of net settlement.<sup>185</sup>

## **2. Transaction Costs in the DVP Repo Market**

Repos are an important source of financing for Treasury dealers and an important lending vehicle for institutional investors. However, DVP repos involve a variety of transaction costs that limit the attractiveness of the instrument for both borrowers and lenders.

A dealer borrowing funds on a DVP repo has to identify by about 11 a.m. the securities that it intends to deliver. It then becomes obligated to deliver those specific securities. This relatively early (in the day) extinction of the dealer's delivery option can be costly to the dealer. If the dealer identifies securities already in its inventory, it may have to forego an attractive opportunity to sell the securities for cash, or same-day, settlement later in the day. If the dealer identifies securities that it expects to receive (but

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<sup>185</sup> Fleming and Garbade (2002) describe the efficiencies of net settlement. The starting leg of the RP is not settled through FICC because, outside of the GCF Repo facility described below, FICC does not provide for net settlement of transactions that settle on the day they are negotiated.

does not already have in its inventory) and the securities fail to arrive, the dealer has to go back to the lender and request that it agree to accept different securities. Lenders almost always accede to a dealer's request to deliver different collateral (as long as the replacement securities are within the agreed-upon collateral class) but revising delivery instructions takes time and adds to the cost of a DVP repo.

The second transaction cost is the cost to a lender of accommodating a dealer's request to substitute collateral on a continuing term, or multiple-day, RP. A dealer that borrowed money on a term RP will sometimes request that it be allowed to substitute collateral if it identifies an opportunity to sell outright some or all of the original collateral at a favorable price. Collateral substitution requires two settlements, one when the lender delivers the original collateral back to the dealer against payment, and the second when the dealer delivers the new collateral to the lender, also against payment. Market participants lending money on general collateral repos thus bear additional expenses whenever a dealer substitutes collateral.<sup>186</sup>

The third transaction cost appears almost exclusively in the context of inter-dealer trading but it has important implications for the broader repo market as well. The starting legs of inter-dealer RPs are settled on an individual, trade-by-trade, basis and thus are more costly to settle than inter-dealer transactions where the parties only have to settle their net obligations. If a dealer agrees at 8 a.m. to borrow \$100 million overnight through broker X and at 9 a.m. agrees to lend \$100 million overnight through broker Y, it has to settle each RP separately, delivering securities to broker X against receiving \$100 million and receiving securities from broker Y against paying \$100 million. The cost of

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<sup>186</sup> Lenders do not ignore the potential costs of collateral substitution. Bids and offers for money on term general collateral repos commonly provide that the borrower has the right, or option, to substitute collateral a specified number of times during the life of the borrowing. Interest rates on contracts for a given term are higher the greater the number of allowed substitutions to compensate lenders for the prospect of greater future settlement expenses. This convention shifts, but does not eliminate, the cost of collateral substitution.

settling each starting leg separately limits the liquidity of the inter-dealer market and, therefore, the liquidity of the broader dealer-institutional lender market.

### *Collateral Specificity*

The cost of early extinction of a borrower's initial delivery option, and the cost of substituting collateral on a continuing RP, both arise from a feature of a DVP repo contract that is not inherent in the basic idea of a general collateral repo: collateral specificity. In particular, the costs arise because a borrower has to identify a *particular* security to a lender before it can deliver that security as collateral (so the lender can instruct its custodian to accept delivery of the security and to make the required payment), and because the lender subsequently holds that *particular* security during the term of the RP. Collateral specificity is also an important impediment to netting inter-dealer repo trades. A dealer can not net a borrowing through broker X with a loan through broker Y because the collateral delivered on the borrowing will rarely be the same as the collateral received on the loan.

Collateral specificity is, however, no more than an ancillary feature of a general collateral repo. By definition, the lender on a general collateral repo has no economic interest in the specific security that collateralizes its loan (as long as the security falls within the agreed-upon collateral class). A DVP repo thus entails greater collateral specificity, both at the time the starting leg settles and during the term of the repo, than lenders require. This suggests that alternative repo structures that suppress collateral specificity might preserve the economic premise of a general collateral repo: secured lending on a specified class of collateral, but have lower transactions costs.

### **3. Tri-party Repo**

As repo financing expanded during the 1980's, market participants began to appreciate that suppressing collateral specificity could reduce transaction costs on general

collateral repos. The first innovation to suppress collateral specificity was an adaptation of tri-party repo, an emerging alternative to DVP repo.

In a tri-party repurchase agreement, an “agent bank” stands between the borrower and the lender. A tri-party agreement between a bank, a dealer, and an institutional lender includes a description of the class of collateral that is mutually acceptable to the dealer and lender for any general collateral repos that they might negotiate pursuant to the agreement. As illustrated in Figure IV.3, at the start of a particular repo the dealer delivers collateral, and the lender delivers funds, to the bank. After verifying that the collateral is within the agreed-upon class and has a market value in excess of the principal value of the loan, the bank releases the funds to the dealer *but continues to hold the collateral*, acting as a custodian for the benefit of the lender. At the end of the RP the dealer returns the principal amount of the loan, plus interest at the negotiated rate, to the bank, the bank releases the collateral back to the dealer, and the bank remits the principal and interest to the lender. If the dealer fails to repay the principal and interest, the lender can instruct the bank to sell the collateral and to apply the proceeds to satisfy the lender’s claim on the dealer.

Tri-party repo was developed to reduce the costs of verifying, valuing and holding collateral and to limit credit exposures in the repo market.<sup>187</sup> Large banks selling custodial services – receiving and transferring money and securities on behalf of customers – can administer collateral programs at lower cost than most other institutions by capitalizing on their economies of scale and scope. Additionally, when an agent bank holds securities on behalf of a lender with a value in excess of the lender’s claim, the lender is protected against the dealer’s default (because the value of the collateral exceeds the lender’s claim) and the dealer is simultaneously protected against the lender’s default (because the lender never takes possession of the collateral).

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<sup>187</sup> Sollinger (1994), Bank of New York (1997).

*Tri-party Repo When the Agent Bank is a Dealer Clearing Bank*

In theory, any bank can serve as an agent bank for tri-party repo. However, there are additional advantages if the agent bank is also the dealer's clearing bank, because a clearing bank can transfer ownership of a dealer's securities on its own books after the close of the securities Fedwire. (Among other things, a clearing bank acts as agent for a dealer customer, holding the dealer's securities – commingled with the securities of other custodial customers – in a book-entry account at the Federal Reserve, receiving deliveries of securities purchased, and making deliveries of securities sold. The bank maintains an internal record of the claims of its customers on the securities held in bulk in its account at the Fed.) This has important implications for initial collateral assignments and subsequent collateral substitutions in tri-party repos.<sup>188</sup>

Tri-party Repo Settlements: Implications for Initial Collateral Assignments. Suppose a dealer and an institutional lender are parties to a tri-party agreement with an agent bank that is also the dealer's clearing bank, and suppose that they agree to terms for a particular repo. The terms include the principal amount, maturity, and interest rate of the repo, but not the specific collateral for the loan. After reaching agreement, the dealer communicates the terms of the repo to the agent bank and the lender transfers the principal amount of the loan to the bank.

Following the close of the securities Fedwire, the bank identifies the securities that remain in the dealer's clearing account and begins to allocate those securities to custodial accounts maintained for the benefit of the various institutions that agreed to lend to the dealer. The allocation process is structured to minimize the amount of unallocated collateral without violating any lender's agreement with the dealer as to the

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<sup>188</sup> Two banks, JPMorgan Chase Bank and Bank of New York, provide dealer clearing services in Treasury securities. The advantages that accrue when a dealer clearing bank acts as tri-party agent explain why JPMC and BoNY dominate the market for tri-party agent services.

class of mutually acceptable collateral.<sup>189</sup> Contemporaneous with allocating the dealer's securities, the bank transfers the lenders' funds to the dealer's account. This process postpones the time collateral is assigned to lenders until after the close of the securities Fedwire, and well after the 11:00 a.m. time for assigning collateral on DVP repos. The process thus suppresses collateral specificity in initial collateral assignments until after the close of the securities Fedwire.

Morning Reversals: Implications for Collateral Substitutions. All of the foregoing transfers are reversed the following morning, before the 8:30 a.m. opening of the securities Fedwire. The principal amount of each repo is debited from the dealer's account at the agent bank and credited to the lender's account, and the securities that collateralized the repo are transferred back to the dealer's account.<sup>190</sup> If the repo is terminating, the interest on the repo is also debited from the dealer's account and credited to the lenders account, and the principal and interest are remitted to the lender.

If a dealer is committed to borrowing on a continuing RP, the agent bank reinstates the dealer's borrowing commitment – and the lender's loan commitment – immediately after the morning reversal. Any additional commitments negotiated by the dealer and the lender during the day are added to the reinstated commitment in arriving at the dealer's and lender's aggregate commitments at the end of the day.

Morning reversals of tri-party repos are important because they restore a dealer's control over its collateral, giving it access to securities that it might need to settle unrelated sales. The reversals eliminate the cost of requesting and effecting specific collateral substitutions on an as-needed basis because dealers regain control over *all* of

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<sup>189</sup> Board of Governors of the Federal Reserve System and Securities and Exchange Commission (2002, Appendix 2). The clearing bank finances any unallocated collateral, at a rate above the contemporaneous general collateral repo rate, as part of its clearing relationship with the dealer. Thus, minimizing the amount of unallocated collateral also minimizes the dealer's aggregate financing costs.

