

Federal Reserve System



Alternative Instruments for Open Market and Discount Window Operations

Federal Reserve System Study Group
on Alternative Instruments for System Operations

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FEDERAL RESERVE SYSTEM

Study Group on Alternative Instruments for System Operations

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FOREWORD

During its meeting on January 30-31, 2001, the Federal Open Market Committee discussed the management of the Federal Reserve System's asset portfolio in light of the rapid declines at that time in the amount of Treasury debt outstanding. The FOMC's historical reliance on purchases and sales of Treasury securities to implement monetary policy would be difficult to maintain if large budget surpluses and the associated steep reductions in Treasury debt were to continue. To prepare for such a contingency, the Committee needed to identify alternative instruments for the conduct of monetary policy and to explore the implications of their use.

Staff members of the Federal Reserve System prepared a variety of materials for the Committee's January 2001 meeting. During the meeting, Committee members indicated that an edited version of the staff's background work should be released to make the public aware of the System's efforts and to spur examination of the topic in the academic and financial communities.

Since then, the prospects for large reductions in Treasury debt appear to have been significantly reduced, at least in the near term. In addition, the Federal Reserve System has revised some of its operating procedures, procedures that in some cases were the subject of close attention in these papers. Especially important among these initiatives has been the redesign of the Federal Reserve's lending facility, to be implemented in early January 2003.

The studies in this volume represent conditions as they appeared in late 2000, and they have not been revised to reflect subsequent changes in circumstances. They have been edited for the sake of clarity, to update some citations to the literature, and to remove confidential information.

The analyses and conclusions set forth are those of the authors and do not necessarily indicate concurrence by the Board of Governors, by the Federal Open Market Committee, by the Federal Reserve Banks, or by members of their staffs.

VINCENT R. REINHART

*Secretary,
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1. PRINCIPLES AND ILLUSTRATIONS FOR FEDERAL RESERVE PORTFOLIO SELECTION AND MANAGEMENT

If the Federal Reserve wishes to widen the types of assets it acquires for the System Open Market Account, it should be guided by a prior set of principles for managing the composition and operations of the account. This chapter offers four such principles for managing the Federal Reserve's portfolio and provides several illustrations of putting them into practice.

In discussing the four principles, we cast the presentation largely in terms of open market operations because they currently are the principal method for effecting the growth and cyclical flexibility of the Federal Reserve's balance sheet. The same principles apply, however, to any discount window credit that would substitute for, or complement, direct purchases and repurchase agreements in the open market.

PRINCIPLES

The starting point for developing a set of principles is the Federal Reserve Act, which gives the central bank its goals of achieving price stability and fostering sustainable economic growth.¹ To accomplish its long-run objectives, the Federal Reserve should adhere to the following principles:

1. Exercise effective control over the stock of high-powered money and the size of the System's balance sheet, both in a technical sense and in the broader sense that the Federal Open Market Committee alone is able to choose and achieve its monetary policy stance in furtherance of its pursuit of the overall goals given by the legislation ("instrument independence")
2. Structure its portfolio and undertake its activities so as to minimize their effect on relative asset values and credit allocation within the private sector
3. Manage its portfolio to be adequately compensated for risks and to maintain sufficient liquidity in its portfolio to conduct potentially large actions on short notice

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1. The Federal Open Market Committee has used these terms to describe the Federal Reserve's goals. Section 2A of the Federal Reserve Act gives the goals as maximum employment, stable prices, and moderate long-term interest rates (12 U.S.C. §225a).

4. Place a high priority on transparency and accountability in its monetary policy operations.

The principles as stated are not immutable, and in other periods of the Federal Reserve's history, they undoubtedly would have been stated differently. But each principle is related to the goals of price stability and sustainable economic growth.

The principle of instrument independence is of fundamental importance. Its importance to achieving the Federal Reserve's goals is supported by a very broad theoretical and empirical literature in monetary economics. In the 1990s, instrument independence figured prominently in central bank reforms in several major foreign economies. These developments reflect a greater social and political consensus globally on the importance of price stability in enhancing economic growth over time and on the need for central banks to have the instrument independence to pursue price stability.

The remaining three principles are based on the historical and practical experiences of the Federal Reserve and other central banks. Unlike the first principle, they are stated not as absolutes but rather as guidelines. This looser standard reflects the fact that some tradeoffs between principles 2 and 3 will be unavoidable in managing a portfolio as large as the Federal Reserve's. Indeed, the tradeoffs between these principles could become even sharper if the Federal Reserve should need to further diversify its portfolio. In addition, the appropriate degree of transparency will need to reflect a scope and detail of disclosure that clarifies policy intentions and avoids detail that becomes distracting or confusing. Thus, the central bank has to determine the weight to place on each of these latter principles, accepting some limitations on its ability to satisfy them simultaneously.

The second principle, minimizing relative price effects and credit allocation in the private sector, is consistent with well-supported doctrines in the economics literature: In general, market price mechanisms allocate resources most effectively when undistorted by government actions, and market-directed resource allocation fosters long-run economic growth.² The truth of these doctrines also has been borne out by much hard experience, both domestic and international, with varying levels of governmental intervention in the market process.

The third principle focuses on portfolio risk and liquidity. It relates to the central bank's responsibility as a public entity to use public resources wisely and to its need to meet its goals in a very broad range of economic and market circumstances.

Finally, the fourth principle, transparency and accountability, has foundations in the literature and in practice. Central bank transparency and accountability contribute to the goals of price stability and maximum sustainable growth by helping to stabilize inflation expectations and to reduce market uncertainty and by supporting instrument

2. An important exception arises when incentives or structural problems cause individual markets to fail. Even in the presence of such problems, policymakers can seek to design appropriate "second best" microeconomic policies to approximate a market-based resource allocation.

independence. While the most important aspects of central bank transparency relate to the stance and strategy of policy, transparency about the size and composition of the portfolio and the actions taken to alter them also helps maintain confidence and avoid misunderstanding. Transparency about portfolio operations enhances accountability by enabling the public to judge whether the actions of the central bank are consistent with its stated portfolio policies.

Maintaining Instrument Independence

The Federal Reserve must alter the quantity of high-powered money and the size of its portfolio to achieve its day-to-day policy stance and to address secular, cyclical, and emergency needs. In the years before the Treasury–Federal Reserve Accord of 1951, governmental pressure at various times directed both the growth and the composition of the Federal Reserve's portfolio.³ Since then, the Federal Reserve has conducted its monetary policy with far less direction from other parts of the government. However, varying degrees of pressure have been brought to bear on policy, including the portfolio choices implicit in "operation twist" in the early 1960s and pressure to ease monetary policy at various times since then. Pressure to alter the *total size* of the portfolio interferes directly with instrument independence, and pressure to influence the *composition* of the portfolio interferes with the Federal Reserve's ability to satisfy the other three principles. As we argue below, compromising unduly on these last three principles also could risk jeopardizing instrument independence.

Minimizing the Effects of Federal Reserve Operations on Credit Allocation and Relative Prices

The monetary policy mission of the Federal Reserve is statutorily cast in terms of macroeconomic outcomes. In contrast, outcomes for specific sectors and for relative prices of credit or assets are within the purview of private markets and fiscal policy. Moreover, monetary stimulus or restraint is transmitted through the reserves market and reflected in the federal funds rate. Other asset prices are affected by the current and expected path of the federal funds rate rather than by *direct* effects on the prices of securities purchased for, or sold from, the asset side of the Federal Reserve's balance sheet. The broad mission of monetary policy and its transmission through the reserves market, together with the desirability of allowing private decisions to allocate credit, imply that, the Federal Reserve, *in choosing its portfolio composition*, should attempt to minimize effects on relative asset prices.

However, conducting monetary policy operations requires designating instruments and counterparties, thus potentially giving those instruments and counterparties at least some advantage over others. While fulfilling its needs to acquire assets, the Federal Reserve should avoid as best it can any such favoritism, whether it be systematic or inadvertent. Not only would the favoring of specific entities in the private sector distort resource allocation, but even appearing to influence relative financial asset prices in the private

3. See appendix 1.A for a legislative history related to open market operations and the discount window.

sector through asset selection might invite pressure from special interest groups to achieve specific outcomes. Such pressure could pull the Federal Reserve into fiscal debates and, by shifting public focus and support from its general macroeconomic mandate to its portfolio actions, possibly compromise its ability to achieve its monetary policy objectives.

Currently, some small external influence on the composition of the Federal Reserve's portfolio exists. Decisions on foreign currency intervention made chiefly by the Treasury can add or subtract foreign currency assets on the Federal Reserve's balance sheet, although such actions have been infrequent and small in recent years. In addition, discount window lending to troubled institutions is undertaken in consultation with other supervisory agencies, but such activity has been limited by the Federal Deposit Insurance Corporation Improvement Act of 1991. Finally, the Congress may have intended to enhance the flow of credit to government agencies when it authorized purchases of their obligations in the 1960s.

The Federal Reserve's current open market strategy of operating primarily in Treasury securities may have some effect on the prices of Treasury securities relative to private securities, thereby creating a distortion in asset markets. Any effect has received little attention to date for three reasons. First, until recently these distortions have appeared to be very small because of the depth and liquidity of the Treasury market, especially since the mid-1970s. Indeed, the Federal Reserve worked with the Treasury to further the liquidity of the government securities market by establishing the primary dealer system. Second, to the extent distortions have occurred, they generally have lowered U.S. government borrowing costs and have thus benefited U.S. taxpayers broadly. Finally, the fact that the Federal Reserve's portfolio consists largely of Treasury securities has enabled the Federal Reserve to maintain neutrality vis-à-vis the rest of government and the private sector by avoiding credit-risk intermediation and picking and choosing among particular private borrowers.⁴

From World War II to the present, markets for few classes of debt securities have approached the depth and liquidity of the Treasury market.⁵ If the Federal Reserve was to conduct the bulk of its operations in assets other than Treasury securities, the risk of

4. The Federal Reserve can be seen as conducting maturity transformations, given the nature of its principal liabilities—currency and demand balances. The recent economics literature appears not to have directly addressed the question of the neutrality of central bank asset choices, although a literature exists on the linkage between monetary and fiscal policy in which the Ricardian equivalence of taxation and debt finance plays a major role. One analysis of the neutrality question is found in S. Rao Aiyagari and Mark Gertler, "The Backing of Government Bonds and Monetarism," *Journal of Monetary Economics*, vol. 16 (July 1985), pp. 19–44. More than forty years ago, Philip Cagan analyzed the effects of central bank balance sheet structure in "Why Do We Use Money in Open Market Operations?" *Journal of Political Economy*, vol. 66 (February 1958), pp. 34–46.

5. J. Alfred Broadus, Jr., and Marvin Goodfriend present a proposal to maintain Federal Reserve portfolio neutrality by ensuring continued issuance of Treasury securities, even if Treasury debt was to decline sharply ("What Assets Should the Federal Reserve Buy?" Federal Reserve Bank of Richmond, 2000 *Annual Report*).

affecting relative prices across *private* assets could be significant, although strategies employing substantial diversification and carefully designed trading rules could greatly reduce these effects.

The structure and liquidity of other markets will change if, as anticipated, eventual shrinkage of the Treasury market impairs that market's liquidity. In such circumstances, private-market participants likely will develop or expand alternative markets to replace the valuable benchmark and liquidity services the Treasury market has provided.⁶ If the supply of Treasury securities shrinks, the need for the Domestic Trading Desk to undertake a significant portion of its transactions in highly liquid instruments may require that it follow private markets to a certain extent as they gravitate toward new securities that provide benchmark and liquidity services. Yet, in entering such markets, the Federal Reserve is likely to have a further impact on the structure and liquidity of these markets, and it will need to take account of any expected effects.

Achieving Portfolio Liquidity and Controlling Risk

Liquidity

It is conceivable that the liquidity needs of the Federal Reserve's portfolio could be great, even though under normal circumstances a substantial portion of the liabilities of the Federal Reserve is essentially permanent. In considering these liquidity needs, the Federal Open Market Committee (FOMC) may wish to distinguish conceptually between two segments of the portfolio: a structural component that grows from year to year and could be relatively illiquid and a liquid component consisting of assets that could be sold into the market or allowed to mature without causing major price distortions.

The traditional approach in the United States and abroad has been for a central bank to issue currency and reserves as its primary liabilities and to hold sound short-term paper, repurchase agreements, or liquid long-term paper as assets. The Federal Reserve's portfolio has grown secularly with currency demand, although there is no guarantee that this growth will continue in a predictable way. However remote the possibility, were there a significant drop in currency demand, the Federal Reserve would have to sell assets to achieve its monetary policy goals.

Principal liquidity concerns, however, stem not from secular or permanent changes in currency but from short-term needs to alter the portfolio's size and composition. Major causal factors have been seasonal and other short-term shifts in currency demand, Treasury deposits, and other factors affecting reserve balances, as well as less-predictable changes in other asset categories, such as foreign currency reserve holdings and discount window advances. A look at the statistical record during the period since 1976 shows typical daily percentage changes in the size of the System portfolio (that is, the standard deviation from the trend growth rate) in the range of 1.5 percent. But particular episodes

6. Those services include (1) establishing anchors for the prices of public and private securities and (2) providing the liquidity necessary to manage substantial private-sector balance sheets, including dealer inventories.

have created swings of as much as 15 percent on rare occasions. Given assets of approximately \$525 billion (as of late 2000), such an extreme swing would amount to an increase or decrease of nearly \$80 billion in a single day.

The Federal Reserve must be prepared to add or drain very large amounts of reserves on short notice to achieve its monetary policy goals. Any assessment of the suitability of a particular portfolio in dealing with such savings will include the expected relative price effects of the Federal Reserve's actions. Thus, relative price effects must be considered under stressful conditions as well as under conditions posed by daily reserve management. But even occasional large liquidity requirements leave considerable scope for holding a sizable portion of the portfolio in less liquid assets. That scope could be somewhat greater if the Federal Reserve was also to adopt a standing facility such as the deposit account described later.

Managing Credit and Interest Rate Risk

Management of a large portfolio of assets necessarily involves choosing strategies for managing credit and interest rate risk. Such strategies must be compatible with meeting monetary objectives and maintaining independence while taking account of the last three of the four principles presented at the outset. However, any strategy of diversification beyond Treasury securities inevitably will involve taking credit risk and possibly incurring occasional losses. Such credit risk should be managed in accordance with sound practices, so that the central bank is compensated for taking risk and would not incur unexpectedly severe losses.

The appropriate level of credit-risk exposure in the Federal Reserve's portfolio will be determined in part by the characteristics of assets available in the market. The Federal Reserve's current approach limits its credit risks by confining its holdings to Treasuries and other perceived high-quality assets, as well as to repurchase agreements and collateralized discount window loans that represent secured credit exposures to strong counterparties. Thus, the Federal Reserve has been able to maintain both liquidity and high credit quality. As the pool of marketable Treasuries shrinks, judgments about how much credit risk to bear and how to employ diversification to manage such risk will become more critical. Among debt instruments, a portfolio of higher credit quality and greater diversification often tends to be more liquid under a broad range of conditions than a portfolio of lower credit quality and lesser diversification, but the relationship is not ironclad.⁷ Nonetheless, efforts to minimize credit allocation effects may be reason to hold a portion of the portfolio in less liquid, less high quality assets.

Whatever its appropriate level, credit risk should be well managed and should not exceed what is necessary to meet the Federal Reserve's monetary objectives. One important reason for much prudence is that knowingly accepting excessive credit risk, like engaging

7. An instrument's liquidity is determined in part by whether or not it is traded in a continuous market. For example, corporate equities traded on exchanges can have extensive price (that is, credit) risk but also be highly liquid because they are traded in continuous auction markets.

in credit allocation, can be thought of as an action exercised more appropriately by the fiscal authorities than by the central bank. Moreover, significant credit problems might give rise to misunderstandings of the rationale behind the Federal Reserve's asset allocation policies and possibly to political interference in these policies. Transparency about strategy and tactics can reduce the risk of misunderstanding but probably cannot fully eliminate it.

Purchasing assets with greater credit risk also would raise practical issues. The potential for credit losses, which often can occur at or just after cyclical troughs, would require the Federal Reserve to adjust the way it values its portfolio. With risky assets, it would make sense to place some portion of earnings into a credit loss reserve and conduct frequent reviews of the portfolio to assess the adequacy of the reserve. Indeed, systematic reserving and prompt write-downs over a large, highly diversified portfolio should be an expected part of managing such a portfolio. With risky assets, the Federal Reserve also would need to develop standards for acquiring and retaining such assets. Higher (that is, narrower) standards would reduce the total asset pool available to the Federal Reserve and could make diversification more difficult.

Maintaining a portfolio that includes intermediate- and long-term fixed-income securities necessarily involves bearing interest rate risk. To date, capital gains and losses on long-term securities in the Federal Reserve's portfolio have received little attention. The Federal Reserve does not explicitly manage its interest rate risk position, although it does manage the size of its positions in individual securities to minimize any adverse effect on market liquidity and relative prices among securities. The FOMC's desire for a short-term portfolio has skewed the System's holdings away from long-term securities whose values fluctuate most with changes in interest rates. The Federal Reserve's use of historical cost accounting for its domestic holdings means that only realized capital gains and losses are reflected in the Federal Reserve's financial results, and the Federal Reserve's current operations do not create a necessity to sell securities that would produce large, realized capital losses. Moreover, the fact that the portfolio is invested largely in Treasury securities probably has drawn attention away from capital gains and losses.⁸ This situation could change with holdings of more non-Treasury assets.

The implications of bearing greater interest rate risk are similar to those for bearing credit risk. The level of interest rate risk should be well managed and compatible with what is necessary to meet the objectives of monetary policy. The level of interest rate risk and

8. It could be argued that gains and losses on Treasury securities are a "wash" with the Treasury because the Federal Reserve simply purchases instruments issued by the Treasury. This argument would be true as a general proposition, however, only if the Treasury and the Federal Reserve coordinated their actions such that the duration of privately held Treasury debt were unaffected by the Federal Reserve's portfolio decisions. Because the Federal Reserve's portfolio is purchased in the open market and the Treasury only indirectly adjusts its offerings to Federal Reserve portfolio decisions by responding to market conditions, the Federal Reserve's choice of maturity mix probably is offset to some extent by changes in that of private holdings, especially in the short run. Thus, the Federal Reserve's maturity mix to some extent affects the capital gains and losses of the private sector relative to those of the government.

credit risk may not always be low. For instance, during conditions of emergency lending, taking on credit risk to prevent a contraction of liquidity in the private sector may be appropriate. In addition, under highly unusual circumstances, such as a period of extreme and prolonged economic weakness and a zero short-term interest rate, the Federal Reserve might increase its interest rate risk or foreign exchange risk beyond customary levels. It would do so with the knowledge that a subsequent economic expansion ultimately could result in capital losses in the portfolio when the economy, interest rates, and the exchange rate returned to higher levels (offset at least partly by capital gains from lower credit-risk premiums on any private securities). In taking on portfolio risk for policy purposes under these circumstances, the Federal Reserve would likely be in close communication with other governmental entities, including the Treasury and the Congress.

If the Federal Reserve portfolio was marked to market, the publicly stated value of the portfolio could be subject to more volatility, which could affect transparency. The value of the Federal Reserve's assets would change with interest rates, whereas the value of reserves and currency would not. Thus, the effect of Federal Reserve policy operations on the balance sheet would require additional explanation to the public. If volatility impaired transparency sufficiently, the Federal Reserve might need to take more explicit consideration of interest rate risk in managing its portfolio.⁹ Some of the potential for volatility can be handled by establishing one or more valuation reserves in conjunction with a program to manage interest rate and credit risk exposures. Such an approach currently is standard practice for the trading accounts of most banks and securities firms and many foreign central banks. (The reflection of risk and its impact on the volatility of the portfolio's value under alternative accounting treatments is discussed in appendix 1.B.)

Internal Control

In selecting portfolio strategies, the Federal Reserve should meet high standards of internal control. Basic control procedures such as segregation of duties, reconciliation, and periodic independent revaluation of portfolio positions are crucial in any control system. Internal control has increasingly become not just a series of checks and balances, such as reconciliation, but a comprehensive process that involves management oversight, identification of risk, procedures to limit risk, monitoring, and communication. The goal of the process is not only to protect the institution (and its counterparties) from the consequences of human error, system breakdown, and impropriety but also to ensure the efficiency and quality of the institution's operations.

Internal controls need to match the complexity and sophistication of the particular activities the Federal Reserve engages in. A number of features of the Federal Reserve's

9. If the Federal Reserve needed to manage interest rate risk, financial techniques could be employed to calculate the expected duration (and convexity characteristics) of the Federal Reserve portfolio. Given the size of the Federal Reserve portfolio, which currently would place the Federal Reserve among the world's largest financial institutions, the Federal Reserve would need to consider what effect its management of interest rate risk would have on the relative prices of securities.

Treasury market activities—well-established trading conventions, relatively continuous availability of market prices near transaction values, and settlement over the Fedwire book-entry securities service, as well as the Federal Reserve's long experience in the Treasury market—facilitate a strong control environment. If the Federal Reserve's portfolio strategy was to shift toward other markets, the complexity of the control process almost certainly would rise.

Management, technological capacity, and system design are the major determinants of an effective control system. While the principles of internal control are widely agreed upon, their application is necessarily activity-specific. Thus, developing a satisfactory control-process design and obtaining the necessary information systems and management skills would be important considerations if the risk profile of the portfolio were to change.

Settlement Risks

To facilitate reserve management, instruments in the liquid portion of the portfolio should have a relatively short settlement cycle. They also should have minimal settlement risk (the risk of loss from a settlement that commences but is not completed), high legal certainty of the pre-settlement and settlement credit amounts, and settlement with finality. Settlements now occur using the Federal Reserve's own payment and book entry systems, as well as the tri-party custody systems at banks that conform to the Federal Reserve's systems. Thus, the principal risk of settlement failure reflects operational risk at the Federal Reserve, the counterparty, or the tri-party custodian. Because the settlement process varies considerably across markets, operational complexity will increase if the Federal Reserve becomes active in an increasing number of markets.

Transparency and Accountability

The Federal Reserve portfolio should be constructed and managed so that the monetary policy mandate of the Federal Reserve to achieve price stability and foster sustainable economic growth is understood by the public to be paramount. If moving further from a Treasuries-only portfolio becomes necessary, well-articulated principles of monetary operations, along the lines outlined in this study, can help prevent the impression that the Federal Reserve is seeking to influence relative prices or otherwise convey advantage to selected institutions or sectors. Moreover, such principles can provide the framework within which the Federal Reserve can publish reports on its actual portfolio composition and performance and thus enhance its transparency and accountability. If Federal Reserve asset choices or the income remitted to the Treasury were to draw more public attention and perhaps become contentious issues, such concerns could be more readily addressed if the basic principles were clearly articulated and supported by transparency and accountability.

ILLUSTRATIONS OF THE PRINCIPLES

The preceding sections explained four principles for the System's conduct of its open market operations and management of its portfolio: (1) maintain instrument independence for monetary policy, (2) minimize credit allocation and distortions to relative asset prices, (3) maintain necessary portfolio liquidity and control credit quality,

and (4) promote transparency and accountability. In this section, we place these principles into context by illustrating how they might be applied very generally under a number of alternatives for the portfolio.¹⁰ The illustrations are intentionally sketchy. The subsequent chapters, covering open market operations and the discount window, will deal much more fully with these issues.

Three themes will emerge from this cursory discussion, all predicated on the assumption of declining Treasury debt. The first theme concerns the difficulty of maintaining a balance sheet consisting largely of Treasury securities, even if the portfolio benefits of such a strategy are seen to outweigh all alternative strategies. The second theme highlights the attractiveness of strategies employing broad diversification. The third theme suggests how operational changes, such as changing the role of the discount window and employing deposit accounts, could simplify reserve management at times of stress and reduce the need for portfolio liquidity.

Investment Only in Treasuries

Maintaining a largely Treasuries-only portfolio would support instrument independence of monetary policy by keeping the Federal Reserve out of the arena of private-sector credit allocation and by helping the Federal Reserve maintain neutrality vis-à-vis the rest of government. External pressure on Federal Reserve asset selection would continue to be minimal. Moreover, as now, Treasury securities would raise few issues regarding portfolio risk and transparency.

To accomplish this in an era of unified budget surpluses, the Federal Reserve would need to enter into an agreement with the rest of the government that the Treasury would continue to issue securities that the Federal Reserve could buy.¹¹ Even with overall budget surpluses—so long as the Treasury (or other governmental entities) would be willing to acquire private instruments—the Treasury could continue to issue debt that the Federal Reserve could purchase to meet the existing and secularly growing demand for the monetary base (mainly currency). Since the Federal Reserve would remit its earnings to the Treasury in any case, the overall federal budget position (combining the Federal Reserve and the Treasury) would be similar whether the Treasury chose to earn its seignorage by holding private instruments and issuing debt that the Federal Reserve purchased or whether the Federal Reserve purchased the private assets. Fundamentally, the public's growing demand for base money forces the government as a whole to choose between lowering taxes, increasing expenditures, or building up its non-Treasury asset portfolio no matter how the Treasury chooses to take its seignorage. In effect, in the

10. The alternatives discussed here are not mutually exclusive, and some would require new legislation.

11. It is noteworthy that the governments of Sweden, Canada, and Australia recognize some merit in continuing to issue government debt, even beyond their current budget requirements, in order to maintain a continuous and dependable market for their debt. Norway's government has run substantial surpluses as a result of its oil revenues, much of which it has retained in its State Petroleum Fund and invested abroad. Because the remainder of its budget has been in deficit, Norway has continued to issue public debt. These developments are discussed further in appendix 1.C.

absence of fiscal policy changes, the choice of which private assets to hold against currency would shift from the Federal Reserve to the Treasury.¹²

Thus, with cooperation from the Treasury, the Federal Reserve could satisfy its long-term need to acquire assets. To accommodate shorter-term needs to adjust its portfolio, the Federal Reserve could supplement its purchases of Treasuries with repurchase agreements in private debt instruments or with some other form of private liquid asset. This supplementation would become necessary if the stock of liquid Treasury securities that the Treasury was willing to maintain in the markets was too small to promote the liquid markets the Federal Reserve needs to adjust its portfolio. It could be difficult to effect large swings in the Federal Reserve's portfolio in the absence of either substantial Federal Reserve holdings of privately backed liquid assets or amounts of privately held Treasury securities sufficient to create a meaningful market in which the Federal Reserve could transact.

A concern is that the Federal Reserve would be dependent on the Treasury's maintaining a stock of outstanding debt solely to facilitate Federal Reserve monetary policy operations. In effect, Federal Reserve monetary policy needs would dictate either the fiscal policy stance of the government or its requirement to accumulate private assets. Great care would have to be taken to structure cooperation with the Treasury so as to avoid situations in which the Federal Reserve's dependence on the Treasury and indirect involvement in fiscal policy compromises its instrument independence. This potential, however, would need to be weighed against the potential that Federal Reserve purchases of private securities could compromise the Federal Reserve's arm's length distance from political influences on its interest rate target.

Expansion through Specific Non-Treasury Classes

Concentrating portfolio growth within one or a few classes of specific non-Treasury assets could result in credit-risk concentrations and noticeable effects on economically important relative prices. Such a strategy could expose the Federal Reserve to pressure to favor certain assets or to increase the return on the portfolio to enhance Treasury revenue. Depending on the asset class, public resistance to necessary reductions in large portfolio positions of specific assets might also arise.

Agencies

Access to federal agency securities has enhanced the liquidity of the Federal Reserve's portfolio by enabling the Desk to operate in markets with extensive trading activity. This advantage is likely to become more pronounced with a decline in Treasury debt outstanding should private trading gravitate toward certain agency securities that begin to share the "benchmark" status traditionally enjoyed by Treasuries. However, relying on a significant expansion of agency securities to fund the growing portfolio has disadvantages, particularly in light of the importance of such securities to specific sectors

12. See Broadus and Goodfriend, "What Assets Should the Federal Reserve Buy?" for a fuller discussion of this approach.

of the economy, such as housing. If large budget surpluses persisted, this approach would require that very large permanent positions be taken in these securities either through outright purchases or through repurchase agreements. Such a strategy could tend to affect credit allocation and relative prices; also, large Federal Reserve holdings might reinforce the misconception that the government would not allow these issues to default. Such an approach also would limit overall portfolio diversification and expose the Federal Reserve to the possibility of outsized portfolio losses.

Foreign Debt

Many central banks in industrialized countries conduct monetary policy using a variety of foreign instruments.¹³ Most frequently employed are repurchase agreements denominated in the domestic currency and backed by foreign collateral. Though the contract itself is free of exchange rate risk, the collateral entails country risk and, outside a common-currency area such as the euro area, exchange rate risk, both of which are priced into margin requirements. Such repurchase agreements tend to have terms of two weeks or less, which helps limit these risks.

A few central banks conduct monetary policy using foreign exchange swaps.¹⁴ By virtue of combining a spot and a forward transaction, foreign exchange swaps generally do not entail exchange rate risk.¹⁵ They are functionally equivalent to repurchase agreements with foreign currency assets as the underlying collateral. A few central banks also conduct monetary policy in foreign-denominated repurchase agreements or outright purchases.¹⁶ If not hedged, such transactions entail direct foreign exchange risk and essentially represent nonsterilized foreign exchange intervention.

All of these foreign transactions involve some element of country risk. If the Federal Reserve conducted monetary policy using these instruments, the list of eligible countries and instruments could attract attention and would need to be chosen with care on the basis of clear, defensible criteria. If the amount of such transactions became very large, country diversification could become important and would entail a fairly broad list of eligible countries. In engaging in foreign transactions, the Federal Reserve would need to pay close attention to operational transparency. In particular, the Federal Reserve would

13. The central banks studied for this report are those of the foreign G-7 countries (Canada, France, Germany, Italy, Japan, and the United Kingdom), those of Australia, Norway, Sweden, and Switzerland, and the European Central Bank. In this chapter, "foreign central banks" refers to the institutions studied.