<sup>190</sup> Board of Governors of the Federal Reserve System and Securities and Exchange Commission (2002, Appendix 2).

their collateral *every* day. Relatedly, a dealer with a continuing borrowing commitment does not have to provide the same securities in the afternoon that it received back in the morning. It can continue its borrowing using other collateral if it delivered some of the securities on unrelated sales. In this way tri-party repo suppresses collateral specificity in continuing repos and makes collateral substitution an entirely transparent process for both a dealer and its institutional creditors.

In summary, three features of tri-party repo facilitate suppression of collateral specificity:

- the ability of a clearing bank to transfer ownership of a security between two custodial customers entirely on its own books and without Fedwire activity,
- the willingness of lenders to rely on a clearing bank to allocate dealer collateral to their custodial accounts, and
- the reversal of securities and loan balances on continuing term repos during the hours that the securities Fedwire is open.

By suppressing collateral specificity, tri-party repos reduce the transaction costs associated with DVP repos that are caused by early extinction of borrower delivery options and lenders holding dealer collateral during the hours that the securities Fedwire is open.

#### **4. GCF Repo**

Tri-party repo provides important efficiencies in dealer borrowings from institutional lenders, but the tri-party model is not readily applicable to inter-dealer repo trading. Tri-party repos do not preserve the mutual anonymity of borrowers and lenders and they are not amenable to net settlement.

In 1998, FICC, in conjunction with the two large two dealer clearing banks – JPMorgan Chase Bank (“JPMC”) and Bank of New York (“BoNY”) – introduced a second innovation in general collateral repo, GCF Repo. GCF Repo was designed to

reduce transaction costs and enhance liquidity in the inter-dealer repo market by providing for net settlement and by suppressing collateral specificity in a tri-party-like structure.<sup>191</sup> This section explains how GCF Repo works. For expository purposes we will describe trading in GCF Repo on all Treasury bills, notes and bonds (“all Treasury issues”) by dealers that clear through JPMC.<sup>192</sup>

### *Trading GCF Repo*

Trading in GCF Repo starts each morning at about 7:30 a.m. when dealers begin to submit bids and offers to inter-dealer brokers that are members of FICC. One dealer might, for example, bid 2.15% for 2-week money and another dealer might offer to lend for the same term at 2.20%. When a dealer signals to an IDB that it is willing to borrow or lend on the terms proposed by another dealer, the IDB brokering the transaction reports the details of the trade to FICC. Trading in GCF Repo stops when the securities Fedwire closes at 3:30 p.m.

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<sup>191</sup> Ingber (2003) recounts the development of GCF Repo. See also Brooks (1998), Taylor (1998), Government Securities Clearing Corporation (1997, 1998), Securities and Exchange Commission (1998a, notice of filing of rule change to allow implementation of GCF Repo), Securities and Exchange Commission (1998b, approval order), Securities and Exchange Commission (1999a, notice of filing of rule change to allow inter-bank netting), and Securities and Exchange Commission (1999b, approval order), as well as Government Securities Clearing Corporation Important Notices 089.98 (Commencement of the GCF Repo Service, November 2, 1998), 051.99 (Implementation of the Interbank Phase of the GCF Repo Service, June 2, 1999), 076.99 (Approval of Second CUSIP for GCF Repo Trades, August 31, 1999), 004.00 (Eligibility of Agency Securities and Mortgage-Backed Securities for GCF Repo Processing, January 7, 2000), 016.00 (Eligibility of Mortgage-Backed Securities for GCF Repo Processing, March 2, 2000), 010.01 (Exclusion of Agency Subordinated Debt Securities from GCF Agency Eligibility, February 1, 2001), and 022.01 (Addition of Medium Term Notes (MTNs) and Discount Notes as Eligible Collateral for the GCF Repo Generic Agency Issue, March 19, 2001).

<sup>192</sup> FICC sponsors GCF Repo trading in a total of five collateral classes: (1) all Treasury bills, notes, and bonds, (2) Treasury bills, notes, and bonds with less than ten years remaining to maturity, (3) fixed-rate unsubordinated non-mortgage backed debt of the Federal Farm Credit Banks, the Federal Home Loan Banks, the Federal National Mortgage Association (“Fannie Mae”), and the Federal Home Loan Mortgage Corporation (“Freddie Mac”), (4) fixed-rate mortgage-backed securities issued by the Government National Mortgage Association, and (5) fixed-rate mortgage-backed securities issued by Fannie Mae and Freddie Mac. For reasons that will become clear shortly, dealers that clear through JPMC can trade GCF Repo only with other dealers that trade through JPMC. Dealers that clear through BoNY can trade only with other dealers that clear through BoNY.

*Settlement*

At 3:45 p.m. FICC computes the *net* obligation of each dealer to lend or borrow money for one business day or longer as a result of the GCF Repo contracts that it negotiated during the day and (as explained below) the continuing term GCF Repo contracts that it negotiated on earlier days. Each dealer is informed either that (a) it is a net borrower and is obligated to deliver Treasury collateral to FICC against payment of the aggregate principal amount of its net borrowing, or that (b) it is a net lender and is obligated to receive Treasury collateral against payment of the aggregate principal amount of its net loan.

A dealer that clears through JPMC and is a net borrower on GCF Repo on all Treasury issues has until 4:30 p.m. to transfer Treasury bills, notes and/or bonds of its choosing to an FICC account at JPMC against payment of the principal amount of its net borrowing. JPMC is responsible for verifying that the securities are Treasury securities and have a market value not less than the principal amount of the dealer's net borrowing. The dealer does not have to identify the securities that it intends to deliver prior to actual delivery, so its delivery option survives well past the time when collateral is assigned for DVP repos.

The securities transferred to FICC's account are redelivered to other dealers that also clear through JPMC and that are net lenders against payment of the principal amounts of their respective net loans. The transfers of securities from net borrowers to FICC's account at JPMC, and the transfers of securities from FICC's account to net lenders, occur entirely on the books of JPMC and do not require any Fedwire transfers.<sup>193</sup>

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<sup>193</sup> The aggregate net borrowing of all of the dealers that are net borrowers and clear through JPMC is identical to the aggregate net loan of all of the dealers that are net lenders and clear through JPMC, because every GCF Repo transaction involves a borrowing and a loan of identical size by dealers that clear through the same bank. Thus, the total payments received by FICC in its JPMC account equals the total payments disbursed by FICC from its JPMC account.

Between June 1999 and March 2003, FICC sponsored trading in GCF Repo that combined dealers that clear through JPMC with dealers that clear through BoNY. See Ingber (2003) and Government Securities Clearing Corporation Important Notice 051.99 (Implementation of the Interbank Phase of the GCF Repo Service, June 2, 1999). Settlement problems led to the separation of the two dealer groups in March 2003.

*Morning Reversal and Afternoon Recollateralization*

All of the foregoing deliveries and payments are reversed the next morning before the opening of the securities Fedwire. Borrowed funds are returned to lenders and collateral securities are returned to borrowers. Except for interest payments (described below), the reversals constitute final settlement of GCF Repos terminating that day. The morning reversals are important because, as with morning reversals of tri-party repos, they restore a borrower's control over its collateral.

If a market participant is committed to borrow or lend on a continuing GCF repo, its commitment is reinstated by FICC immediately following the morning reversal. Any additional commitments negotiated during the day are added to, or subtracted from, the reinstated commitments in arriving at the 3:45 p.m. calculation of each dealer's net obligation to borrow or lend that day.

If a dealer is a net borrower at 3:45 p.m. it is obligated to deliver Treasury collateral to FICC against payment of the aggregate principal amount of its net borrowing. It does not, however, have to deliver the same securities that it received in the morning (assuming it had been a net borrower on the preceding day). As with tri-party repo, it can deliver entirely different securities. In this way GCF Repo also suppresses collateral specificity and makes collateral substitution a transparent process.

Accrued Interest and Mark-to-Market Payments. As illustrated in Figure IV.1, interest on a textbook RP is included as part of the invoice price due upon return of the collateral at the close of the RP. Interest on GCF Repo is also paid at maturity but, in addition, there are daily accrued interest and mark-to-market payments associated with

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See Fixed Income Clearing Corporation, Government Securities Division Important Notice GOV025.03 (Status of the GCF Repo Service, March 5, 2003), "Risks Force Limitations on Popular Repo Market Product," *Dow Jones Newswire*, March 12, 2003, and "Repo Market is Hit by Limits on a Top Product," *Wall Street Journal*, March 17, 2003, p. C13.

the reversals described above. These payments limit credit exposures that might otherwise arise from the reversals and are, therefore, a crucial aspect of GCF Repo.

In order to justify the return of a borrower's collateral against payment of only the original principal amount of the borrower's RP, FICC requires that the borrower pay accrued interest on its borrowing and make (or receive) a mark-to-market payment to account for the decline (or rise) in the market value of its contract due to changes in GCF Repo rates since the contract was negotiated. To preserve the convention that interest on GCF Repo is paid in full at maturity, both of the foregoing payments are returned the following day with interest at the overnight repo rate. Appendix E shows a numerical example.

**Table I.1. Auction Offerings of Treasury Notes, 1970-1971**

<b>Auction Date</b>	<b>Issue</b>	<b>Term</b>	<b>Quantity offered (\$ billions)</b>	<b>Quantity bid (\$ billions)</b>	<b>Range of accepted yields (%)</b>	<b>Average accepted yield (%)</b>
Nov 5, 1970	6-3/4% notes of May 15, 1972	18 mo	2.00	5.2	6.09 to 6.26	6.21
Jun 22, 1971	6% notes of Nov 15, 1972	16 mo	2.25	4.0	5.71 to 6.05	6.00
Aug 5, 1971	6-1/2% notes of Feb 15, 1973	18 mo	2.50	4.1	6.44 to 6.59	6.54
Aug 31, 1971	6-1/4% notes of Nov 15, 1976	5 yr 2 mo	1.25	3.4	5.92 to 6.02	5.98
Oct 15, 1971	5-7/8% notes of Feb 15, 1975	3 yr 4 mo	2.00	4.6	5.46 to 5.61	5.58
Nov 9, 1971	4-7/8% notes of Feb 15, 1973	15 mo	2.75	4.0	4.79 to 4.96	4.91

**Table I.2. Auction Offerings of Treasury Notes and Bonds, 1972**

<b>Auction Date</b>	<b>Issue</b>	<b>Term</b>	<b>Quantity offered (\$ billions)</b>	<b>Quantity bid (\$ billions)</b>	<b>Range of accepted yields (%)</b>	<b>Average accepted yield (%)</b>
Mar 28, 1972	5-7/8% notes of May 15, 1975	3 yr	1.75	3.8	5.69 to 5.80	5.78
May 2, 1972	4-3/4% notes of May 15, 1973	1 yr	1.25	3.3	4.23 to 4.47	4.44
May 2, 1972	6-3/8% bonds of Feb 15, 1982	9 yr 9 mo	0.50	1.3	6.23 to 6.32	6.29
Oct 11, 1972	6% notes of Sep 30, 1974	2 yr	2.00	4.8	5.77 to 5.89	5.86
Nov 1, 1972	6-1/4% notes of Nov 15, 1976	4 yr	3.00	7.1	6.16 to 6.21	6.20
Dec 20, 1972	5-7/8% notes of Dec 31, 1974	2 yr	2.00	5.6	5.72 to 5.85	5.83

**Table I.3. Auction Offerings of Long-Term Treasury Bonds in a Single-Price Format, 1973-1974**

<b>Auction Date</b>	<b>Issue</b>	<b>Term</b>	<b>Quantity offered (\$ billions)</b>	<b>Quantity bid (\$ billions)</b>	<b>Yield (%)</b>
Jan 4, 1973	6-3/4% bonds of Feb 15, 1993	20 yr	0.63	1.7	6.79
May 2, 1973	7% bonds of May 15, 1993	25 yr	0.63	1.2	7.11
Aug 1, 1973	7-1/2% bonds of Aug 15, 1993	20 yr	0.50	0.2	8.00
Oct 31, 1973	7-1/2% bonds of Aug 15, 1993	19 yr 9 mo	0.30	1.3	7.35
Feb 2, 1974	7-1/2% bonds of Aug 15, 1993	19 yr 6 mo	0.30	1.1	7.46
May 8, 1974	8-1/2% bonds of May 15, 1994	25 yr	0.30	0.9	8.23

**Table II.1. Marketable Treasury Debt, billions of dollars**

<b>Fiscal year Ending June 30</b>	<b>Total Amount Outstanding</b>	<b>Maturing Within 1 Year</b>	<b>Maturing 1 to 5 Years</b>	<b>Maturing 5 to 10 Years</b>	<b>Maturing 10 to 15 Years</b>
1958	166.7	67.8	42.6	21.5	27.0
1959	178.0	73.0	58.3	17.1	21.0
1960	183.8	70.5	72.8	20.2	11.7
1961	187.1	81.1	58.4	26.4	8.7
1962	196.1	88.4	57.0	26.0	6.0
1963	203.5	85.3	58.0	37.4	2.2
1964	206.5	81.4	65.5	34.9	2.2
1965	208.7	87.6	56.2	39.2	2.6
1966	209.1	89.1	60.9	33.6	4.5
1967	210.7	89.6	71.4	24.4	4.5
1968	226.6	118.2	52.7	33.5	4.5

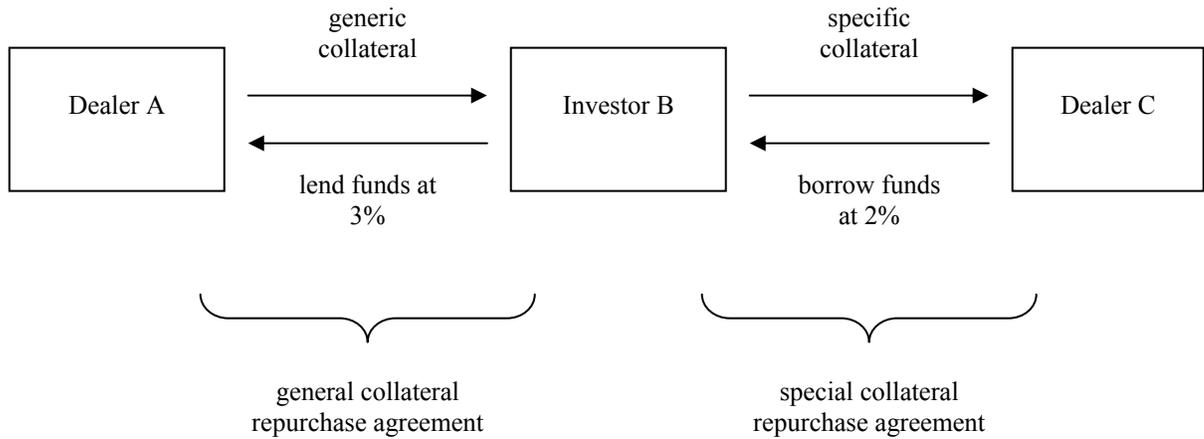
Source: Statistic Appendix to Annual Report of the Secretary of the Treasury for the Fiscal Year Ended June 30, 1968, p. 74.

**Table II.2. Marketable Treasury Debt in Book-entry Form, billions of dollars**

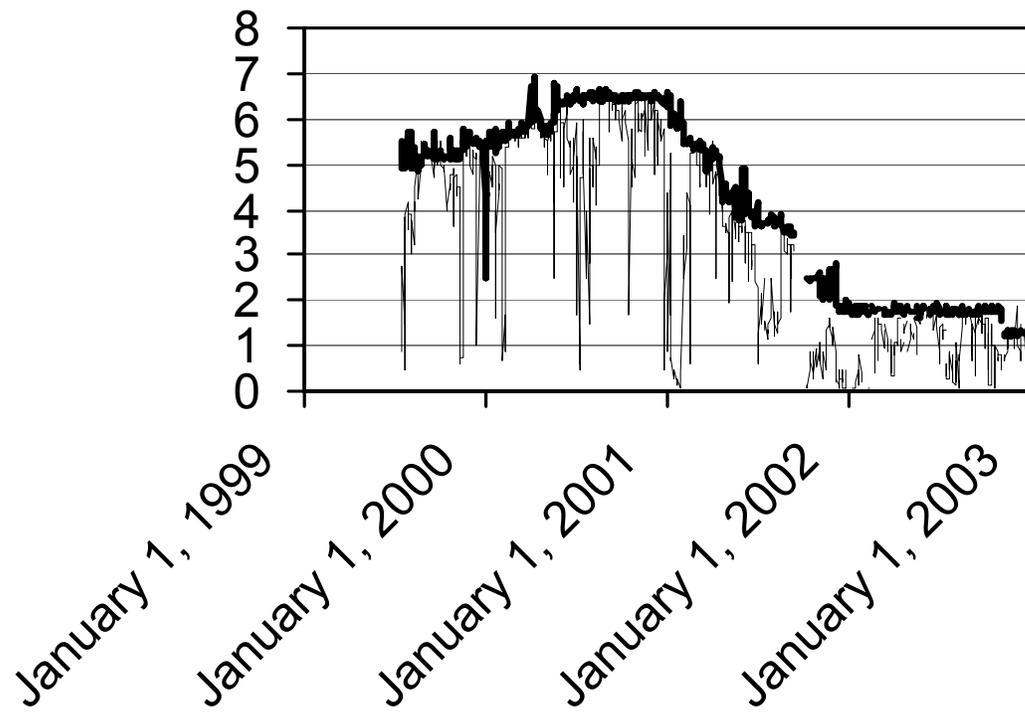
<b>Calendar year Ending Dec 31</b>	<b>Amount Outstanding</b>	<b>Amount Held in Book-entry Form</b>	<b>Percent Held in Book-entry Form</b>
1968	236.8	36.5	15.4
1969	235.9	38.2	16.2
1970	247.7	121.3	48.9
1971	262.0	152.6	58.2
1972	269.5	160.2	59.4
1973	270.2	176.6	65.4
1974	281.3	201.4	71.6
1975	363.2	285.1	78.5
1976	421.3	354.1	84.0
1977	459.9	428.2	93.1
1978	487.5	457.4	93.8
1979	530.7	497.8	93.8
1980	623.1	585.2	93.9
1981	720.2	686.0	95.2

Source: Ringsmuth and Rice (1984, p. 32)