14. The central bank of Switzerland has employed foreign exchange swaps extensively to increase domestic liquidity. Foreign exchange swaps are discussed in the papers upon which appendix 1.C is based. See Richard W. Kopcke, "The Practice of Central Banking in Other Industrialized Countries," Federal Reserve Bank of Boston, *New England Economic Review* (Second Quarter 2002), pp. 3–9, and the related papers in that issue.

15. When the forward leg of the operation is missing, the transaction resembles an outright purchase with foreign exchange as the underlying asset, a form that is usually classified as foreign exchange intervention.

16. Limited direct purchases and sales are used by the central bank of Switzerland and the Bank of England. The central bank of Norway purchases Norwegian government debt denominated in foreign currencies.

need to make clear to the public the distinction between operations in foreign assets for monetary policy purposes (which it controls) and operations in foreign assets for foreign exchange interventions (for which the Treasury has primary responsibility).

Corporate Equities

Although the equity market comprises a large and diverse pool of assets, actions involving a portfolio of equities even as broad as the Wilshire 5000 could be seen as affecting the relative price of that class of assets—an important macroeconomic indicator—risking at times the perception that the Federal Reserve was targeting the equity price level as well. The size of the Federal Reserve's equity portfolio would be subject to public scrutiny, and assets would be exposed to large variations in market value, unless equity-risk exposures were hedged by using futures and options, leaving the equivalent of a short-term cash investment. Such strategies would have to be carefully designed, fully publicized, and consistently and openly implemented or they could cloud transparency and shift the public focus from monetary policy to equity actions.

In any event, Federal Reserve ownership of equities would raise questions about government ownership of capital and the government's role in corporate governance. Substantial concerns about Federal Reserve credibility, independence, and reputation would need to be addressed in order to rely on a portfolio emphasizing equity investments unless, perhaps, a very broad pool of equities were included as a rule-based portion of a much broader portfolio approach that included a wide array of debt instruments.

Other Specific Classes

The Federal Reserve could restrict portfolio activity beyond Treasuries to other specific classes such as high-grade commercial paper, negotiable certificates of deposits (issued by a bank other than the tendering institution), state and local government debt, asset-backed securities, or corporate bonds of a stated grade or above.¹⁷ As with agency securities, however, this approach could be seen to favor certain classes of assets and could affect relative prices, possibly to a significant degree, depending on specifics. Limiting purchases to a few narrow asset classes would lead to concentrated positions as the portfolio grew over time. Because of risk concentrations and external pressure to favor specific assets, procedures to safeguard the Federal Reserve's reputation and instrument independence would need to be addressed.

Expansion through Broadly Diversified Non-Treasury Portfolios

These alternative approaches include different, but not mutually exclusive, strategies for building a diversified asset portfolio. The chief strength of these approaches in comparison with the asset-by-asset approaches reviewed above is their potentially low impact on relative prices and liquidity in any individual market. Disadvantages are that they do not necessarily eliminate external pressure for credit allocation (for example, to

17. In its early years, the Federal Reserve concentrated its direct purchases on bankers acceptances. See David Marshall, "Origins of the Use of Treasury Debt in Open Market Operations: Lessons for the Present," Federal Reserve Bank of Chicago, *Economic Perspectives*, vol. 26 (First Quarter 2002), pp. 45–54.

place small amounts of favored securities in the portfolio) and that they may conflict with the need for liquidity, which would suggest trading in the limited number of instruments preferred by private traders.

Outright Purchases

A portfolio of outright purchases across a broad range of markets could help maintain relative price neutrality and, if the guidelines were well defined, perhaps reduce incentives for attempts to exert external influence. Specific portfolio guidelines would need to be designed to ensure sufficient diversification and to minimize relative price effects, achieve sufficient liquidity, and manage credit quality. Portfolio management might be rule-based to some extent, with investment guidelines and criteria spelled out publicly to limit the sense that portfolio choices were being skewed toward certain instruments or agents for reasons unrelated to the conduct of monetary policy. Portions of the portfolio might be structured as mutual funds and might even employ formal indexation where weights of portfolio holdings would be set in accordance with the weighting of the indexes. In that regard, though, careful thought would have to be given to any consequences that fixed portfolio rules might have in amplifying market responses to Federal Reserve trades if such rules dictated sizable transactions over a short period in illiquid assets. Attention would also have to be paid to operational complexities that might accompany a broadly diversified portfolio.

Because it would tend to avoid market consequences of asset decisions, this diversified, indexed portfolio approach has the advantage that the Federal Reserve not only could increase its portfolio if budget surpluses were to persist but also would more likely be able to contract or eliminate this portion of the portfolio with minimal repercussions if budget surpluses failed to persist. The use of externally managed mutual funds would raise some issues. One such issue would be establishing a system for manager selection, a question analogous to that of selecting primary dealers. Again, an open approach with transparent criteria would seem to have considerable advantages.

Repurchase Agreements with Broadly Based Collateral

The Federal Reserve could choose to limit the expansion of outright purchases in favor of increasing its reliance on temporary open market transactions against a wide range of collateral. In essence, this option would entail frequent auctions of overnight and term repurchase agreements on a broad array of collateral, perhaps including foreign assets. Repurchase agreements offer advantages over direct purchases for a portion of the portfolio because they are highly liquid and especially safe (they are backed both by the counterparty and by the value of the underlying asset). The second leg of protection presumably would be maintained by adjusting the amount of collateral after its value was marked to market. As with broadly based outright purchases, public guidelines and criteria for acceptable collateral would help limit the impression that the Federal Reserve favored certain instruments apart from monetary policy requisites and help prevent concentrations of specific collateral in the portfolio. To some extent, heavy reliance on shorter-term repurchase agreements relative to outright purchases might increase operational risk due to frequent rollovers.

A policy of widening the collateral base significantly would help mitigate relative price effects and lessen pressure for preferential collateral selection, though widening the base might require efforts by the Federal Reserve to develop repurchase markets beyond those that exist today. Very extensive reliance on repurchase agreements would also make counterparty selection more critical. Counterparties would need to be monitored for their creditworthiness and operational capacity. Diversifying across counterparties, marking collateral to market at least daily, and adjusting margin requirements accordingly would lessen counterparty risk. Tri-party arrangements would prove very helpful in these regards. Foreign central banks use repurchase agreements extensively, and they employ all of the methods mentioned above to ensure low risk, including limiting their counterparties to well-regulated institutions, such as financial institutions using major settlement systems.¹⁸

Broader Use of the Discount Window

For the most part, the Federal Reserve makes discount window credit available to depository institutions at below market rates, but has imposed administrative rationing.¹⁹ In recent history, lending has been very small relative to the open market portfolio.²⁰ Broad statutory latitude on the pricing and amount of discount window lending, plus its broader framework for eligible collateral, have enabled the Federal Reserve to administer discount window collateral requirements flexibly. (See appendix 1.D for a discussion of basic criteria for discount window collateral.)

Discount window advances bear a close resemblance to repurchase agreements, since both are in effect collateralized loans to a select group of counterparties. A more active discount window lending program could be used as an element of adjusting the size and composition of the System portfolio, along with repurchase agreements and outright purchases of assets in the open market. Advantages would be dealing with counterparties that are financial institutions with reserve accounts, settling instantaneously, and having an existing legal framework for broad collateral. Discount window credit, like repurchase agreements, relies to some extent on the private sector to allocate credit, not the Federal

18. Thus far, the European Central Bank has limited its open market operations to repurchase agreements (RPs). RPs account for an increasing share of the portfolios and most of the open market operations among the other foreign central banks surveyed in this study. The prevalence of RPs abroad may be explained in part by the fact that the portfolios of those central banks tend to be experiencing slower secular growth than that of the Federal Reserve. These RP operations differ somewhat from those in the United States in that the central bank is often a dominant participant in the RP market, shaping the terms of RPs significantly, whereas the primary use of RP markets in the United States is for financing and risk management by private-market participants (see also the citations in note 14).

19. In May 2002 the Federal Reserve published for public comment a proposed amendment to Regulation A that would change its operation of the discount window (67 Fed. Reg. 36,544, May 24, 2002); a discussion of the proposal is in Brian F. Madigan and William R. Nelson, "Proposed Revision to the Federal Reserve's Discount Window Lending Programs," *Federal Reserve Bulletin*, vol. 88 (July 2002), pp. 313–19.

20. As noted in appendix 1.A, the window was significant in providing cyclical and seasonal reserve needs under the gold standard.

Reserve, though the Federal Reserve's choice of eligible collateral and margins on collateral could influence credit allocation.

A substantial increase in the volume of discount window credit suggests that discount window arrangements would need to differ substantially from those prevailing today to satisfy the four principles set out here. Greatly expanding discount window lending under the current system with below-market rates would raise questions of credit allocation and favoritism toward depository institutions, which would have access to these subsidized funds. In this regard, an auction process for granting discount window credit, combined with explicit and publicly stated collateral and margin requirements, would need to be considered to minimize preferential credit allocation and enhance transparency.

A significant volume of discount window credit would increase the importance of coordination between the administration of open market and discount window operations. Depending on the arrangements, such coordination would require some rethinking of sensitive issues relating to the roles of the FOMC, the Board, and Reserve Bank directors and to the allocation of responsibilities between the Desk and the Reserve Banks. Common elements for risk-management, accounting, and custodial frameworks in both open market and discount window lending operations could increase operational flexibility for the Federal Reserve, with gains in managing liquidity and enhancing internal control.

Liability Management through Deposit Facilities

The ECB and some other central banks employ deposit facilities to augment open market operations. In all cases, the facility pays an administered rate that is set below the target for the intended overnight rate. The facilities are used to set a floor on the overnight rate, and in some cases central banks discourage the use of the deposit facility.

Such a facility would provide a means by which to drain overnight reserves in the event of unexpectedly large increases in reserves such as those caused by large emergency loans to specific institutions. As the federal funds rate fell to the rate offered by the deposit facility, institutions with reserve accounts could place excess reserves in the facility and settlement would be instantaneous. Because of its natural applicability to emergency-related draining of reserves, a deposit facility could potentially relieve some of the need to hold large quantities of highly liquid assets in the portfolio. Currently the Desk must provide collateral in order to effect a draining of reserves with reverse repurchase agreements. A legal framework enabling the Federal Reserve to offer interest-bearing deposit accounts would facilitate the draining of reserves without the need for collateral because, like reserve accounts, deposit accounts would be considered risk-free by the private sector.

Appendix 1.A

Legislative History of the Federal Reserve Act as It Relates to the Discount Window and Open Market Operations

Currently, Reserve Banks can accept any assets satisfactory to them as collateral for discount window loans; however, in conducting open market operations they can purchase only limited classes of assets specified in section 14 of the Federal Reserve Act. When the Federal Reserve System was founded, "discounting" was viewed as the main monetary policy tool, and collateral eligibility was restricted in conformance with the understanding at the time of what the "real bills" doctrine would require in monetary economics.¹ As the discount window function evolved into a lender-of-last-resort function, the strict limitations on the types of assets that Reserve Banks could accept as discount window collateral were gradually removed to enable the Federal Reserve to respond more effectively to emergency conditions. The Reserve Banks' open market operations began as an ancillary power but soon became the preeminent tool for implementing monetary policy. In response, the Congress established the Federal Open Market Committee (FOMC) to ensure coordination and governmental oversight of open market operations. However, the Reserve Banks' open market authority under section 14 of the Federal Reserve Act was broadened only modestly—perhaps the Congress believed that the authority to purchase and sell Treasury and agency securities provided the Federal Reserve with sufficient flexibility to implement its monetary policy objectives.

ORIGINAL CONGRESSIONAL INTENT

The Congress passed the Federal Reserve Act in response to the 1907 panic, which revealed that the country's banking system, particularly its currency system, was in need of reform. At that time, currency was issued by national banks and collateralized by obligations of the United States. The consensus was that this collateral requirement made it difficult to issue or withdraw currency in response to the changes in business demands for credit and that this "inelasticity" contributed to the 1907 panic. One of the key reforms that the Congress sought to achieve through the Federal Reserve Act was to furnish an "elastic" currency through discount window operations. A related objective was to establish a more nearly uniform rate of discount across the country through the Reserve Banks' discount window operations and their purchases of eligible commercial paper in the open market. An additional view was that the creation of a market for eligible commercial paper through the discount authority described below would lessen speculation and smooth the business cycle.²

To ensure that the new currency would be issued to meet "legitimate" business demands for credit, and also to protect the soundness of the currency, the Congress carefully limited in section 13 the types of instruments that Reserve Banks may discount for their member banks. As originally enacted, section 13 authorized Reserve Banks to discount for their member banks

NOTE. Joyce M. Hansen and HaeRan Kim prepared this appendix.

1. "Discounting" is the act of purchasing a debt instrument for less than the full amount due at maturity. The original Federal Reserve Act authorized Reserve Banks to provide credit to member banks by discounting eligible paper. However, until 1916, the act did not expressly authorize Reserve Banks to provide credit by making loans secured by eligible assets ("advances").

2. See, generally, *Changes in the Banking and Currency System of the United States*, House Report 69, 63 Cong. 1 Sess. (Government Printing Office, 1913).

eligible commercial paper, that is, notes and bills (1) endorsed by a member bank and (2) with remaining maturities of not more than ninety days (six months for agricultural paper) and drawn for agricultural, industrial, or commercial purposes or the proceeds of which have been used for such purposes.³ Section 13 also authorized Reserve Banks to rediscount acceptances of member banks based on the foreign trade of goods; those acceptances could have remaining maturities of not more than three months and had to be endorsed by a member bank. Bankers acceptances were included because of a desire to create an acceptance market in the United States that would be similar to the market in Europe.⁴ In section 13, the Congress authorized, but did *not* require, Reserve Banks to discount all eligible paper presented to them. Reserve Banks retained full discretion to inquire into the soundness of the paper presented and the solvency of the maker.⁵

The Congress then provided for various measures in section 16 of the act to protect the soundness of the currency, including (1) making the currency an obligation of the United States, redeemable in gold upon demand at any Reserve Bank or the Treasury, (2) limiting the discretion of the Reserve Banks to issue currency by requiring 100 percent of the currency issued and outstanding to be collateralized by eligible paper discounted under section 13, and (3) further requiring Reserve Banks to maintain a reserve in gold of not less than 40 percent of the currency issued and outstanding.⁶

Some discussions considered whether currency could be based on bonds issued by the United States, a state, or a municipality or on longer-term commercial paper. Bankers uniformly argued against issuing currency on such instruments. At that time, proponents of the real bills doctrine viewed short-term commercial paper as "self-liquidating" and thus much better collateral for currency than any government bonds.⁷ By basing the new currency on self-liquidating commercial paper, not on government obligations, bankers hoped to ensure that the volume of currency would expand or contract on the basis of the aggregate value of paper eligible for discount. This "elasticity" was deemed essential to meet business demands for credit and to guard against inflation.⁸

Under section 14 as originally enacted, Reserve Banks were authorized to make open-market purchases and sales of bankers acceptances and bills of exchange of the kinds eligible for discount under section 13, with or without the endorsement of a member bank. Because the endorsement of a member bank was not required, this authority was somewhat broader than the section 13 authority regarding these instruments. Section 14 also authorized Reserve Banks to make open-market purchases and sales of the following types of assets that they could not acquire under section 13: (1) gold and cable transfers (that is, foreign exchange), and (2) obligations

3. Recourse to the member bank that endorsed the discounted paper was viewed as providing Reserve Banks with an important additional protection against the risk of loss.