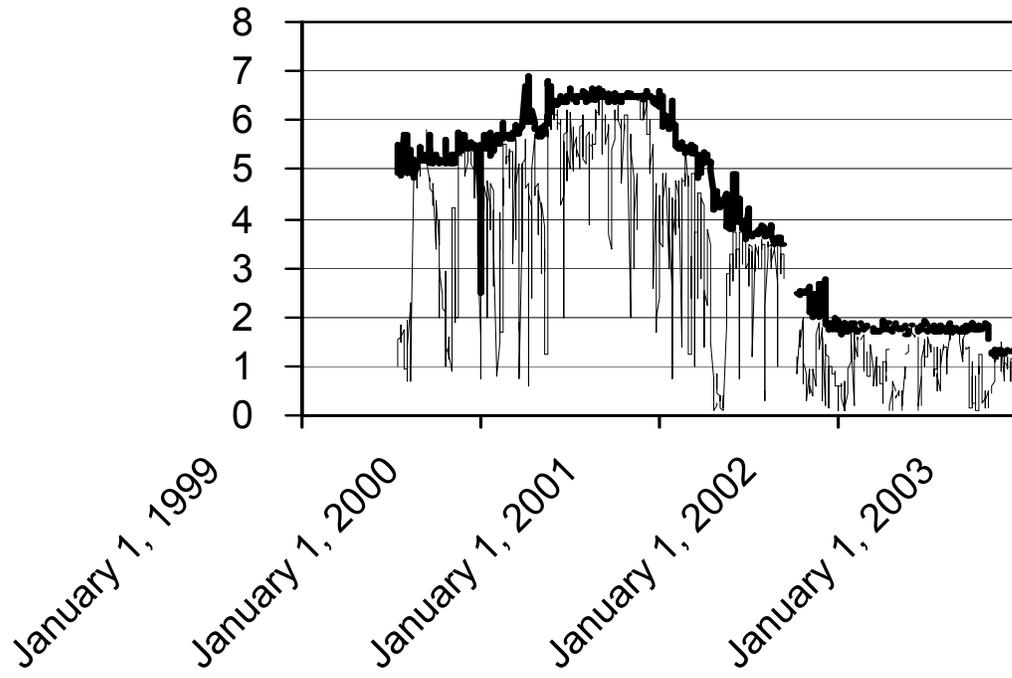
**Figure III.1. Lending Collateral (and Borrowing Money) on a Special Collateral Repurchase Agreement and Relending the Money on a General Collateral Repurchase Agreement**



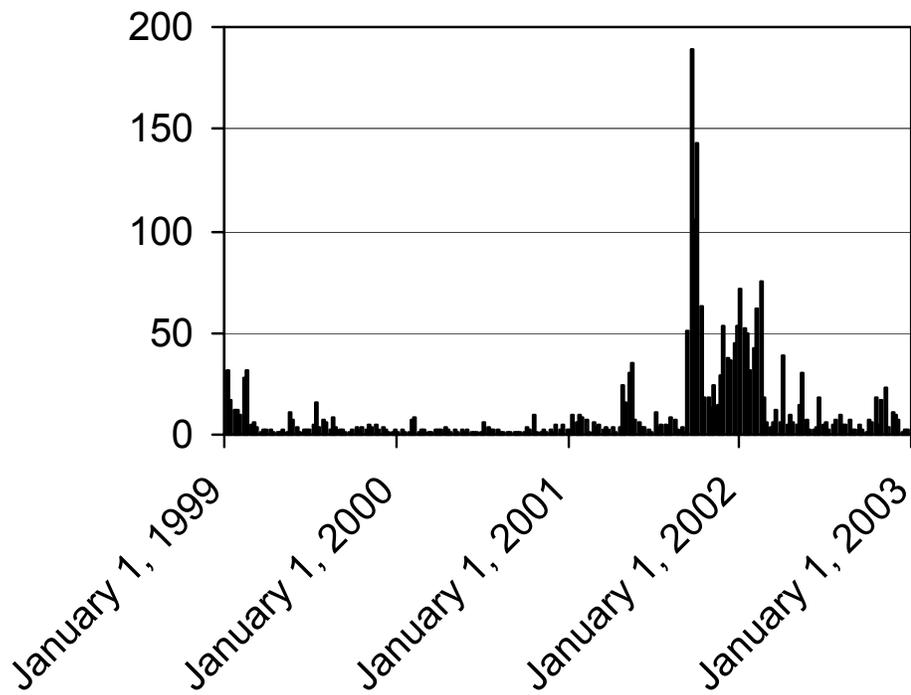
**Figure III.2. General Collateral RP Rates (heavy line) and Special Collateral RP Rates for the On-the-run 5-year Treasury Note (thin line)**



**Figure III.3. General Collateral RP Rates (heavy line) and Special Collateral RP Rates for the On-the-run 10-year Treasury Note (thin line)**

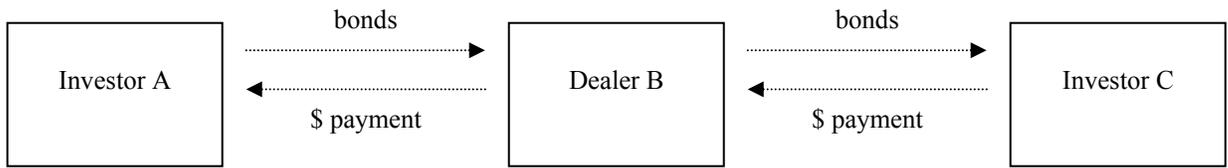


**Figure III.4. Settlement Fails in U.S. Treasury Securities (\$ billions per day, daily average over a week)**

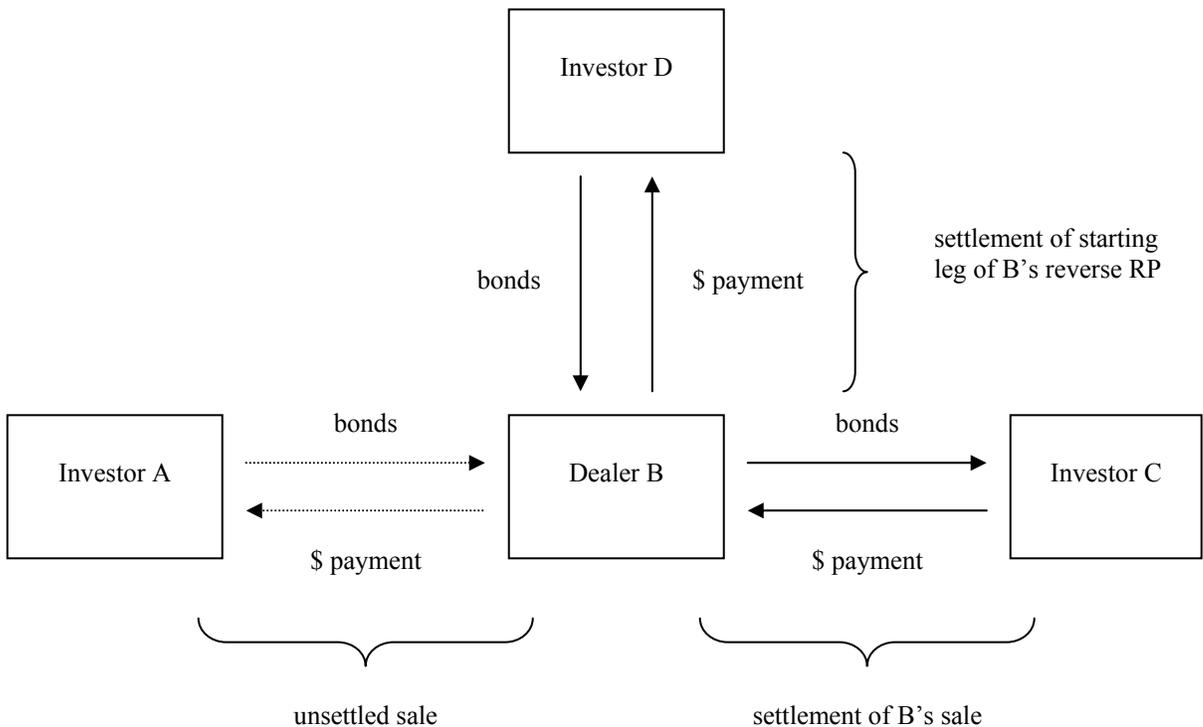


**Figure III.5. Borrowing Securities to Cure a Settlement Fail**

Suppose investor **A** sells bonds to dealer **B**, who then resells the bonds to **C**. The delivery and payment obligations of **A**, **B**, and **C** on the morning of the settlement date are shown with dashed lines in the diagram below.