4. *Changes in the Banking and Currency System of the United States*, House Report 69, p. 49.

5. Discretionary discounting authority was a major issue in the original Federal Reserve Act. Some proponents of the real bills doctrine—especially those suspicious of non-automatic monetary policy—wanted obligatory discounting by Reserve Banks of all eligible paper presented to them for discounting.

6. The Congress also required Reserve Banks to maintain a reserve in gold of not less than 35 percent of deposits that member banks maintained with Reserve Banks.

7. See, for example, the statement of O.W.M. Sprague, in *Banking and Currency: Hearings on H.R. 7837 (S. 2639), before the Senate Committee on Banking and Currency*, 63 Cong. 1 Sess., vol. 1 (GPO, 1913), p. 532.

8. See, for example, in *Banking and Currency: Hearings*, vol. 2, the statement of J.H. Tregoe; p. 1047; and the exchange between Senator James Reed and Samuel Untermyer, p. 1306.

issued by the United States and short-term obligations issued by a state or municipality in anticipation of the receipt of taxes or assured revenues.

The need to provide Reserve Banks with the authority to deal in gold and foreign exchange was obvious, given the Reserve Banks' obligation to redeem Federal Reserve notes in gold upon demand and to maintain a reserve in gold against their deposit liabilities and Federal Reserve notes. However, the provisions of section 14 that authorized Reserve Banks to purchase assets that they could not discount under section 13 raised some controversy. Because of a concern about competition from the Reserve Banks, some bankers objected to the provision of section 14 that authorized Reserve Banks to purchase bankers acceptances and bills of exchange from anyone without the endorsement of a member bank.⁹ The proposal to have Reserve Banks make open-market purchases and sales of obligations issued by a state or municipality, and to a lesser extent obligations issued by the United States, was also controversial, as these obligations were considered to be less sound than short-term commercial paper eligible for discount under section 13.¹⁰

Nonetheless, the Congress determined that it would be useful to permit Reserve Banks to purchase eligible paper in the open market without the endorsement of a member bank. The Congress wanted to enable Reserve Banks to influence general credit conditions by setting discount rates even when member banks became unwilling to present eligible paper to them for discount. The Congress viewed section 14 authority to purchase eligible paper in the open market as *secondary and incidental* to the new currency and discount system established under section 13 and section 16 of the act. The Congress expected Reserve Banks to meet business demands for credit primarily through discount operations authorized under section 13 and to exercise their authority to purchase eligible paper under section 14 only in times of business disturbance or threats against the gold reserve in accordance with rules prescribed by the Board.¹¹

The Congress also determined that it would be useful to enable Reserve Banks to invest their idle funds in the obligations issued by the United States and in short-term obligations issued by a state or municipality in anticipation of the receipt of taxes or assured revenues. With self-liquidating characteristics similar to those of eligible paper, these obligations were viewed as relatively sound instruments for investment.

Under the original Federal Reserve Act, assets acquired through open market operations could not collateralize Federal Reserve notes. As noted above, section 16 required Reserve Banks to use eligible paper discounted under section 13 to collateralize 100 percent of the Federal Reserve notes issued and outstanding.

SUBSEQUENT CHANGES

Changes to the Collateral and Gold Reserve Requirements for Currency

The requirement that all outstanding Federal Reserve notes be collateralized with eligible paper discounted under section 13 stemmed from the "real bills" doctrine, which postulated that the volume of currency based on such assets would automatically adjust to the changes in business

9. See, for example, the statement of Frank A. Vanderlip, *Banking and Currency: Hearings*, vol. 3, pp. 1938–39.

10. See, for example, the statement of Victor Morawetz, *Banking and Currency: Hearings*, vol. 3, p. 2683.

11. *Changes in the Banking and Currency System of the United States*, House Report 69, pp. 52–53.

demands for credit. However, from early on it became apparent that section 16's strict collateral requirement and the gold reserve requirement could limit monetary expansion needed to accommodate the economy. To enable monetary expansion, the Congress was forced to amend section 16 from time to time: (1) to expand the types of assets that can collateralize Federal Reserve notes,¹² (2) to repeal the provision requiring Federal Reserve notes to be redeemable in gold (1934), and (3) to reduce and ultimately remove the gold reserve requirement.¹³ As a result of the 1999 amendment to section 16, all types of assets that Reserve Banks acquired through their discount window operations and open market operations may now collateralize Federal Reserve notes issued and outstanding.

Subsequent Changes to the Reserve Banks' Open Market Authority

The key changes to the Reserve Banks' open market authority occurred in 1933, when their open market operations were made subject to centralized oversight, and again in 1935. By the early 1930s, the Reserve Banks' open market operations became "the most important single instrument of control over the volume and the cost of credit in this country."¹⁴ The growing realization that the Reserve Banks' open market operations could adversely affect the general economy—bolstered by a general sense that their operations in 1927 provided banks with excess reserves and thereby fed the speculative bubble—led to the call to subject the operations to centralized oversight.¹⁵

In response, the Congress amended the Federal Reserve Act in 1933 by adding section 12A to create the FOMC consisting of the representatives of all twelve Reserve Banks. Section 12A granted the Board the authority to regulate the Reserve Banks' open market operations, but individual Reserve Banks retained discretion not to participate in open market operations.¹⁶ In 1935, the Congress amended section 12A to change the composition of the FOMC, with the Board of Governors in the majority, and to require Reserve Banks to participate in open market operations as directed by the FOMC.

The Congress also amended section 14 on several occasions to expand the types of assets that Reserve Banks could purchase and sell in the open market. For example, in 1935, section 14 was amended to authorize Reserve Banks to purchase and sell obligations that are fully guaranteed as

12. For example, in 1917 the requirement that 100 percent of the currency outstanding be collateralized by eligible paper was modified to permit Reserve Banks to issue currency based on gold. In 1932, Reserve Banks were given temporary authority to use direct obligations of the United States to collateralize Federal Reserve notes; the authority was extended periodically and became permanent in 1945.

13. In 1945 the gold reserve requirements (to be satisfied by Reserve Banks with gold certificates subsequent to the Gold Reserve Act of 1934) both for Federal Reserve notes and for Reserve Bank deposit liabilities were reduced to 25 percent of outstanding liabilities. The reserve requirement for deposit liabilities was removed in 1965, and the requirement for notes was removed in 1968.

14. Statement of Marriner S. Eccles, in *Banking Act of 1935: Hearings on H.R. 5357, before the House Committee on Banking and Currency*, 74 Cong. 1 Sess. (GPO, 1935), p. 181.

15. Exchange between Senator Carter Glass and Arthur C. Miller, in *Operation of the National and Federal Reserve Banking Systems: Hearings Pursuant to S. Res. 71, before a Subcommittee of the Senate Committee on Banking and Currency*, 71 Cong. 3 Sess. (GPO, 1931), p. 134.

16. The Congress also amended section 14 to place the Reserve Banks' relations with foreign banks, bankers, and governments under the Board's special supervision.

to principal and interest by the United States, without regard to maturity.¹⁷ In 1966, Reserve Banks were given a temporary authority to make open-market purchases and sales of obligations (both direct and guaranteed) of any agency of the United States. This authority was periodically extended and became permanent in 1979. Finally, in 1980, section 14 was amended to authorize Reserve Banks to purchase and sell obligations (both direct and guaranteed) of foreign governments.¹⁸

The legislative history suggests that, with the exception of the 1980 amendment, the amendments expanding eligible paper for open market operations were motivated in part by the Congress's desire to assist certain sectors of the economy. For example, the legislative history of the 1966 amendment indicates that, in authorizing Reserve Banks to deal in agency obligations, the Congress wanted the Reserve Banks to purchase obligations of a Federal Home Loan Bank (FHLB) and the Federal National Mortgage Association (FNMA) to assist these agencies in bringing private funds into mortgage credit for residential housing.¹⁹ The 1923 and 1934 amendments to section 14, which authorized Reserve Banks to make open-market purchases and sales of acceptances of the Federal Intermediate Credit Bank and the National Agricultural Credit Corporation, obligations of the Federal Farm Mortgage Corporation, and obligations issued under the Home Owners' Loan Act of 1933, similarly reflect the Congress's desire to assist the agriculture and housing sectors of the economy.

Changes to the Reserve Banks' Discount Window Authority

Under the original Federal Reserve Act, the type of commercial paper and acceptances eligible for discount had to meet narrow legal requirements as described above. In addition, the Federal Reserve Act specifically prohibited the discount of paper covering merely investments or issued or drawn for the purpose of carrying or trading in stocks, bonds, or other securities other than notes and bonds of the United States. The Board issued numerous interpretations regarding paper that qualified for discount. Almost from the start, the strict limitations began to erode as interpretations and amendments to the Federal Reserve Act were made to accommodate business

17. Section 14 was also amended in 1935 to require Reserve Banks to purchase obligations of the United States only in the open market. In 1942, Reserve Banks were given temporary authority to purchase such securities directly from the United States. Periodically renewed, the authority was allowed to expire in 1981.

18. In connection with this legislative change, the Federal Reserve made commitments to use this authority to purchase foreign government securities only to invest the System's excess holdings of foreign currency obtained from its normal activities in the foreign exchange market and not to "bail out" foreign governments. See *Oversight Hearing on Section 14(b)(1) of the Federal Reserve Act as Amended by Section 105(b)(2) of the Monetary Control Act of 1980*,: Hearing before the Subcommittee on Domestic Monetary Policy of the House Committee on Banking, Finance and Urban Affairs, 98 Cong. 1 Sess. (GPO, 1983), pp. 22–23.

19. An effort arose in 1968 to amend section 14 to *direct* Reserve Banks to purchase FNMA and FHLB securities to support the mortgage market. Some members of the Congress were of the view that the Federal Reserve should take some responsibility for the difficulties in the housing sector caused by its tight monetary policy. The Board vigorously resisted this effort, noting that such a directive would violate a fundamental principle of sound monetary policy in that it would attempt to use the credit-creating powers of the central bank to subsidize programs benefiting special sectors of the economy. See, generally, *To Extend for One Year the Authority for More Flexible Regulations of Maximum Rates of Interest or Dividends, Higher Reserve Requirements and Open Market Operations in Agency Issues: Hearings on H.R. 16092, before the House Committee on Banking and Currency*, 90 Cong. 2 Sess. (GPO, 1968).

conditions.²⁰ For example, in 1915 the Board interpreted trade acceptances and commodity paper as eligible and even established a preferential discount rate for such paper.²¹

Changes also occurred on the legislative front. For example, in the 1920s there was sentiment for facilitating credit for farmers; the Agricultural Credits Act, passed in 1923, set up twelve Federal Intermediate Credit Banks with authority to make agricultural and livestock loans. Reserve Banks were authorized to hold their stock, and the Federal Reserve Act was amended to expand the types and maturities of agricultural paper eligible for discount.²²

The original Federal Reserve Act had no express authority for Reserve Banks to make advances rather than discounts. In 1916, the eighth paragraph of section 13 was amended to permit fifteen-day advances secured by the types of paper eligible for discount as well as obligations of the United States. The Board requested this amendment as a means to facilitate administration of credit transactions. Because most borrowing was very short term, the Reserve Bank probably found it cumbersome to purchase the paper and then sell it back to the bank before the paper reached maturity.

During the Great Depression, as open market operations gained importance, the Reserve Banks' discount window function began to evolve into a lender-of-last-resort function. As was the case with open market authority, new authorities to advance funds were enacted in 1932-35 period in the context of the banking crisis. At this time, banks operated in a climate of fear and felt the need to keep on hand liquid securities and eligible paper. Enabling Reserve Banks to make advances secured by long-term paper was intended to reassure banks.²³ This new authority, however, was not without controversy and was considered inflationary by some.²⁴

Among a number of new authorities incorporated into the Federal Reserve Act at that time were section 10A of (permitting extensions of credit to groups of banks) and section 10B (permitting advances on "satisfactory" assets). The 10B authority, originally temporary, was to be used only in emergencies and was more restrictive than the 10A authority. Among other restrictions, the 10B authority was limited to small banks, the borrower could have no other paper eligible for discount, and the credit was subject to a penalty rate (1 percent above the discount rate). When the provisions expired in 1935, there was an attempt to recodify the authority without the restrictive provisions. This attempt was largely successful except that the penalty rate, reduced to ½ percent above the discount rate, was retained. One rationale for the bill was the change in the

20. Paper the proceeds of which were used for fixed investments such as land, plant, and machinery was excluded, but notes given for the purpose of purchasing certain machinery for agricultural operations were permissible (Howard H. Hackley, *Lending Functions of the Federal Reserve Banks: A History*, Washington: Board of Governors of the Federal Reserve System, 1973, p. 36).

21. Hackley, *Lending Functions*, p. 35. Another example is that finance paper (paper whose proceeds are lent to some other obligor) was not eligible for discount until 1937, when the restriction was lifted for finance paper the proceeds of which were used for commercial, agricultural, or industrial purposes.

22. In testimony about the bill, the importance of adapting the Federal Reserve System to changed conditions was emphasized. Statement of Eugene Meyer, *Rural Credits: Hearings on S. 4280 (H.R. 13033)*, before the House Banking and Currency Committee, 67 Cong. 4 Sess., part 1 (GPO, 1923), p. 62 (quoted in Hackley, *Lending Functions*, p. 45).

23. Remarks of Senator Carter Glass, *Congressional Record*, vol. 75 (February 17, 1932), pp. 4135–4136..

24. Remarks of Congressman Fiorello LaGuardia, *Congressional Record*, vol. 75 (February 15, 1932), p. 3970.

business and economic life of the country.²⁵ Governor Eccles testified, and some senators believed, that it was more important to emphasize the soundness of the paper than its technical requirements.²⁶ Although the Board made numerous attempts to amend the Federal Reserve Act to eliminate the penalty rate, it persisted until the Monetary Control Act of 1980.

The expansion of the lending authority of the Reserve Banks was also accompanied by some fear of an increase of bank speculation. As a result, in 1933 the eighth paragraph of section 13 (section 13(8)) was amended to make any advance due and payable if, after a warning by the Board, loans on stock and securities increased during the term of the advance; and section 4 was amended to take such matters into consideration in making advances. The types of paper eligible as collateral for advances under section 13(8) were expanded from time to time, but not until 1968 was section 13(8) amended to permit advances on any obligation eligible for purchase under section 14, thereby eliminating the Board's restrictive interpretation of section 13(8).

Other emergency authorities that were enacted at the same time fundamentally changed the nature of Reserve Bank lending authority. In 1933, Reserve Banks were permitted to make advances to nonmember banks under section 10B on the same basis as advances to member banks. In 1932, the enactment of section 13(3) authorized Reserve Banks to *discount* eligible paper for individuals, partnerships, and corporations (IPCs) in unusual and exigent circumstances. Originally, this authority was limited to discounting only those notes, drafts, and bills of exchange of the kinds and maturities that Reserve Banks could discount for member banks under section 13; but section 13(3) was amended in 1991 to permit Reserve Banks to discount notes of IPCs "secured to the satisfaction" of the Reserve Banks. Finally, in 1933, Reserve Banks were authorized in section 13(13) to make *advances* to IPCs if secured by direct obligations of the United States. This authority was expanded in 1968 to permit Reserve Banks also to accept obligations (both direct and guaranteed) of any agency of the United States as collateral for advances to IPCs.

One emergency authority that Reserve Banks no longer retain is noteworthy. In 1934, Reserve Banks, with the support of the Board, were authorized to make working capital loans to businesses, particularly small businesses, directly (in emergency situations) or indirectly (through the discount mechanism or through participations in bank loans) to stimulate economic recovery. The direct loans to businesses did not have to be secured, but they had to be made on a "sound basis." Also at this time, the Reconstruction Finance Corporation, chartered in 1932, had its powers expanded to make such loans directly to businesses. The Reserve Banks' authority existed until 1958, and the largest amount outstanding at any time was about \$60 million in 1935.²⁷ The operations of the Reconstruction Finance Corporation in this area came to be more important than those of the Reserve Banks.

25. Remarks of Senator Arthur Vandenberg, *Congressional Record*, vol. 75 (February 18, 1932), p. 4228.

26. *Congressional Record*, vol. 79, remarks of Congressman Franklin Hancock (May 1, 1935), p. 6736; remarks of Congressman Henry Steagall (August 19, 1935), p. 13706.

27. Hackley, *Lending Functions*, p. 140.

Appendix 1.B

Portfolio Risks and Accounting Treatment

If the Federal Reserve portfolio was to include instruments whose risks, especially credit risks, were significantly higher than those that make up the current portfolio, an important question would arise as to how the Federal Reserve would reflect any possible losses in its accounting statements. A related question is the extent to which changes in the credit standing of individual assets in the portfolio would increase the volatility of the portfolio's value, either daily or over a longer period, under different accounting treatments. The following discussion addresses the issues associated with the two most important accounting treatments—historical cost and mark to market. The discussion is nontechnical and is therefore somewhat stylized.

The choice of accounting treatment should not make a large difference in the volatility of the portfolio's reported value attributable to credit risk. Both historical cost (with credit reserving) and mark-to-market accounting require the ability to evaluate credit quality and compute fair values, that is, sound estimates of the market value of the portfolio, even though fair values are not used directly in historical cost accounting. The quality and accuracy of credit reserving systems, whether the historical cost accounting's credit loss reserve or mark-to-market accounting's combination of fair values and a credit risk valuation adjustment, will depend on the careful and frequent assessment of credit quality and prompt recognition of impairment of individual credits.

Volatility in the portfolio's reported value that is driven by interest rate changes is probably significantly higher under a mark-to-market treatment than under historical cost treatment if the portfolio contains long-term fixed-income assets. Such volatility does not make the execution of monetary policy more difficult, since the underlying relationships between reserve balances, the federal funds rate, and market interest rates would be unchanged. But explaining monetary policy operations and their effects to the public may become more difficult because the fair value and hence the reported value of the Federal Reserve's balance sheet would change as interest rates change, but without any implications for reserve availability. For this reason, the implications of mark-to-market accounting for the Federal Reserve's balance sheet require further analysis beyond this note.

More generally, close attention to fair values is important for several reasons, even under historical cost accounting. One reason is that fair values can signal credit concerns or possible impairment from other factors that should become reflected in the historical cost accounts. Another reason is that fair value accounting is the appropriate framework for understanding how the portfolio will respond both to monetary policy actions and to external forces. Even though the Federal Reserve is not managing its portfolio to earn a profit, but rather to execute monetary policy with little effect on relative prices, the Federal Reserve needs to understand how the portfolio's value can change under different market conditions in the normal course of understanding and managing the risk of the portfolio. Analysis requires an initial valuation and alternatives computed from fair values. In particular, the fair values of credit-sensitive fixed-

NOTE. Christine M. Cumming prepared this appendix.

income instruments will decline at an increasing rate as the credit deteriorates from its initial rating.¹

HISTORICAL COST ACCOUNTING

Except for holdings of foreign exchange, the Federal Reserve's portfolio is valued on the basis of historical cost. In the historical cost framework, sound accounting principles require that a credit loss reserve be established and that it reflect the expectation that some credit losses will occur over time.² The expected amount of loss should be based on historical averages, historical probabilities of changes in credit ratings (migration analysis), or other analytical techniques.³ An issue currently under discussion is, How certain do the potential losses need to be before reserves are established? Nonetheless, reserves are expected to increase in a systematic fashion as the creditworthiness of individual names or classes of borrowers deteriorates. In principle, estimates of portfolio value based on historical cost minus robustly estimated credit loss reserves should track changes in the "fair value" of such portfolios reasonably well in the absence of any other changes.

What historical cost accounting does not capture is a change in portfolio value due to changes in interest rates or other general market repricing, such as an elevated liquidity risk premium. In addition, the day-to-day changes in credit loss reserves that result from review of the credit quality of the portfolio are likely to be smoother than changes in portfolio values based on the prices of individual credits. The difference is attributable, in part, to technical factors, such as market participants' hedging needs, that may generate some noise in the prices of individual credits or groups of credits.

In addition to requiring a credit loss reserve, sound accounting principles call for writing down to their market or recoverable values those assets that have lost significant value and that are unlikely to recover. When the reason for impairment is credit-related, the portion charged off is usually offset against the credit loss reserve, and the reserve is reevaluated and replenished as necessary. Impairment for other reasons, such as changes in cash flows caused by the triggering of an imbedded written option in a complex security, are generally taken directly against income.

If the Federal Reserve's portfolio contained significant credit risk, the Federal Reserve would need to develop a credit loss reserve methodology. Evaluating the credit loss reserve infrequently, such as only at quarter-end, would mean that relatively large discrete changes might occur on days when the results of the assessment were reflected in accounting statements. These

1. For each notch down in credit rating on a given bond, the interest rate spread above a given base rate (such as that for AAA financials or AAA corporates) increases. As the interest rate on the bond rises, the pace of its price decline increases, the well-known convexity of bond prices. At investment grade ratings and current interest rate levels, such convexity is not very significant empirically, but convexity can become very pronounced as credit ratings move into the lower speculative grades and approach default.

2. Loan-loss reserves are the most familiar form, but in principle, credit loss reserves can be established for any asset class under historical cost accounting. U.S. banks mark their trading accounts to market. Those banks that hold securities in their banking book generally hold investment-grade securities with low expected losses; and most account for these securities using "held for sale" accounting, which has the same effect on equity (but not income) as mark-to-market accounting.

3. Migration analysis provides a more refined estimate of expected credit losses than simply applying the long-run historical probability of loss for each credit rating category in the portfolio, especially when the portfolio contains long-term debt. Migration analysis takes into account the probability that an individual credit sometime in its life will move into a new (usually lower) credit category and thus have a higher probability of loss.

changes would be largest when credit quality generally was changing for the better or worse throughout the financial system. If minimizing the day-to-day fluctuations in the size of the portfolio is considered important for transparency and for reducing operational risk, the Federal Reserve would probably want to review its credit loss reserve more frequently.

MARK-TO-MARKET ACCOUNTING

Mark-to-market accounting, better referred to as fair value accounting, is an estimate of a portfolio's value at current market prices. For instruments whose prices are easily observed, the starting point for marking any instrument to market is the price midway between the bid and the offered quote, the so-called midmarket price. For instruments whose prices are not easily observed, accounting guidance prescribes a specific series of estimation methods for approximating the midmarket price. After using these methods, most large financial institutions make several valuation adjustments to obtain a conservative valuation. Such adjustments might take into account liquidity, credit, or other factors that could make it difficult to hedge a risk or liquidate the position without some loss of value. The credit-related valuation adjustment is generally an estimate of the potential change in the portfolio's value attributable to the normal migration of credits to lower or higher credit ratings over a short-term horizon.

Fair value accounting is meant to reflect the full effect of changes in interest rates, credit quality, and other risk factors on the value of individual positions. It is possible to decompose the changes, at least to a first approximation. Although the specific levels of interest rate and credit volatilities determine the relative importance of each factor, changes in interest rates will tend to account for most of the day-to-day volatility in the portfolio's fair value when the portfolio is of reasonably high quality and is well diversified with a significant portion in medium- and long-term fixed-rate instruments. Interest rate volatility is of primary importance because changes in credit quality affect only a portion of the portfolio at any time and are likely to be concentrated around the peaks and troughs of the credit or business cycle.

In practice many large banks have developed methodologies to decompose gains and losses in their trading portfolios and to attribute them to changes in observable risk factors, such as changes in interest rates, movements in credit spreads, or migrations between credit ratings. Because the division between credit and market risk is not clearly defined, different risk measurement systems will attribute changes due to one or the other of the two risks somewhat differently. For example, for a fixed-income debt security, the amount of issuer-specific credit risk in the security can depend on the number of separate yield curves estimated in the market-risk measurement system.⁴

The use of valuation adjustments in fair value accounting for trading portfolios has become better grounded in risk concepts and risk measurement techniques over the past decade and can be made relatively systematic and therefore easily auditable. Nonetheless, the authorities that set accounting standards have not yet rendered a judgment on the relative soundness of different methodologies. As a result, these adjustments remain somewhat in limbo: They are widely used, but little professional guidance exists on how to apply them.

4. If one system for measuring market risk estimates a single yield curve, and a second system measures an investment-grade curve and a high-yield curve, and a third estimates separate curves for each of the main ratings categories, the estimates of issuer-specific risk will differ in the three systems when specific risk is estimated as the residual portfolio risk.

ADDITIONAL THOUGHTS ON THE VOLATILITY OF THE PORTFOLIO UNDER THE TWO ACCOUNTING TREATMENTS

For the Federal Reserve, historical cost accounting has two important advantages: It makes changes in the size and composition of the balance sheet readily understandable, and it eases the cash-flow analyses needed, for example, to replace maturing securities. If the credit quality of the portfolio is reviewed frequently and systematically and the credit loss reserve is adjusted accordingly, the portfolio's value may change over the credit cycle but should do so relatively smoothly. For a short-term, well-diversified, investment-grade portfolio, expected portfolio losses should be near zero over the credit cycle. The larger the proportion of long-term instruments and the lower the average credit quality of the portfolio, the greater the change in value from the peak to the trough of the cycle. However, even when credit losses are significant and likely to occur only near the trough of the credit cycle, systematic reserving based on a careful credit assessment over the life of exposures in the portfolio should reduce the amplitude of short-term changes in the portfolio's value.⁵

The strength of mark-to-market accounting is that it picks up the full range of factors affecting portfolio value and slowly, day-by-day, alters the portfolio's value accordingly. In practice, such adjustment tends to be thought of as smooth, but the size of portfolio changes depends on the behavior of prices. If price changes are large—and whether they are for only a few days or persist through a succession of positively correlated price movements over several months (as in 1994), the portfolio's value can shift sharply. The portfolio's volatility may also be heightened if prices tend to overshoot or if markets are slow to recognize changes in credit quality and then reflect them suddenly.

5. The severe losses of the early 1990s provide an estimate of possible credit losses for a largely below-investment-grade portfolio with risk concentrations in a severe, but not worst-case, credit deterioration. Aggregate credit-related write-offs by large banks as a result of loan losses in the early 1990s ran as high as 2 percent to 2.5 percent of total loans per year. On a portfolio of roughly \$525 billion, the changes in value would amount to \$11 billion to \$14 billion, in the general range of the increase and subsequent decrease in the foreign repurchase-agreement pool in the weeks around December 31, 1999. The write-off rate on bank loans is net of recoveries, which tend to be higher for bank loans than for bonds.

Appendix 1.C

The Practice of Central Banking in Other Industrialized Countries

Central banks in larger industrialized countries increasingly favor market operations over standing facilities in conducting their monetary policies. In these operations, foreign central banks most commonly trade securities issued or guaranteed by their governments and repurchase agreements that are collateralized by a variety of assets, including private securities and securities denominated in foreign currencies. Some banks also hold securities that are guaranteed by governments or financial institutions. In some cases, these securities may be denominated in foreign currencies.

Repurchase agreements have come to account for most of the market operations of these banks in recent years, and they represent an increasing share of their assets. The expanded use of repurchase agreements reflects in part their growing importance in financial markets and in part their ability to limit central banks' credit, liquidity, and interest rate risks as they expand their market operations to more assets and agents.

In most of the larger industrialized countries, the ratio of government debt to gross domestic product is falling, in a few cases to unusually low levels, a development that also has fostered their central banks' reliance on repurchase agreements. In anticipation of their impending social security and pension deficits, the governments of some of these countries have considered the merits of issuing more debt than they require in order to maintain a market for their securities.

THE SAMPLE OF FOREIGN CENTRAL BANKS

Our survey covers the central banks of the foreign G-7 countries—Canada, France, Germany, Italy, Japan, and the United Kingdom—plus the Eurosystem (the European Central Bank and its associated national central banks) and the central banks of Australia, Norway, Sweden, and Switzerland (see tables 1.C.1 and 1.C.2 at end of this appendix). The current objectives for monetary policy for the central banks of most of these countries (including the three Commonwealth countries) are forms of price stability. The central banks of the Commonwealth countries have a relatively long history of reliance on market operations to conduct their policies. The other central banks in our survey have come to the intensive use of these operations more recently, in the process diminishing their reliance on discount, Lombard, and deposit facilities. In the past ten years, many of these central banks have gained a greater degree of independence from their governments.

ELIGIBLE ASSETS

Among the central banks in our survey, outright purchases tend to have the most restricted list of eligible assets. When implementing monetary policy, most of the central banks may purchase securities that are denominated in their currencies and have been issued or guaranteed by their

NOTE. Richard W. Kopcke prepared this appendix. A slightly expanded version has been published as Richard W. Kopcke, "The Practice of Central Banking in Other Industrialized Countries," Federal Reserve Bank of Boston, *New England Economic Review* (Second Quarter 2002), pp. 3–9; see also the related papers in that issue.

central governments. Some may purchase securities issued by their local governments. Only a few, among them the central banks of Canada and Japan, purchase longer-term government notes and bonds. The Bank of England and the Bank of Japan also may purchase private bills that are guaranteed by the banks that accept them. The Eurosystem can, and the central banks of France and Germany could, buy high-quality, marketable private securities.¹ Nonetheless, at the end of the 1990s, the central bank of Germany held no securities outright, and that of France held only Treasury bills. Since the inception of the European Central Bank (ECB), the Eurosystem has not purchased securities outright in its refinancing operations.

The balance sheets of the central banks in our sample can include longer-term assets and assets denominated in foreign currencies. The central banks may be holding some of these assets on behalf of their governments, but these positions also can represent their own assets. For example, the Eurosystem, the Bank of England, and the central banks of Norway, Sweden, Switzerland, and Australia, hold a considerable amount of assets denominated in foreign currencies, which they manage according to benchmarks set by their respective governing councils and boards. These benchmarks typically dictate, among other things, their positions in each currency, the average duration of their securities for each currency, and the average minimum quality of their credits.