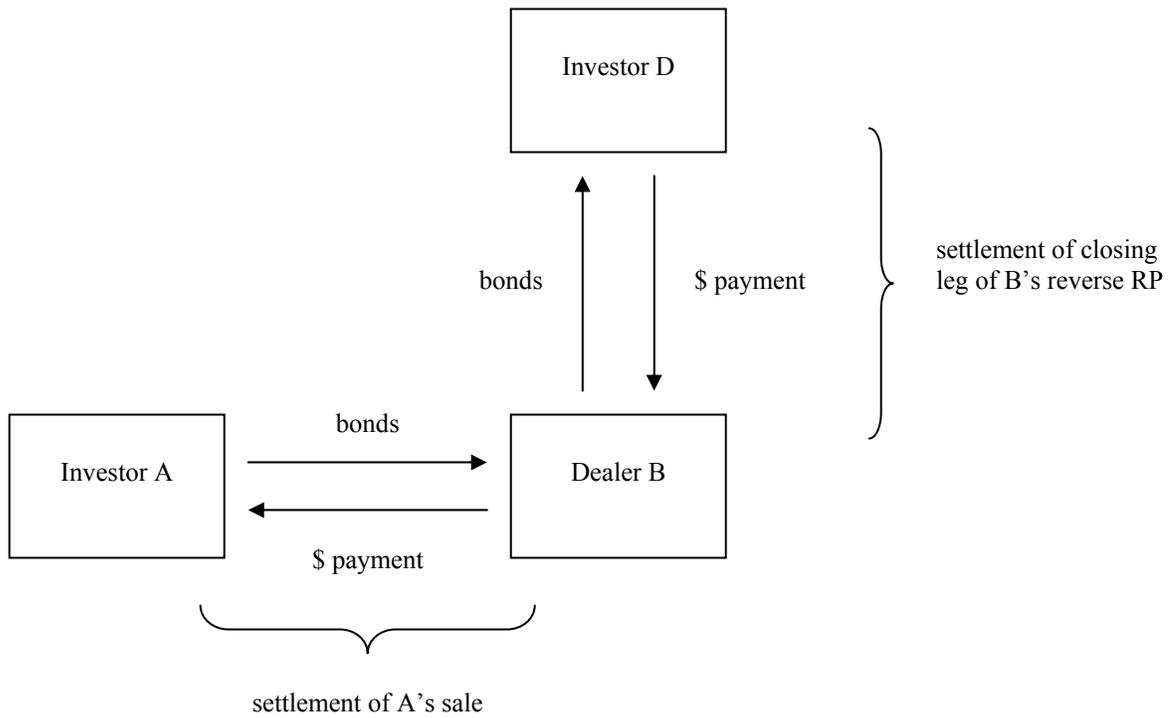


Assume that **A** fails to deliver the bonds to **B**, causing **B** to fail to **C**. To cure its fail to **C**, **B** can reverse in the bonds from investor **D** and deliver the borrowed bonds. Actual movements of bonds and funds are shown with solid lines in the diagram below. The continuing (unfulfilled) obligations of **A** to deliver bonds to **B** and **B** to pay for the bonds are shown with dashed lines.



**Figure III.5. continued**

When **A** finally delivers the bonds to **B**, **B** can terminate its reverse repurchase agreement with **D**.



**Table III.1. Changes in the Terms of the Federal Reserve's Securities Lending Program, April 26, 1999 – December 31, 2002**

**Minimum Loan Fee**

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April 26, 1999	1.50% per annum
September 18, 2001	1.00% per annum

**Maximum Percent of SOMA Position in a Security that Can be Lent**

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April 26, 1999	25%
September 7, 1999	45%
September 27, 2001	75%
October 18, 2001	45%
May 15, 2002	65%

**Maximum Amount of a Security that a Dealer Can Borrow**

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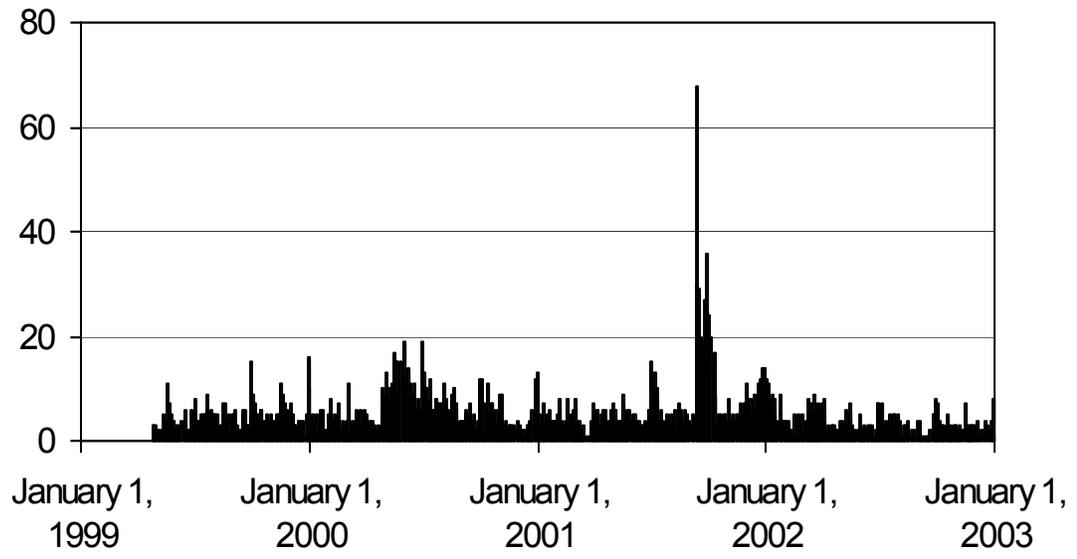
April 26, 1999	\$100 million
September 11, 2001	Unlimited
September 18, 2001	\$100 million
September 27, 2001	\$250 million (\$100 million for the 5% note of August 15, 2011 and the 4.25% note of November 15, 2003)
October 3, 2001	\$250 million (\$100 million for the 5% note of August 15, 2011)
October 18, 2001	\$100 million
May 15, 2002	\$200 million

**Maximum Total Amount of Securities that a Dealer Can Borrow**

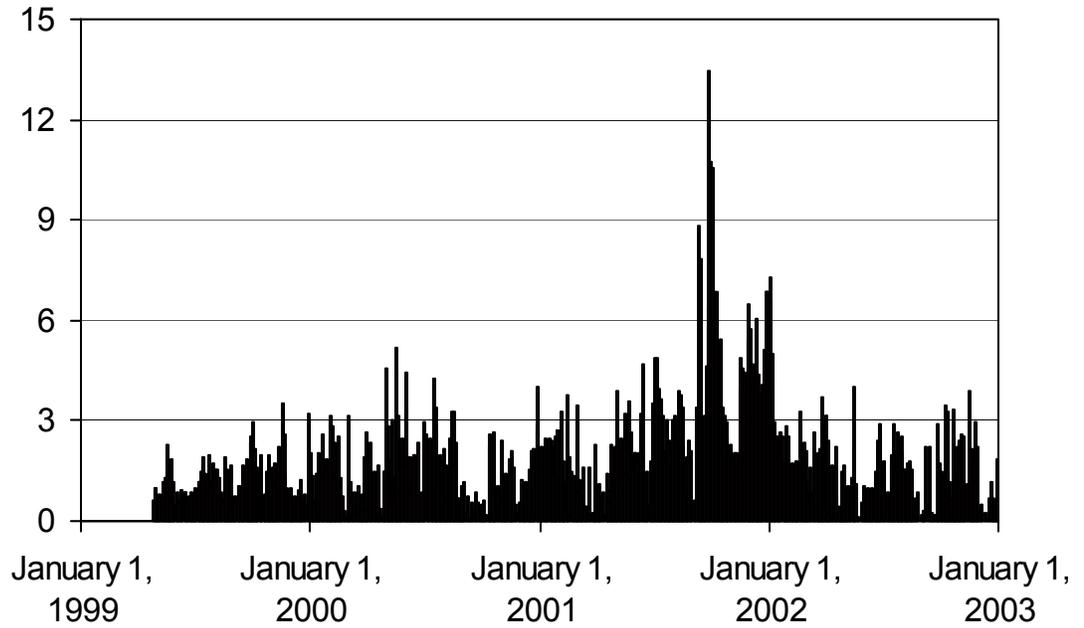
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April 26, 1999	\$500 million
September 11, 2001	Unlimited
October 18, 2001	\$500 million
May 15, 2002	\$1 billion

**Figure III.6. Number of Treasury Securities Borrowed in a Federal Reserve Securities Loan Auction**



**Figure III.7. Aggregate Value (\$ billions) of Treasury Securities Borrowed in a Federal Reserve Securities Loan Auction**



**Table III.2. Loans of 2-year Notes in 909 Auctions Between April 26, 1999 and December 31, 2002 (excluding September 11 to October 5, 2001, inclusive)**

Sequence	Fraction of Auctions Borrowed, percent	Average Size of Aggregate Borrowing When Borrowed, \$ millions
on-the-run	19.4	930.0
1 <sup>st</sup> -off-the-run	12.5	607.6
2 <sup>nd</sup> -off-the-run	4.5	265.7
3 <sup>rd</sup> -off-the-run	2.8	191.7
4 <sup>th</sup> -off-the-run	2.3	141.1
5 <sup>th</sup> -off-the-run	0.9	154.4
6 <sup>th</sup> -off-the-run	1.2	54.8
7 <sup>th</sup> -off-the-run	1.7	111.1
8 <sup>th</sup> -off-the-run	0.7	187.7
9 <sup>th</sup> -off-the-run	0.0	n/a
10 <sup>th</sup> -off-the-run	0.8	75.1
Average across all more seasoned issues	1.2	56.9

**Table III.3. Loans of 5-year Notes in 909 Auctions Between April 26, 1999 and December 31, 2002 (excluding September 11 to October 5, 2001, inclusive)**

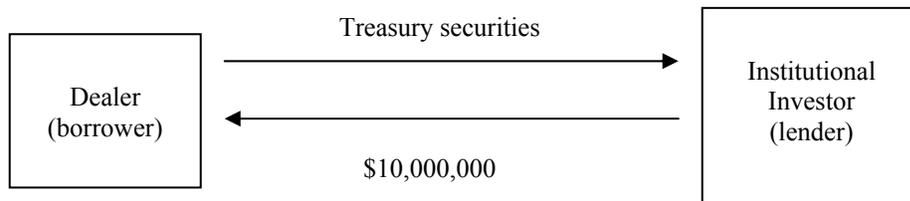
Sequence	Fraction of Auctions Borrowed, percent	Average Size of Aggregate Borrowing When Borrowed, \$ millions
on-the-run	38.3	971.7
1 <sup>st</sup> -off-the-run	9.7	553.8
2 <sup>nd</sup> -off-the-run	4.1	337.7
3 <sup>rd</sup> -off-the-run	1.4	206.6
4 <sup>th</sup> -off-the-run	2.2	151.6
5 <sup>th</sup> -off-the-run	3.7	164.8
6 <sup>th</sup> -off-the-run	4.3	131.6
7 <sup>th</sup> -off-the-run	4.3	142.2
8 <sup>th</sup> -off-the-run	3.1	162.6
9 <sup>th</sup> -off-the-run	1.3	113.8
10 <sup>th</sup> -off-the-run	1.0	39.2
Average across all more seasoned issues	1.9	36.8