The lists of eligible collateral for repurchase agreements (including sell–buyback and security lending agreements) tend to be more liberal.² Some central banks either accept more securities through repurchase agreements or are considering doing so as the supplies of their governments' securities dwindle relative to their GDP. In some cases, central banks have responded to their counterparties' requests to accept more types of securities as collateral.

Foreign central banks accept longer-term government securities as collateral for repurchase agreements as well as other securities that are usually relatively liquid, easily valued, and easily cleared (through real-time-gross-settlement and delivery-versus-payment networks). The experiences of several banks suggest that counterparties tend to offer their less-liquid eligible collateral for repurchase agreements. In addition to the assets it is willing to purchase outright, the Bank of England recognizes bonds (issued in either sterling or foreign currencies) issued by its government and the debt of certain governmental and quasi-governmental agencies. The central banks of Germany and France accepted private securities. The Reserve Bank of Australia conducts foreign exchange swaps in U.S. dollars. The central bank of Canada recognizes mortgage-backed securities that are guaranteed by the government. The central bank of Sweden also accepts certain mortgage-backed securities and the debt of some foreign governments. The central bank of Switzerland accepts debt denominated in Swiss francs issued by quasi-governmental agencies and certain foreign banks.

The ECB recognizes two tiers of collateral for its transactions, whether they are repurchase agreements, collateralized loans, or outright purchases. The first tier comprises certain private securities plus marketable, euro-denominated debt issued by its members' governments. The second comprises additional euro debt and some equities. Currently, about 96 percent of the collateral used by banks in the Eurosystem is in the first tier and is about evenly split between the debt of governments and that of credit institutions.

1. See general note to table 1.C.1 for the composition of the Eurosystem.

2. The nature of reverse transactions is often dictated by the laws and customs that govern the parties to the transaction. For simplicity, this summary generally refers to all reverse transactions as repurchase agreements.

Most of these central banks formally accept the same collateral for loans as they do for repurchase agreements, but in emergencies the list of collateral for loans is probably even more liberal. An institution with eligible collateral typically would not choose to pay the penalty of pledging these assets as collateral for emergency loans.

MARKET OPERATIONS AND REPURCHASE AGREEMENTS

During the 1990s, most of the banks in this survey began to execute much of their monetary policy through market operations in repurchase agreements. The Bank of Canada has used repurchase agreements since the 1950s. But the Bank of England, the Bank of Japan, and the central banks of Germany, Sweden, and Switzerland greatly expanded their use of repurchase agreements only in the past decade.

Since the inception of the ECB, the Eurosystem's refinancing operations in reverse transactions have accounted for most of the growth of its assets. In these operations, the Eurosystem provides funds against collateral at a rate of interest determined by auction. Most of these reverse transactions take the form of collateralized loans with an enforceable security interest against pools of assets available to the national central banks; the transfer of ownership of specific securities occurs less often.³ The Eurosystem maintains a marginal lending (Lombard) facility and a deposit facility in order to set a ceiling and a floor for the overnight rate. Since June 2000, the ECB has set its lending rate 1 percentage point above, and its deposit rate 1 percentage point below, the minimum bid rate announced for its main refinancing operation. Throughout the year, the overnight interbank rate, as measured by eonia, has remained within the corridor defined by the lending and deposit rates, often within 1/2 percentage point of the minimum bid rate. The central banks in most of the other countries also provide lending and deposit facilities that define corridors for their policy rates. These facilities are seldom used.

As money markets developed, market operations became more efficient than standing facilities for the execution of monetary policy, and, in turn, central bank market operations could cultivate financial markets. In this context, repurchase agreements suit the efficient execution of policy. They allow central banks to limit their risks, adjust the terms of their transactions (such as amount, maturity, frequency, and tender system) to match market conditions, trade with more counterparties, and expand the assets backing market operations. These features are especially appealing when the supply of short-term government securities is insufficient. Because repurchase agreements allow central banks to limit their risks as they expand their range of eligible assets, they also mitigate the need for these banks to define, manage, and maintain their capital or valuation reserves.

Foreign central banks regard repurchase agreements as being less risky than the outright purchases of the collateral that backs the agreement. Most repurchase agreements mature within a week or two. A few banks accept repurchase agreements with longer maturities, ranging up to three months. For example, the Eurosystem currently purchases two-week reverse agreements at its weekly main refinancing operations to supply about two-thirds of the base money that it adds

3. "Depending on both jurisdiction and national operating systems, national central banks allow for the pooling of underlying assets and/or require the earmarking of assets used in each individual transaction" (European Central Bank, *The Single Monetary Policy in Stage Three*, November 2000, section 6.4.2, pp. 43–45; see also section 3.1.1, p. 14).

to the banking system. It supplies much of the remainder through three-month reverse agreements in its monthly long-term refinancing operations.⁴

Every day, most central banks mark to market the collateral that backs their repurchase agreements and require their counterparties to post additional collateral as required. Most also impose margin requirements (haircuts) that reflect the volatilities of the market values of each type of collateral. All central banks require their counterparties to meet capital requirements and satisfy acceptable credit standards. Some banks limit their exposure to a counterparty according to the amount of its capital. For most central banks, eligible counterparties include commercial banks, securities houses, and money market dealers. Although, by statute, only institutions subject to the ECB's minimum reserve requirement are eligible counterparties for its refinancing operations, securities houses and dealers that are affiliated with banks may participate indirectly in auctions through their affiliates.

The central banks' increasing use of repurchase agreements, their choice of eligible collateral, the terms under which they accept this collateral, and their choice of counterparties depend very much on the prevailing settlement systems. For those assets that are covered by efficient real-time-gross-settlement (RTGS) and delivery-versus-payment systems (DVP), the simultaneous settlement of the securities and cash legs of transactions minimizes credit risks while permitting timely and economical market operations. In principle, all financial institutions that participate in these RTGS and DVP systems can become potential counterparties for the central banks' market operations. Although the collateral requirements of RTGS and DVP systems absorb securities, thereby tending to increase central banks' incentives for expanding their lists of eligible collateral, in some countries a portion of the collateral held in these settlement systems can be released for overnight repurchase agreements with central banks.

MAINTAINING THE SUPPLY OF GOVERNMENT DEBT

The governments of Australia, Canada, and Sweden recognize some merit in continuing to issue government debt in amounts even greater than that required by their current budgets in order to maintain a continuous and dependable market for their debt.⁵ By maintaining their supply of debt, governments also would relieve their central banks from relying so greatly on other sources of collateral as they, instead of their central banks, acquired private and foreign assets. Canada and Australia, however, have not issued otherwise unneeded debt for this purpose. Sweden, for example, has recently amended its law to allow its public pension fund to invest a share of its assets in private and foreign securities.

4. Reverse transactions accounted for less than one-third of all the base money supplied by the Eurosystem at the end of the third quarter. Claims on non-euro-area residents in foreign countries (primarily foreign exchange reserves), gold, and gold receivables accounted for almost one-half of the supply of base money. Unless the Eurosystem begins buying a sufficient quantity of securities outright, however, the share of base money that it provides through reverse transactions will continue to increase with time. As an example from outside the Eurosystem, repurchase agreements represented about 85 percent of the assets of the Issue Department of the Bank of England in 1999; Treasury bills, the remainder (Bank of England, *Annual Report*, February 2000). The assets of the Bank's Issue and Banking departments were nearly equal. As the Issue Department continues to grow relative to the Banking Department, a greater share of the United Kingdom's base money will be backed by repurchase agreements and bills.

5. Although most of the countries in our sample expect to achieve budgets that reduce their public debt relative to their GDP during the coming two decades, their rising pension and social security obligations could later entail substantial budget deficits.

In Norway, the government holds substantial financial assets and has a gross public debt nearly equal to one-fourth of its GDP. Norway's government has run substantial surpluses as a result of its oil revenues, much of which it has retained in its State Petroleum Fund and invested abroad. Because the remainder of its budget has been in deficit, Norway's public debt has fallen only slightly relative to its GDP recently.

1.C.1. Government Finances, Money, and Central Bank Assets in Selected Industrial Countries, 1999

Percent of GDP except as noted

Category	Canada	France	Germany	Italy	Japan	United Kingdom	Euro-system	Australia	Norway ¹	Sweden	Switzerland
Government finances											
Surplus (–, deficit)	2.8	-1.8	-1.1	-1.9	-7.0	1.1	-1.2	1.6	4.9	1.9	-6
Structural surplus (–, deficit) (percent of potential GDP)	2.9	-1.5	-3	-7	-6.0	.9	-7	1.3	-2.9	2.1	n.a.
Net debt	55.3	43.0	47.0	104.4	37.7	38.7	58.1	13.8	-47.8	13.0	n.a.
Gross debt	93.0	65.0	63.5	116.6	105.3	53.0	75.3	26.2	34.6	68.3	51.4
Money and central bank assets											
Money (national definition) ²	61.9	68.8	101.3	235.8	125.7	104.8	67.4	70.6	55.9	45.3	104.0
Reserve money	4.8	3.7	7.5	26.2	18.1	4.3	6.4	5.2	7.0	5.2	12.7
Central bank assets	13.0	41.3	15.3	68.0	5.9	7.9	19.6	14.0	51.0	18.0	27.0
Central bank assets (percent of government gross debt)	13.9	63.5	24.1	40.8	5.6	14.9	26.0	53.6	147.5	26.4	52.5

NOTE. The first six countries are the non-U.S. members of the Group of Seven. The Eurosystem comprises the European Central Bank and the central banks of the members of the European Economic and Monetary Union (EMU) (which are the countries that have adopted the euro as their national currency); as of January 1, 1999, when they adopted the euro, the members of the EMU were Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain. Like the member countries of the Eurosystem, Sweden is one of the fifteen members of the European Union (the other three are Denmark, Greece, and the United Kingdom). Greece subsequently joined the EMU and adopted the euro on January 1, 2001.

1. The value shown for Norway's structural deficit is a percentage of mainland potential GDP; it excludes revenues from oil production.

2. The monetary aggregate in each case would be that most comparable to M2 in the United States.

SOURCE. International Monetary Fund, *International Financial Statistics Yearbook* (IMF, 2000); Deborah Roseveare and others, "Ageing Populations, Pension Systems and Government Budgets: Simulations for 20 OECD Countries," Economics Department Working Papers 168 (Organisation for Economic Co-operation and Development, 1996).

1.C.2 Foreign Central Banks' Approach to Monetary Policy

Category	Canada	Pre-EMU France	Pre-EMU Germany	Pre-EMU Italy	Japan	United Kingdom	Euro- system	Australia	Norway	Sweden	Switzer- land
General information											
Intermediate monetary policy target	π	e, M	M3	e	diverse	π	$\pi, M3$	π	π	π	π
Operating target: market interest rates	O/N	Short-term	Short-term	O/N	O/N	Short-term	Short-term	O/N	Short-term	O/N	Short-term
Reserve requirements	No	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes ^a	Yes
Frequency of market operations	$1 \times d$	$2 \times w$	$1 \times w$	$1 \times w$	$>1 \times d$	$\approx 2 \times d$	$1 \times w$	$\approx 1 \times d$	$\approx 1 \times d$	$>1 \times w$	$\approx 1 \times d$
Standing facilities											
Type of facilities	MC, MF	MC	MC, BM	MC, BM	MC	MC, MF	MC, MF	MC, MF	MC, MF	MC, MF	MC
Frequency of use	Occasional	Rare	MC rare, BM active	Active	Very rare	Occasional	Occasional	MC occasional, MF active	MC rare	Occasional	Rare
Characteristics of outright purchases											
Type of security allowed											
i. Public-sector liabilities	CG only	Yes	Yes	Yes	Yes	Yes	Yes	CG only	b	Yes	Yes
ii. Private-sector liabilities	No	Yes	Yes	No	Yes	bills only	Yes	No	b	Yes	Yes
iii. Foreign liabilities	No	No	No	No	No	Yes ^c	No	No	b	Yes	Yes ^d
Type of security most frequently used	i (CG)	i (CG)	e	i (CG)	i (CG)	i (CG)	f	i (CG)	b	i (CG)	g
Characteristics of repurchase agreements											
Use in market operations	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Dominant	Exclusive ^h	Exclusive ^s	Dominant
Type of security allowed											
i. Public-sector liabilities	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ii. Private-sector liabilities	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
iii. Foreign liabilities	No	No	Yes ⁱ	No	No	Yes	No	Yes	Yes	Yes ^j	Yes ^k
Type of security most frequently used	i	i, ii	i, ii	i (CG)	i, ii	i, ii, iii	i, ii	i (LG)	i, ii, iii	i, ii	i, ii, iii
Initial maturity of contracts	1 day	7 days ^l	14 days	14 days	7 days to 6 months ^m	14 days	14 days and 3 months ⁿ	14 days ^o	2 days to 14 days	7 days	O/N to 3 weeks ^p
Counterparties: Banks (B), securities houses (SH), money market dealers (MM)	B, SH	B	B	B, SH, MM	B, SH, MM	B, SH, MM	B	B, SH, MM	B	B, SH	B
Margining practices											
Mark to market	Daily	No	No	No	Daily	Daily	Yes ^d	Daily	No	Daily	Daily
Margin call	Yes	No	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Initial haircut	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No

1.C.2 Continued

Category	Canada	Pre-EMU France	Pre-EMU Germany	Pre-EMU Italy	Japan	United Kingdom	Euro- system	Australia	Norway	Sweden	Switzer- land
Composition of central bank assets (percent of total assets)^f											
Gold, international reserves, and other foreign assets	4.8	56.6	33.7	35.1	4.5	22.0	48.5	64.0	83.0	71.0	67.0
Securities held outright	87.8	3.0	0	45.5	67.0	18.0	10.2	8.3	4.0	11.0	2.8
Loans and repos	5.2	21.2	62.4	13.6	26.0	57.0	31.0	25.9	11.0	17.0	26.8
Other domestic assets (including fixed assets)	2.2	19.2	3.9	5.8	2.5	3.0	10.3	1.8	2.0	1.0	3.4
MEMO: Government deposits as a percent of total liabilities	Less than 1.0	7.0	Less than 1.0	15.5	12.1	1.2	7.1	26.5	27.7	Less than 1.0	16.0

π = Inflation

e = Exchange rate

O/N = Overnight

CG = Central government liabilities

MC = Market ceiling rate (the technical form of this standing facility is usually a fixed-term loan)

MF = Market floor rate (the technical form of this standing facility is a deposit)

BM = Below market rate (the technical form of this standing facility is usually a rediscount)

LG = Local government liabilities

NOTE. See general note to table 1.C.1.

a Reserve requirements are currently set to zero.

b The central bank of Norway does not use outright purchases of securities as a monetary policy instrument.

c Liabilities must be sterling denominated.

d Must be denominated in Swiss francs.

e The central bank of Germany conducted outright purchases of very limited significance.

f To date, the Eurosystem has not conducted outright purchases.

g The central bank of Switzerland conducts outright purchases of very limited significance.

h The central bank of Norway uses fixed-term loans against full collateral as the main instrument to supply liquidity.

i Limited to exchange rate swaps, and rarely used.

j The central bank of Sweden accepts OECD countries' securities with an external credit rating of single A or higher for intraday and overnight credit only.

k Liabilities are mostly denominated in Swiss francs.

l For repurchase agreements on a tender basis; the maturity at market prices is five to ten days.

m In 2000, the average maturity was fifty days.

n The maturity is fourteen days for main refinancing operations, and three months for longer-term refinancing operations.

o Average maturity.

p In 2000, the average maturity was nine days.

q Frequency varies across countries from daily to weekly.

r End of 1999 except for the United Kingdom (February 2000); Canada, Japan, Australia, and Sweden (May 2000); France and Germany (end of 1997); and Italy (end of 1998).

s The central bank of Sweden uses repurchase agreements to provide liquidity to the banking sector; it issues debt certificates when a structural liquidity surplus exists.

Appendix 1.D

Criteria for Assessing Discount Window Collateral

When making discount window loans, the Federal Reserve looks primarily to the borrowing institution for repayment. The Federal Reserve does, however, take collateral to protect itself in the remote possibility of borrower default. In this appendix, we consider issues related to the criteria for assessing discount window collateral. In recent years, the Federal Reserve has moved to expand the range of assets it will accept as collateral. If the System was to rely more on discount window lending to supply reserves, the variety of collateral it accepts would become still wider, a development that would present challenges to risk management.

PURPOSE OF DISCOUNT WINDOW LENDING

Discount window lending long ago ceased being the primary monetary policy tool envisioned by the framers of the Federal Reserve in 1913. Currently, discount window lending serves two basic functions—to complement open market operations and to provide liquidity to individual depository institutions under certain conditions.¹ These two functions need not be mutually exclusive. As a complement to open market operations, discount window lending can fill the gap late in the business day when reserve supply falls short of demand and pushes the federal funds rate above the targeted level. Discount window lending provides an efficient method for channeling funds to the institutions experiencing reserve shortages that result for a number of reasons, including any projection errors on the part of the Federal Reserve. Current guidelines for discount window administration assure that it is viewed as a discretionary lending facility to be used sparingly (that is, as the lender of last resort). By design, then, discount window borrowing has served primarily as an important safety valve in the implementation of monetary policy.

The volume of discount window lending has been relatively light in recent years. However, expected declines in Treasury debt outstanding in coming years could lead to discount window lending becoming a source of expansion in Federal Reserve assets. This suggests that the pledged collateral base would need to expand as well if the Federal Reserve decided to rely more on discount window loans as an asset class, since all such loans must be secured to the satisfaction of the Federal Reserve by collateral that is acceptable for credit purposes. At the same time, asset holdings of depository institutions may become less liquid and more risky since there will be fewer (or perhaps no) Treasury securities available for institutions to hold.

By accepting a broad range of collateral, the Federal Reserve serves the public interest by being a bank to banks. Discount window lending is a means of converting less liquid assets (of depository institutions) to more liquid ones (balances at the Federal Reserve). This approach leads to a broad array of "riskier" assets being judged acceptable as collateral, and minimizes those risks by managing them.

This approach poses potential challenges in addition to those of managing risks. With a very wide array of assets eligible as collateral, depository institutions might be inclined to come to the window more frequently and for larger amounts. This additional activity could impair the

NOTE. Anne Marie Gonczy, Edward Green, and Gregory Stefani prepared this appendix.

1. Three types of credit are currently available—adjustment, seasonal, and extended—with guidelines spelled out as to when and under what conditions each type of credit can be made available.

implementation of monetary policy unless appropriate pricing, administrative guidelines, and coordination between the open market and discount functions were in place.

ASSETS THAT CAN BE USED AS COLLATERAL

The legal constraints on the types of assets that can be pledged as collateral seem to be minimal. Echoing language from the Federal Reserve Act, the Federal Reserve's Regulation A states that a Federal Reserve Bank may make an advance to a depository institution if the advance is secured to the satisfaction of the Federal Reserve Bank.² This guidance provides considerable flexibility in administering collateral.

Although the traditional collateral management approach focused on highly liquid instruments with minimal credit and market risks (such as U.S. Treasury and agency securities), the System took a more flexible view of collateral during the course of its efforts to ensure that the financial industry was prepared for the century date change. During 1999, the System greatly expanded the acceptability and valuation criteria for a number of asset types used as discount window collateral and also streamlined certain procedures for the administration of collateral. The decisions to take these steps hinged on striking a balance between managing risk to the Federal Reserve and accommodating depository institutions in order to reduce barriers to use of the discount window. As a result, a wide array of asset types were (and continue to be) identified as being acceptable as collateral. The experience with the century date change provided useful guidance for assessing the criteria for discount window collateral in the future.

MAJOR CONSIDERATIONS IN ASSESSING COLLATERAL

Collateral is intended to guard against default risk, that is, to protect the Federal Reserve from financial loss in the event of default by a borrowing institution. Discount window advances must be secured to the satisfaction of the Federal Reserve Bank, but the primary source of repayment is rarely the liquidation of collateral but rather the proceeds from normal cash flow. The usual guiding principle applies—discount window loans can be made to solvent institutions. Monitoring the financial well-being of potential and actual borrowers should be just as important in risk management as assessing the assets pledged as collateral. Expanding discount window lending and including more term or permanent lending programs would not change the underlying need for such monitoring. Nonetheless, the quality of collateral and the careful, conservative assessment of its value would still play a critical role in discount window activities and in the ability of Reserve Banks to minimize their risk exposure, especially in situations of lending to a problem organization.

Acceptable discount window collateral generally can best be described as any asset that can confidently be liquidated within a reasonable period of time at the value at which it is accepted.³ As a general rule, the greater the level of risk associated with a certain type of underlying collateral, the lower the (lendable) valuation assigned to the collateral. Accurately measured, the margins or haircuts used in the valuation process should reflect the true relative risks of the various asset types, and they should contribute to relative asset price neutrality across the broad spectrum of assets deemed eligible for collateral.

2. Under normal conditions, however, Federal Reserve Banks can lend only to depository institutions with deposits subject to reserve requirements. As a result, discount window lending programs could be viewed as favoring depository institutions over nondepositories, a possible form of credit allocation.

3. This definition is meant to describe the Federal Reserve's "bankable assets" concept of acceptable collateral that includes any asset that meets the regulatory standards for sound asset quality.

Determining the criteria for discount window collateral requires an understanding of the various risks associated with such assets. Defining the level of tolerance for each risk is critical to shaping the overall tradeoff between the level of risk the Federal Reserve Bank is willing to undertake versus the degree of accommodation provided to the pledging institution. Current practices measure risk using information such as public rating sources (such as Moody's and Standard & Poor's) as well as proprietary risk rating systems (such as a pledging institution's internal risk rating system). In most instances, consistent thresholds have been established on the basis of a matrix in which the market price of the underlying collateral is discounted by using historical data and identified proxies for each asset.

CRITERIA FOR ASSESSING MAJOR RISKS

The primary risks associated with underlying collateral are credit, liquidity, market, operational, and legal risks. These risks must be taken into account when setting margins on acceptable collateral. And changing risks and valuations could necessitate calls for additional collateral to provide adequate safeguarding. These risks and the criteria for assessing them are described below and in table 1.D.1.

Credit Risk

Credit risk refers to the potential that the obligor or issuer of the asset held as collateral will be unable or unwilling to perform on an obligation, resulting in economic loss to the Federal Reserve. Several criteria should be applied in assessing the credit risk associated with collateral for discount window purposes. The asset should have satisfactory operating and cash flow performance, and the obligor or issuer should demonstrate a reasonable level of debt in relation to the overall balance sheet. In addition, the discounted value of the asset should be sufficient to fully repay the debt through liquidation.

Market Risk

Market risk refers to the potential that the value of the underlying collateral will be reduced by movements in market rates or prices. In assessing assets for market risk, it should be determined that the value of the collateral does not decline substantially when the asset is stress tested under various market or interest rate scenarios.

Liquidity Risk

Liquidity risk refers to the potential that the underlying collateral could not be liquidated in a timely manner and at a stable market price. In assessing assets for liquidity risk, it should be determined that the asset either matures or can be easily sold (liquidated) within a reasonable period at a time, cost, and price relatively consistent with the normal market value. The length of time available to liquidate collateral or allow it to reach maturity will depend on the role of discount window lending in the overall liquidity management of the Federal Reserve's balance sheet. If the portfolio is managed to have a rapidly adjustable liquid component and a structural, relatively illiquid, component, the liquidation period available would depend on whether discount window lending is largely an instrument for short-term adjustment of the balance sheet or a component of the portfolio's permanent growth.

1.D.1. Risk-Based Criteria for Assessing Discount Window Collateral

Type of risk	Definition	Criteria
Credit	Obligor or issuer of the asset held as collateral may be unable or unwilling to perform on an obligation, resulting in economic loss to the Federal Reserve	Satisfactory operating and cash flow performance and reasonable level of debt in relation to overall balance sheet Sufficient collateral to fully repay the debt through liquidation
Market	The value of the collateral may be reduced by movements in market rates or prices	Collateral does not substantially decline when the asset is stress tested under various market or interest rate scenarios
Liquidity	The Federal Reserve might not be able to liquidate the collateral in a timely manner and at a stable market price	Asset matures or can be easily liquidated within a reasonable period at a time, at a minimal cost, and at a price relatively consistent with the normal market value
Operational	The systems and controls used to monitor, safeguard, and value the collateral result in an unexpected loss because the collateral did not fully secure what became a bad loan	Cost to monitor, safeguard, and value the assets is reasonable.
Legal	The Federal Reserve has not properly perfected its security interest in the underlying collateral or does not have priority over other secured parties, thus impairing its ability to liquidate collateral to effect loan repayment	The Federal Reserve can easily obtain a perfected, senior lien position on the assets All required legal documentation is executed

Operational Risk

Operational risk refers to the potential that the systems and controls used to monitor, safeguard, and value the underlying collateral fail to provide full collateralization on one or more loans and a loss results. In assessing assets for operational risk, the cost to monitor, safeguard, and value the assets should be determined to be reasonable.

Legal Risk

Legal risk refers to the potential that the Federal Reserve Bank has not properly perfected its security interest in the underlying collateral or does not have priority over other secured parties, in which cases the Reserve Bank's ability to liquidate collateral to effect loan repayment would be impaired. In assessing assets for legal risk, the Reserve Banks must determine that they can easily obtain a perfected, senior lien position on the assets and that all required legal documentation is executed.

OTHER CONSIDERATIONS

Managing Risk and Uniform Collateral Procedures

Managing the major risks associated with various classes of assets can be accomplished through appropriate "haircuts" and by perfecting interest in the assets pledged as collateral. For the sake of nationwide consistency and in support of the general principle of transparency, the Federal Reserve applies a single set of collateral procedures for use at all Reserve Banks, including the list of assets identified publicly as acceptable for collateral and the associated haircuts. For a large portfolio of discount window collateral, guidelines at the portfolio level may be necessary to manage relative price impacts, concentrations, and portfolio liquidity.

Custody Arrangements

Risk might also be affected by collateral custody arrangements. If the volume of Treasury debt outstanding declines, then the proportion of collateral pledged in book-entry form will also likely decline. Prudent risk management would involve continued close scrutiny of the credit quality of institutions holding collateral in borrower-in-custody form.

Administrative Staffing

Highly skilled staff will continue to be needed to administer discount window collateral. Indeed, required skill levels will rise if more complex asset types are judged to be routinely acceptable as collateral. Some efficiencies may be possible given the System's uniformity in policies and procedures. However, the staff at individual Reserve Banks will need to monitor the health of actual and prospective borrowers, determine the value of pledged collateral with applied haircuts, and assure that all paperwork associated with custody and perfection of interest is in order.

Competition for Collateral

Depository institutions pledging collateral for discount window purposes may be separately required to pledge collateral to the Federal Reserve under the Federal Reserve's Payment System Risk (PSR) policy or because the institution holds Treasury tax and loan (TT&L) accounts. Moreover, institutions need to pledge collateral if they borrow from the Federal Home Loan Banks. These competing claims for collateral pose challenges not only for the discount window function but also for open market operations. Some efforts have been made to coordinate collateral needs for discount window, PSR, and TT&L purposes.

Systemic Risk and Public Accountability

Although the Federal Deposit Insurance Corporation Improvement Act of 1991 changed the rules for Federal Reserve lending to undercapitalized and critically undercapitalized institutions, systemic risk considerations may, in the future, justify making a large loan to a troubled institution. Or, systemic risk considerations might justify a loan larger than the normal amount of pledged collateral to an institution experiencing some significant operational problem. In these and other unusual cases, flexibility may be necessary in terms of the collateral accepted against discount window loans.

The Federal Reserve must continue to meet a high standard of public accountability for its discount window lending, especially when such lending is part of a plan for orderly closing of a failing institution. Lending in such situations is done with the involvement of executive Reserve Bank management and under active oversight by the Board of Governors. The decisions that are taken require the exercise of prudent and seasoned judgment in situations that are unique to each case. The reliance on experienced persons making such loans, and the integrity of the lending process, are the safeguards of the public interest in carrying out this activity that would be difficult to regulate by means of specific constraints fixed in advance.

2. FINANCIAL ASSETS AVAILABLE FOR PURCHASE IN THE OPEN MARKETS

This chapter identifies and discusses the financial assets that the Federal Reserve could consider purchasing for the System Open Market Account (SOMA) should it choose to substantially diversify the account's holdings beyond U.S. Treasury securities. The discussion is in two parts. The first part identifies the issues that are common to most of the assets considered here. These issues include various types of risk, market liquidity and development, and market transparency. The second part discusses in detail the characteristics of a wide range of assets that could be acquired by the SOMA.

Throughout, the chapter analyzes the suitability of potential SOMA assets in terms of the guiding principles for the acquisition of assets by central banks as articulated in chapter 1:

1. Maintain operational independence for monetary policy (instrument independence)
2. Minimize effects on relative asset prices and credit allocation
3. Minimize portfolio risks and maintain sufficient liquidity
4. Place a high priority on transparency and accountability.

In developing an investment strategy, the Federal Open Market Committee (FOMC) will need to establish priorities for these principles or, alternatively, to develop minimum requirements for each principle, because trade-offs will be necessary. That is, some assets have characteristics that satisfy certain of these principles to a substantial degree while satisfying others to a lesser or small degree. For example, the purchase of a given asset might not distort market prices, but the asset might have little liquidity.

COMMON ISSUES

In this section we discuss a number of issues that the Federal Reserve will need to confront if it chooses to move toward purchasing non-Treasury securities in the open market. Many of these issues are present today in the management of the SOMA, although perhaps to a lesser degree than might be the case with a portfolio that diversified beyond U.S. Treasury securities.

Credit Risk

The Federal Reserve will face an element of credit risk—the risk of default by the issuer—in most instruments. Credit risk is an issue for every credit instrument that we consider except for Treasury securities and other issues that are backed by the full faith and credit of the U.S. government. As a commodity, gold has no credit risk. Equities, while not having credit risk per se, do have market risk. Portfolio credit risks can be attenuated partly by careful diversification and partly by purchasing relatively short-term

debt instruments. The System could also require that individual assets meet or exceed a threshold level of credit quality, possibly as gauged by the ratings of major credit rating agencies.