**Table III.4. Loans of 10-year Notes in 909 Auctions Between April 26, 1999 and December 31, 2002 (excluding September 11 to October 5, 2001, inclusive)**

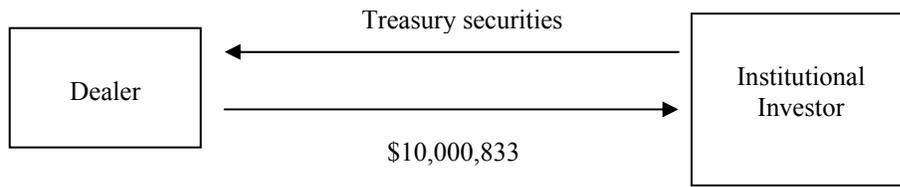
Sequence	Fraction of Auctions Borrowed, percent	Average Size of Aggregate Borrowing When Borrowed, \$ millions
on-the-run	43.8	570.4
1 <sup>st</sup> -off-the-run	17.5	569.0
2 <sup>nd</sup> -off-the-run	3.2	350.7
3 <sup>rd</sup> -off-the-run	2.2	393.5
4 <sup>th</sup> -off-the-run	1.9	282.4
5 <sup>th</sup> -off-the-run	0.6	108.2
6 <sup>th</sup> -off-the-run	0.9	279.0
7 <sup>th</sup> -off-the-run	2.1	124.5
8 <sup>th</sup> -off-the-run	1.0	79.4
9 <sup>th</sup> -off-the-run	0.9	113.5
10 <sup>th</sup> -off-the-run	0.4	176.5
Average across all more seasoned issues	1.6	79.0

**Figure IV.1. Settlement of the Starting and Closing Legs of a Repurchase Agreement**

Starting leg:

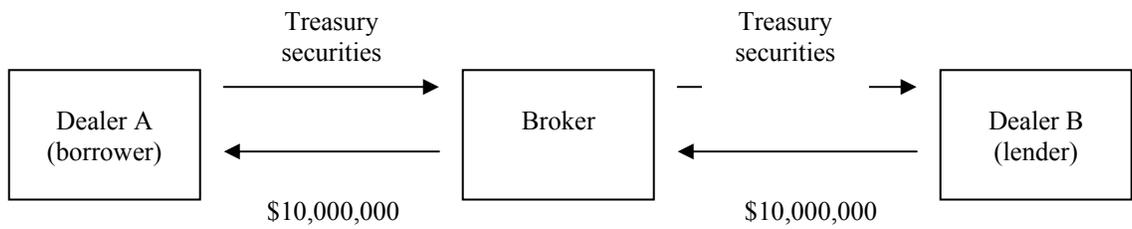


Closing leg:

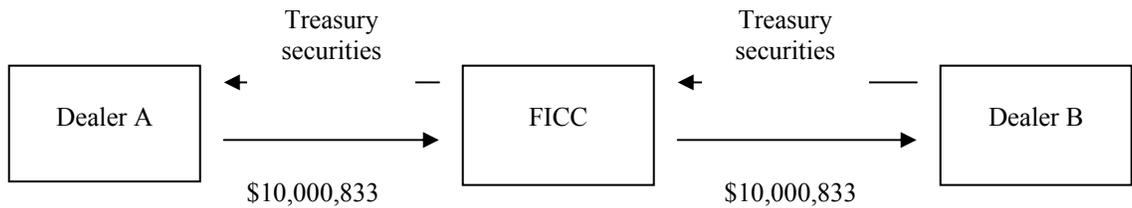


**Figure IV.2. Settlement of a Brokered Repurchase Agreement Between Two FICC Members**

Starting leg:

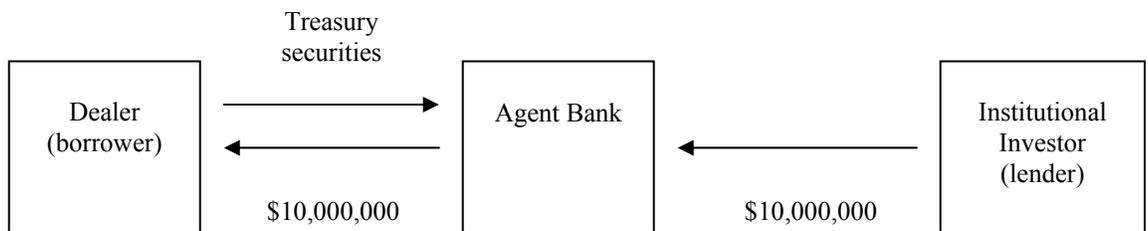


Closing leg:

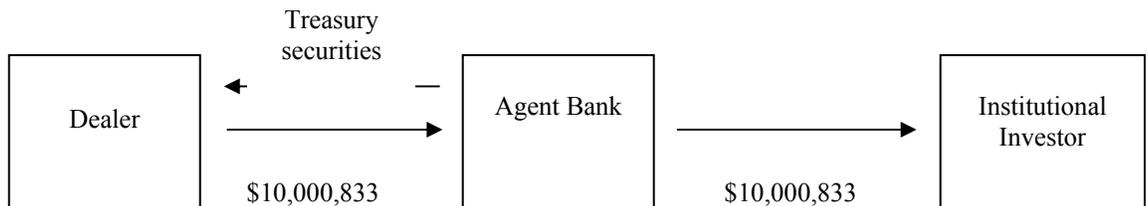


**Figure IV.3. Settlement of the Starting and Closing Legs of a Tri-party Repurchase Agreement**

Starting leg:



Closing leg:



## Appendix A. The 1935 Bond Auctions

Between May 29 and August 14, 1935, Treasury auctioned \$200 million of 13-year bonds and \$300 million of 25-year bonds in five separate auctions of \$100 million each. The auctions were part of a plan to move away from a debt management program of large quarterly financings, toward a program of selling smaller amounts in more frequent offerings.<sup>194</sup> (There is also some indication that Treasury may have planned to replace large, infrequent, regularly scheduled subscription offerings with small, frequent, discretionary auction offerings in order to “time” offerings to when demand for Treasury securities was strong and to stay out of the market when demand was weak.<sup>195</sup>) Treasury officials further expected that auction sales would lead to lower financing costs than subscription sales.<sup>196</sup> The terms and results of the five offerings are shown in Table A1.

The first offering, announced on May 27, was widely characterized as experimental,<sup>197</sup> although Treasury was reported to be ready to use the auction method more frequently if the offering succeeded.<sup>198</sup> The auction attracted tenders for \$270 million of bonds (2.7 times the amount offered) at prices ranging from 103-26/32 down to 103-1/32. The auction was viewed as a modest success; Treasury officials were disappointed only because the large over-subscription did not produce better sale prices.<sup>199</sup> The next two auctions attracted greater interest and produced better prices. The Secretary of the Treasury was quoted as being “very pleased” with the second and

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<sup>194</sup> “Treasury Plans Large Refinancing,” *New York Times*, May 28, 1935, p. 39 (“[Secretary of the Treasury Morgenthau] said that the plan of issuing securities at only the quarterly financing periods of June 15, Sept. 15, Dec. 15 and March 15 had been abandoned and the issues would be ordered when it appeared that the Treasury needed the money...”).

<sup>195</sup> See “Treasury Retains Bond Auction Plan,” *New York Times*, September 14, 1935, p. 14 and U.S. Treasury (1940).

<sup>196</sup> See “Treasury Offers \$100,000,000 Issue in Financing Test,” *New York Times*, May 27, 1935, p. 1 and “Treasury to Sell \$100,000,000 Issue,” *New York Times*, June 24, 1935, p. 25.

<sup>197</sup> See “Treasury Plans Large Refinancing,” *New York Times*, May 28, 1935, p. 39 (auction offering “a feeler”) and “A Treasury Experiment,” *New York Times*, May 29, 1935, p. 20.

<sup>198</sup> “Treasury Plans Large Refinancing,” *New York Times*, May 28, 1935, p. 39.

<sup>199</sup> “New Bond Bids Treble Offering,” *New York Times*, May 31, 1935, p. 25.

characterized the third as “very satisfactory.”<sup>200</sup> The fourth offering fared a little worse than the second and third,<sup>201</sup> and the fifth, in mid August, received a distinctly less enthusiastic reception.<sup>202</sup>

Although the offerings were generally well received, some market participants expressed dissatisfaction with the details of the auction process. In particular, Treasury’s practice of announcing and holding auctions on short notice and on no regular schedule made auction participation risky for dealers, dealers believed the profit opportunities did not justify the risks of participation, and banks and investors outside of the largest financial centers became reluctant to participate because they believed the auctions favored market professionals.<sup>203</sup>

In late August 1935, the Federal Farm Mortgage Corporation auctioned \$100 million of 1-1/2% 4-year Treasury-guaranteed bonds and received tenders for only \$85 million bonds.<sup>204</sup> The failed auction was widely noted<sup>205</sup> and by late October Treasury had abandoned the auction method.<sup>206</sup>

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<sup>200</sup> “Subscriptions of \$461,341,000 are Received for \$100,000,000 Offer of Treasury Bonds,” *New York Times*, June 28, 1935, p. 31 and “New Federal Issue Subscribed 5 Times,” *New York Times*, July 19, 1935, p. 25.

<sup>201</sup> “Treasury Bond Sale Sets Premium Mark,” *New York Times*, August 2, 1935, p. 26.

<sup>202</sup> “Bids Show Decline on Federal Bonds,” *New York Times*, August 12, 1935, p. 23.

<sup>203</sup> U.S. Treasury (1940, p. 1157). Dealer unhappiness with the auction process was also reported in “New Federal Issue Subscribed 5 Times,” *New York Times*, July 19, 1935, p. 25 and “Treasury Retains Bond Auction Plan,” *New York Times*, September 14, 1935, p. 14.

<sup>204</sup> “Federal Bond Sale Fell Short of Goal,” *New York Times*, August 30, 1935, p. 1.

<sup>205</sup> “The Under-subscribed Loan,” *New York Times*, September 1, 1935, p. 8 and “Borah Sees Danger Signal,” *New York Times*, September 2, 1935, p. 22.

<sup>206</sup> “Treasury Announces \$50,000,000 Bill Issue,” *New York Times*, October 25, 1935, p. 31 (stating that “it was ... learned today that the Treasury intends to drop, for the time being at least, the auction method of selling bonds”) and “Debt Over \$300,000,000 as Treasury Announces Financing of \$1,318,000,000,” *New York Times*, December 21, 1935, p. 1 (stating that the failed Federal Farm Mortgage Corporation issue had “brought the use of the [auction] method into question”).

**Table A1. Auction Offerings of Treasury Bonds in 1935**

<b>Auction date</b>	<b>Issue</b>	<b>Quantity bid (\$ millions)</b>	<b>Range of accepted prices</b>	<b>Average accepted price</b>
May 29	3% bonds of June 15, 1948	270	103-1/32 to 103-26/32	103-4/32
June 26	3% bonds of June 15, 1948	461	not reported	103-18/32
July 17	2-7/8% bonds of March 15, 1960	510	101-19/32 to 101-27/32	101-19/32
July 31	2-7/8% bonds of March 15, 1960	321	101-7/32 to 101-24/32	101-18/32
August 14	2-7/8% bonds of March 15, 1960	147	100-21/32 to 101-8/32	100-25/32

Other terms:

- All five auctions were for \$100 million principal amount of bonds.
- All five auctions reopened bonds previously sold in subscription offerings.
- All five auctions used a multiple-price format.
- Competitive bids below 100 and non-competitive bids were not accepted.

## Appendix B. The 1963 Bond Auctions

In 1963, Treasury sold \$550 million of long-term bonds in two “all-or-none” auctions designed to emulate existing forms of syndicate bidding for state and local government and power company bonds.<sup>207</sup>

The first auction, on January 8, was for \$250 million of 30-year bonds. Each participating syndicate was required to choose a coupon rate of either 4% or 4-1/8% and to submit a bid for all of the bonds at that coupon rate. The syndicate bidding the lowest yield would be awarded all of the bonds. Following award of the bonds, the winning syndicate was required to reoffer all of the bonds to the public.<sup>208</sup>

Four syndicates submitted bids for the bonds.<sup>209</sup> The first three bidders proposed a coupon rate of 4%. The winning syndicate bid a price of 99.85111 (to yield 4.008210%) and reoffered the bonds at par, the second syndicate bid 99.85100 (to yield 4.008216%), and the third syndicate bid 99.710014 (to yield 4.016334%). The fourth bid, submitted by a single dealer acting alone, proposed a coupon rate of 4-1/8% and a price of par (to yield 4.124621%). The public reoffering sold out at the reoffering price within a few hours.<sup>210</sup>

The second auction, for \$300 million of 31-year bonds, was held on April 9. Each syndicate was again required to choose a coupon rate of either 4% or 4-1/8% and to bid for all of the bonds at the chosen rate.<sup>211</sup> Three syndicates submitted bids.<sup>212</sup> The first two syndicates proposed a coupon rate of 4-1/8%. The winning syndicate bid a price of 100.55119 (to yield 4.093145%) and reoffered the bonds at 100.75 (to yield 4.082%).

<sup>207</sup> Banyas (1973, pp. 14-15) reviews the 1963 bond auctions.

<sup>208</sup> FRBNY Circular No. 5273, December 20, 1962, and Circular No. 5280, January 2, 1963. The criteria for a *bona fide* reoffering appear in the *Treasury Bulletin*, January, 1963, p. A-1.

<sup>209</sup> FRBNY Circular No. 5282, January 8, 1963.

<sup>210</sup> “Debt Management, ’63,” *New York Times*, January 14, 1963, p. 13.

<sup>211</sup> FRBNY Circular No. 5317, March 20, 1962, and Circular No. 5321, April 3, 1963.

<sup>212</sup> FRBNY Circular No. 5322, April 9, 1963.

The second syndicate bid 100.51259 (to yield 4.095344%). The third syndicate proposed a 4% coupon and bid 98.21262 (to yield 4.101936%).

Unlike the first auction, the public reoffering of bonds in the second auction received a cool reception from investors. Less than half of the issue was sold by the close of trading on the day of the auction and few, if any, bonds were sold in succeeding days.<sup>213</sup> After the winning syndicate finally disbanded on April 25, the bonds traded at 100-10/32 (to yield 4.10%).<sup>214</sup>

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<sup>213</sup> “Treasury Raises 300 Million in Auction of Long-Term Bonds,” *New York Times*, April 10, 1963, p. 51, “Bonds: Market Unsettled by \$300,000,000 Long-Term Offering by U.S. Treasury,” *New York Times*, April 10, 1963, p. 56, and “Bond Syndicate Being Broken Up,” *New York Times*, April 26, 1963, p. 47.

<sup>214</sup> “Bond Syndicate Being Broken Up,” *New York Times*, April 26, 1963, p. 47 and “Bonds: Treasury’s New Issue Declines After Restrictions End,” *New York Times*, April 27, 1963, p. 32.

### Appendix C. A Last Harrah for Subscriptions

Although by mid-1973 it seemed clear that, going forward, yields on primary market sales of Treasury notes and bonds would be market-determined rather than fixed by Treasury officials, subscription offerings staged a brief comeback in 1976 when Treasury acted to extend the average maturity of its debt quickly and materially.<sup>215</sup>

In late January 1976, Treasury announced the terms of the February refunding: \$3.0 billion of 3-year notes, \$3.5 billion of 8% 7-year notes, and \$400 million of 8-1/4% 29-year, 3-month bonds.<sup>216</sup> The shorter notes and the bonds were to be sold at auction, but – in a surprise to market participants – the intermediate-term notes were offered at a fixed price of par to yield 8.00%, more than 30 basis points over secondary market yields in the 7-year sector.<sup>217</sup> Subscriptions for less than \$500,000 would be accepted in full; subscriptions for more than \$500,000 would be allocated in proportion to the amount sought, subject to a minimum allocation of \$500,000. Following the close of the subscription books Treasury announced that it had received subscriptions for \$29.2 billion of the notes (8.3 times the amount offered) and that, due to the “overwhelming response,” it would increase the size of the issue to \$6.0 billion.<sup>218</sup> It also announced that subscriptions would be filled in full only up to \$200,000 and that subscriptions for more than \$200,000 would receive only \$200,000 of the notes. The price of the notes in WI trading rose to 101-1/2 on news of the severe rationing.<sup>219</sup>

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<sup>215</sup> See U.S. Treasury (1977, p. 11) (“To develop a broad market for the coupon financings of the size and frequency necessary to accomplish significant debt lengthening, the Treasury made use of the fixed-price subscription technique twice in fiscal 1976 and once during the transition quarter... The shift in 1976 from short-term bill financing to longer term coupon financing resulted in a reversal of the 10-year decline in the average maturity of the debt. The average length of the privately held Treasury marketable debt has steadily declined from 5 years 4 months in June 1966 to 2 years 4 months in February 1976, but increased to 2 years 9 months by the end of [September 1976].”)

<sup>216</sup> FRBNY Circular No. 7807, January 29, 1976.

<sup>217</sup> U.S. Treasury (1977, p. 21) and “8% Treasury Notes Draw a Deluge of Orders,” *New York Times*, February 6, 1976, p. 39.

<sup>218</sup> FRBNY Circular No. 7811, February 6, 1976.

<sup>219</sup> “8% Treasury Notes Draw a Deluge of Orders,” *New York Times*, February 6, 1976, p. 39.

Treasury resorted to subscription offerings twice more in 1976, once in the May refunding (when it offered \$3.5 billion of 7-7/8% 10-year notes at par) and again in the August refunding (when it offered \$4.0 billion of 8% 10-year notes at par).<sup>220</sup> The offering yield on the 10-year notes in the May refunding was not dramatically greater than yields in the secondary market; one dealer remarked that the “the new 7-7/8s are not the giveaway that the 8s were.”<sup>221</sup> Nevertheless, Treasury received subscriptions for \$8.9 billion of the notes (2.5 times the amount offered). In view of the “substantial response,” it increased the size of the issue to \$4.7 billion, filling in full all subscriptions for less than \$500,000 that were accompanied by a 20% deposit and allocating 15% of the amount subscribed for to all other subscriptions.<sup>222</sup>

Treasury priced the 10-year notes in the August refunding more attractively and received subscriptions for \$24.4 billion of the notes (6.1 times the amount offered). It increased the size of the issue to \$7.6 billion, filling in full all subscriptions up to \$300,000 that were accompanied by a 20% deposit and allotting \$300,000 to any subscription for an amount between \$300,000 and \$500,000 that was accompanied by a 20% deposit.<sup>223</sup> The price of the new notes in WI trading rose to 101-10/32 on news of the rationing.<sup>224</sup>

The 1976 subscription offerings allowed Treasury to achieve its stated objectives: selling a large quantity of intermediate-term notes directly to retail investors and materially extending the average maturity of its debt.<sup>225</sup> The vast over-subscriptions on the February and August offerings also proved Friedman’s point: that it was difficult to set the terms of a fixed-price offering at a level that would generate the desired level of

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<sup>220</sup> FRBNY Circular No. 7864, April 29, 1976, Circular No. 7865, April 30, 1976, and Circular No. 7927, July 29, 1976.

<sup>221</sup> “Long-Term Bonds Advance in Price,” *New York Times*, April 29, 1976, p. 59.

<sup>222</sup> FRBNY Circular No. 7870, May 10, 1976.

<sup>223</sup> FRBNY Circular No. 7932, August 10, 1976.

<sup>224</sup> “\$7.6 Billion Sale of Notes is Made by U.S. Treasury,” *New York Times*, August 6, 1976, p. D1.

<sup>225</sup> Treasury noted (U.S. Treasury, 1977, p. 27) that the 10-year note sold in August was “well distributed with the bulk of it going to banks and individuals while dealers received very little.”

demand and no more. Treasury has not subsequently offered securities on a fixed-price basis.

#### **Appendix D. The Federal Reserve Private Wire System**

The Federal Reserve private wire system, designed to allow rapid communication between the twelve district Federal Reserve banks, the Federal Reserve Board, and the Department of the Treasury, was inaugurated on June 7, 1918. The new leased wire telegraph system was needed to accommodate the expansion in System messages that followed the initiation of Federal Reserve clearing and collection of commercial bank checks in mid-1916, as well as Treasury financing operations during World War I. (System messages had previously been sent by commercial telegraph.) Message volume was expected to increase further in July 1918, when the frequency of inter-district settlements was scheduled to change from weekly to daily.<sup>226</sup>

The private wire system was upgraded several times during the following decades as a result of technological developments and growth in message volume. In the late 1920s, a scarcity of telegraph operators led to the adoption of teletype machines and the replacement of telegraphers with less expensive typists on some circuits. By mid-1936 all of the system's circuits had been converted to either private wire or commercial (non-private) teletype.<sup>227</sup>

In July 1953, the system underwent a major upgrade when the manual teletype system was replaced with a perforated tape system configured around a semi-automatic message switching center in Richmond, Virginia.<sup>228</sup>

The perforated tape system lasted until 1971, when continued growth in the volume of money and securities transfers prompted the Fed to upgrade again, this time to a fully automatic computer-based system built around a switching center in Culpepper,

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<sup>226</sup> Smith (1956, pp. 11-24).

<sup>227</sup> Smith (1956, pp. 32-35).

<sup>228</sup> Smith (1956, pp. 44-47), Federal Reserve Bank of Richmond (1960), and Vollkommer (1970, pp. 23-25).

Virginia.<sup>229</sup> Concurrently, the Federal Reserve Bank of New York installed a new computer system, the Sigma V, to interface with the Culpepper switch and to maintain the money and securities accounts of member banks in the Second Federal Reserve District.<sup>230</sup> The Culpepper switch and the Sigma system were still in use at the end of the time period examined in this paper.

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<sup>229</sup> Vollkommer (1970, pp. 26-28) and Hoey and Vollkommer (1972, pp. 23-24).

<sup>230</sup> Federal Reserve Bank of New York (1984).

### **Appendix E. Interest Payment and Mark-to-Market Payments on a GCF Repo**

Suppose dealer A, acting through an IDB, enters into a 3-day GCF Repo on Treasury collateral with dealer B for \$100 million at an interest rate of 2.10%, where the repo starts on June 1 and terminates on June 4. The total interest liability of dealer A is \$17,500 ( $\$17,500 = \frac{3}{360} \cdot 2.10\%$  of \$100 million).

Sometime after 3:45 p.m. and before 4:30 p.m. on June 1, dealer A delivers \$100 million of Treasury securities to FICC against payment of \$100 million. Suppose also that after the close of trading on June 1, FICC announces a System Repo Rate of 2.05% for GCF Repos terminating on June 4. (This rate reflects FICC's best estimate of where 3-day GCF Repos are trading on the afternoon of June 1.)

On the morning of June 2 the collateral securities are delivered back to dealer A against payment of \$100 million. Dealer A also makes a \$5,833.33 payment to FICC for the accrued interest on its GCF Repo contract for one day at the contract rate of 2.10% ( $\$5,833.33 = \frac{1}{360} \cdot 2.10\%$  of \$100 million) and a mark-to-market payment of \$277.78 for the value of the difference between the contract rate of 2.10% and the System Repo Rate of 2.05% over the two days remaining in the life of the RP ( $\$277.78 = \frac{2}{360} \cdot .05\%$  of \$100 million). The total payment from dealer A to FICC is \$6,111.11 ( $6,111.11 = \$5,833.33 + \$277.78$ ). Dealer B receives the same amount from FICC.<sup>231</sup> At this point dealer A is "current" with respect to its interest liabilities and has posted margin to secure the decline in the value of its side of the repo contract attributable to the decline in the repo rate from 2.10% to 2.05%. This is why dealer A was allowed to recover its collateral on the morning of June 2 against payment of only the original principal amount of its borrowing.

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<sup>231</sup> These payments are included in each dealer's daily "funds-only" settlement. See Fixed Income Clearing Corporation, Government Securities Division, Rulebook (January 14, 2003), Rule 13 – Funds-Only Settlement.

Sometime between 3:45 p.m. and 4:30 p.m. on June 2, dealer A delivers \$100 million of Treasury securities to FICC against payment of \$100 million in satisfaction of its reinstated commitment to borrow. Concurrently, FICC resets the System Repo Rate for GCF Repos terminating on June 4. Suppose it resets the rate to 2.20%.

On the morning of June 3 the collateral securities are again returned to dealer A against payment of \$100 million. Additionally, dealer A receives back the \$6,111.11 that it paid the day before, plus interest at the overnight general collateral repo rate on that payment. (Dealer B pays an identical amount to FICC.) Receipt of interest on the \$6,111.11, as well as the return of the \$6,111.11, means that dealer A's payment of \$6,111.11 the previous day did not constitute a net economic burden for the dealer: the money was returned and the dealer was compensated for the time value of its money. The payment of the \$6,111.11 by dealer A on June 2 merely served to facilitate the return of dealer A's collateral against payment of only the principal amount of the RP.

The return of the \$6,111.11 payment on the morning of June 3 means that dealer A has to make new payments to justify the return of its collateral on June 3 against payment of the original principal amount of the GCF Repo. Consequently, dealer A makes a new payment of \$11,666.67 to FICC, representing accrued interest on the GCF Repo contract for *two* days at the contract rate of 2.10% ( $\$11,666.67 = \frac{2}{360} \cdot 2.10\%$  of \$100 million), and receives a mark-to-market payment of \$277.78 for the value of the difference between the contract rate of 2.10% and the revised System Repo Rate of 2.20% over the one day remaining in the life of the RP ( $\$277.78 = \frac{1}{360} \cdot .10\%$  of \$100 million). The total payment from dealer A to FICC is \$11,388.89 ( $\$11,388.89 = \$11,666.67 - \$277.78$ ). FICC pays the same amount to dealer B.<sup>232</sup> These payments justify the return on the morning of June 3 of dealer A's collateral against payment of the \$100 million original principal amount of the GCF Repo.

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<sup>232</sup> In practice, the reversal of the previous day's payment, plus interest on that payment, is netted against the current payment in each dealer's funds-only settlement.

Sometime between 3:45 p.m. and 4:30 p.m. on June 3, dealer A delivers – for the last time – \$100 million of Treasury securities to FICC against payment of \$100 million.

On the morning of June 4, dealer A recovers – also for the last time – its collateral from FICC against repayment of the \$100 million principal amount of its borrowing and also makes an interest payment to FICC of \$17,500, representing interest on the GCF Repo contract for three days at the contract rate of 2.10%. FICC pays the same amount to dealer B. Additionally, dealer A receives back the \$11,388.89 that it paid the day before, plus interest on that payment. (Dealer B pays an identical amount to FICC.) Receipt of the \$11,388.89, plus interest on that amount, means that dealer A's payment of \$11,388.89 the previous day did not constitute a net economic burden for the dealer. The \$11,388.89 payment on June 3 served only to facilitate the concurrent return of dealer A's collateral against payment of the principal amount of the RP.

Comment: The process of marking a GCF Repo contract to market is conceptually different from the process of, for example, marking a commodity futures contract to market. Following a rise in a futures price, the settlement prices on all existing contracts are revised, or marked, to the new price. Shorts pay longs the change in price to compensate the longs for the higher price the longs will have to pay upon delivery of the underlying commodity.

In contrast, the interest rate on a GCF Repo contract is never changed from the rate originally agreed to by the ultimate counterparties and interest is paid in full at the original contract rate at maturity. However, in order to facilitate the daily reversals of collateral against payment of the original principal loan amounts, borrowers have to pay lenders accrued interest and they have to make (or receive) mark-to-market payments for changes in repo rates since their contracts were originally negotiated. These facilitation payments do not change the fact that interest on a GCF Repo contract is paid in full at

maturity at the original contract rate because every facilitation payment is returned (with interest) the following day.



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