Market Risk

The Federal Reserve will take on some degree of market risk—the risk of fluctuation in market value of asset holdings in response to broad market price movements—in essentially any instrument that it purchases. Indeed, the Federal Reserve is subject to market risk in its current portfolio. Market risk can be minimized by focusing purchases on credit instruments with relatively short maturities. Diversification of holdings can also be used to reduce (but not eliminate) market risk in the portfolio. Also, in some cases derivative instruments could be used, at least in principle, to transfer some or all of the market risk. Of course, the market risk of credit instruments would not translate into a realized financial loss if all assets were held to maturity.

Market Liquidity and Development

A substantial proportion of Federal Reserve assets must be sufficiently liquid to allow the FOMC to manage banking system reserves. In this context, liquidity is the ability to buy and sell in the desired quantities in a short period of time without the transactions having a significant effect on market prices.¹ The absence of a liquid secondary market could be a particular disadvantage to the Federal Reserve should it need to reduce its portfolio holdings sharply to absorb reserves in the event of, say, a jump in discount window lending or of a sharp drop in required reserves.² Liquidity could be achieved in part by holding assets having a relatively short term; it could also be achieved in part by holding assets for which a robust secondary market exists.

A number of instruments discussed below are traded in markets in which liquidity is limited; for some of these instruments, secondary markets are essentially nonexistent. A related concern is that the Federal Reserve's holdings of a given asset should not be so large as to impair the liquidity of the market. Federal Reserve involvement in a particular market may, however, spur additional trading and liquidity, as was apparently the case with the Federal Reserve's involvement in the market for agency securities in the early 1970s.

1. For an asset, liquidity tends to be characterized by narrow spreads between its typical bid and asked prices. The depth of bid and asked quotes—the amounts that can be transacted at those quotes—is also an important dimension of liquidity. The more liquid an asset, the larger the amount of it that prospective buyers and sellers can transact near market prices. The generally accepted understanding of market liquidity is similar to that of asset liquidity. The more liquid the market for an asset class, the larger the amount of that asset class that prospective buyers and sellers can transact near market prices.

2. Currently, the SOMA's liquidity derives in part from its holdings of short-term Treasury securities, in particular, Treasury bills. That is, the SOMA can be reduced by permitting its holdings of Treasuries to mature without replacement. The SOMA's liquidity also derives from the secondary-market characteristics of Treasury securities. In the secondary market, high volumes of Treasury securities are bought and sold daily at narrow bid-asked spreads, with settlement lags typically of at most one day.

Liquidity need not be of paramount importance for each type of security held in the SOMA. Assets that are desirable for reasons related to the other principles may be used for the portion of the portfolio that is likely to persist even when the portfolio has to be quickly and sharply reduced.

Sovereign Risk

One set of risks is unique to obligations of foreign sovereign governments and to other securities held abroad. These are the risks that a foreign sovereign government, for internal or external political purposes, may default on its own debt or may act to freeze payments leaving the country. Sovereign risk could be viewed as a type of credit risk, but the range of events that could lead to a default or freeze is wider than those relevant for private, domestically issued securities. A related issue is that the Federal Reserve would need to ensure that any legal uncertainty related to issuance and custody in foreign jurisdictions was minimized.

Counterparty and Settlement Risks

The Federal Reserve manages various operational risks in the SOMA. These risks could be larger if the System begins to transact in markets other than that for Treasury securities. The System will need to be cognizant of counterparty risk—the risk that counterparties to System transactions will not perform as promised; as with sovereign risk, this contingency could be regarded as a type of credit risk. Similarly, custody, clearing, or settlement institutions may not perform as required—a specific type of credit risk that we refer to generically as settlement risk.

The relevant counterparties for alternative asset classes may be different from those with which the System has transacted historically (the primary dealers) and may have different risk characteristics. Thus, the Federal Reserve will need to give careful attention to credit considerations in its decisions about the eligibility of counterparties and, on the basis of these considerations, may wish to limit its exposures to particular counterparties.

Regarding settlement risk for the SOMA, a clearing bank for the SOMA's tri-party repurchase transactions agrees to maintain the SOMA's intraday funds in a segregated account to protect them from loss should the institution become insolvent. Nevertheless, a sudden cessation of activity by a clearing bank could temporarily prevent the System from transacting to the desired extent in the relevant asset class. This interference from problems at one clearing bank could arise if other clearing banks cannot handle the increased volume or if counterparties that used the remaining clearing banks did not have sufficient demand to meet the System's needs.

The System currently faces this settlement risk with its reliance on two clearing banks for tri-party repurchase operations against collateral in the form of Treasury, agency, and mortgage-backed securities. The System might find that the number of clearing institutions for particular other assets is limited; on the other hand it might also find that, considering all eligible assets, the universe of institutions that can clear for the System would be greater than it is currently. Thus, the presence of a larger number of asset types

in the SOMA could improve on the current distribution of the risks associated with clearing banks.

Given these considerations about the exposure to clearing bank operations, the Federal Reserve might wish to establish guidelines for maximum exposures to clearing banks.

Legal Risks

The expansion of SOMA transactions to non-Treasury securities and other assets would pose a variety of legal risks, some generic and some unique to certain markets or financial products. For example, the Federal Reserve might want to commission bankruptcy-law opinions from counsel in non-U.S. jurisdictions in conjunction with certain products or counterparties. In addition, issues pertaining to legal documentation would have to be resolved before the System made certain investments.

Market Transparency and Transacting at Market Prices

To help avoid distorting markets and to protect the taxpayers' interests, the Federal Reserve needs to be sure that it transacts at market prices. Achieving this end is best accomplished if trading is transparent.³ The indicators of transparency depend to some extent on market architecture, but key element is the rapid publication either of tradable bid and asked prices or actual transaction prices, together with volumes, for a given credit quality.

The markets in which the Federal Reserve could consider transacting vary considerably in their transparency. Markets in which the issues traded are small and heterogeneous tend to lack the infrastructure for providing the information needed for transparency. In several of these markets, such as those for municipal and corporate bonds and for asset-backed securities, quotes can be obtained only by directly contacting individual dealers. In some cases, prices and quantities are visible on a broker's screen, but additional information that may be important to prospective counterparties is not provided; this problem exists with the market for federal funds, in which the creditworthiness of the buyer may be a factor in the pricing of a transaction. Thus, the price on the broker's screen is an incomplete representation of the pricing information that the System would need.

Historically, the System has ensured that it is transacting at market prices partly by obtaining assets through auctions. The ability to conduct such auctions is promoted by transacting in relatively homogeneous assets, such as government securities or repurchase agreements against government securities. Likewise, for non-Treasury assets, such auctions would be easiest to implement for assets that are relatively homogeneous—for example, commercial paper of a given quality or repurchase agreements against

3. Market transparency generally refers to the ability to observe representative trades in an asset. Market transparency is increasingly associated with the ability to observe market bid and asked prices and associated transaction volumes on a public web page that shows representative prices provided by a securities intermediary.

commercial paper. In contrast, if the Federal Reserve was to purchase assets in the corporate or municipal bond markets, which are characterized by thousands of heterogeneous instruments, satisfactory auctions might be very difficult to design. And the Federal Reserve would need to rely on dealer quotes and any published data to ensure that it was obtaining market prices.

A mutual fund is an asset for which the standard of "market price" is especially difficult to apply. Direct price comparisons across non-exchange-traded funds typically would not be possible because of differences in their asset allocations. And the share price of a non-exchange-traded fund, which depends on the prices of the underlying assets, is not determined until the end of the day.

Suitability of Assets for Fine-Tuning Operations

One benefit of investing in Treasury securities is the ability to settle outright and repurchase transactions either on the day of or the day after the transaction. Same-day settlement is essential for fine-tuning operations. Also, for outright transactions, short settlement periods help minimize counterparty risk borne by the System. For operations that implement longer-term adjustments to reserves, however, considerably longer lags can be acceptable if the levels of counterparty, market, and settlement risk are satisfactory.

For outright purchases of the asset types that are considered below, same-day settlement is rarely market convention. The exceptions that permit same-day settlement for outright purchases include agency discount notes, commercial paper, certificates of deposit, and mutual funds. For purchase under repurchase agreements, most agency and many asset-backed securities can be used for same-day settlement. A limited volume of repurchase agreements are transacted against corporate securities, commercial paper, and certificates of deposit.

The prevalence of more-delayed settlement in non-Treasury markets—which reflects trading system conventions, technological barriers, and time-zone differences—points out the likelihood that some operations (including some repurchase transactions) would involve settlement periods longer than those to which the System is currently accustomed.

Public Perceptions

Upon the expansion of the asset classes in which the SOMA transacts, the public might see the involved issuers, counterparties, clearing banks, and custodians as having implicitly received the imprimatur of the Federal Reserve. Firm rules supporting impartiality, based to the extent possible on objective criteria, should guide the various decisions that must be made in the course of conducting transactions for the System account. Publicizing these rules would help make clear that the SOMA's purchases are not motivated by a desire to support particular entities and that its transactions do not imply an imprimatur.

Costs of Portfolio Management

Another issue to be considered by the Federal Reserve in contemplating the purchase of alternative assets is the costs of portfolio management. These costs could involve a number of components, including overall portfolio design, credit assessment, and transaction costs. Any estimate of these costs would need to take into account both internal expenses and charges for externally provided services. Depending in part on its choices of alternative assets, the Federal Reserve may want to consider the benefits and costs of outsourcing some of the tasks associated with portfolio management.

Effects on Market Prices

As noted at the outset, one of the general principles that should guide central bank transactions is the need to avoid distortions to relative asset prices and to avoid altering the allocation of credit. Such distortions may be impossible to avoid entirely, but they can be minimized in part by transacting in highly liquid markets. Diversifying the System's transactions across a range of markets, so that its activities do not constitute an appreciable proportion of the transactions in any one market, also would help limit price effects. Finally, transacting on a repurchase rather than an outright basis in some markets also should help minimize distortions to prices.

Forms of Purchase: Outright and as Collateral in Repurchase Transactions

Repurchase transactions have advantages besides helping to minimize price distortions. Certain asset types may be more suitable for purchase under repurchase agreements than on an outright basis. The purchase of assets under repurchase agreement ordinarily would involve less risk than outright purchase for several reasons: Repurchase transactions are backed both by the credit of the counterparty and by the underlying collateral, the transactions are self-reversing, the prices of the "reverse" transactions are fixed in advance, and collateral is adjusted as market prices change. Because repurchase transactions are self-reversing, assets held under repurchase agreement also are effectively more liquid than assets held outright. Finally, because the purchaser in a repurchase agreement does not accept the credit risk of the issuer except as a residual outcome in the case of the default of the counterparty, the repurchase agreements may involve a smaller degree of credit allocation and smaller relative price effects than would the corresponding outright purchase.⁴

Nonetheless, repurchase agreements would need to be evaluated with respect to diversification criteria. And, of course, once a decision is made to accept a certain asset class as collateral for repurchase agreements, financing rates for this asset class will likely be affected—the only question would be to what degree. Moreover, the Federal Reserve would be subject to the credit risks associated with its counterparty and the tri-party clearing bank. These risks would need to be managed. In sum, the System may be

4. A minor offset to these advantages is the fact that assets originally obtained under a repurchase agreement could come to be owned outright by the System if the counterparty to the transaction failed to deliver the cash to repurchase the asset.

willing to accept an asset under repurchase agreement even while avoiding incorporation of that asset onto the System's balance sheet directly and more permanently.

ASSETS AVAILABLE FOR PURCHASE IN THE OPEN MARKETS

This section discusses the characteristics of a number of financial assets and assesses their potential usefulness for the System Open Market Account.⁵ First to be discussed are several types of private short-term (money market) instruments—bankers acceptances, certificates of deposit, federal funds and eurodollar deposits, and commercial paper. Next come several longer-term (capital market) instruments, including obligations of entities associated with the U.S. government, corporate bonds, asset-backed securities, and municipal obligations. Also discussed are the markets for foreign sovereign debt, foreign exchange swaps, corporate equities, mutual funds, and gold.

The statutory authority for the purchase of many of these assets by the System does not currently exist. (See appendix 2.A for the passages of section 14 of the Federal Reserve Act that provide most of the Federal Reserve's authority to engage in open market transactions.)

Bankers Acceptances

Bankers acceptances, which are relatively cumbersome, paper-based instruments not well suited to modern finance, have fallen from active use. Only about \$10 billion of bankers acceptances were outstanding as of September 2000. Markets reportedly are inactive, and robust trading is generally not expected to re-emerge. The System's ability to prompt any significant resurgence in activity and amounts outstanding in this market is questionable, especially because borrowers and lenders typically find other short-term financing instruments such as commercial paper, much more efficient than bankers acceptances. In sum, bankers acceptances are unlikely to be a useful vehicle for Federal Reserve investment.

Certificates of Deposit

A certificate of deposit (CD) is a negotiable instrument documenting the existence of a time deposit at a depository institution. The U.S. primary market for large CDs is reasonably large and liquid. Issuers of CDs typically are banks with relatively favorable credit ratings (A or better), and they issue both directly and through brokers. Money market mutual funds reportedly purchase the majority of wholesale CDs. Traders estimate the amount of dollar-denominated CDs outstanding to be in the range of \$800

5. In addition to the asset purchases authorized under section 14 of the Federal Reserve Act, certain types of commercial paper may be discounted by the Federal Reserve Banks under section 13 if that paper is endorsed by a depository institution. Because the outstanding volume of these types of paper appears to be low, their potential as an asset for the SOMA is not further analyzed here.

billion to \$1 trillion.⁶ A large portion of this amount consists of CDs issued by U.S. branches and agencies of foreign banks (Yankee CDs).

Investors typically view CDs as a close substitute for commercial paper. Similarly, bank holding companies and their affiliates use CDs and commercial paper as substitutable funding sources. CDs are not backed by collateral, and thus the investor is exposed to the credit risk of the issuer (except for \$100,000 if the deposit is insured by the FDIC.)

A secondary market for CDs exists, although it is not especially liquid or transparent. Money market brokers and dealers intermediate the CD market, but secondary market prices are not made available on brokers' electronic display screens and must be obtained from dealers on an issue-by-issue basis. Still, a reasonable expectation is that the transparency of the secondary market for CDs would improve if the Federal Reserve was to make such improvement a requirement for purchases of this asset type.

The Federal Reserve would need to manage the credit risk associated with individual institutions and instruments. To a degree, this risk could be managed and reduced through diversification and through selective credit decisions, based either in part or wholly on commercial rating services. In a decision regarding, for example, whether the Federal Reserve should purchase Yankee CDs, the type of charter of the institution selling them and the perceived liquidity of that institution's CDs also might play a role. A significant issue is whether supervisory information should be used in determining the eligibility of CDs from particular institutions. To avoid the need to decide which institutions' instruments to purchase, the Federal Reserve might buy CDs indirectly through the purchase of shares in a diversified mutual fund.

CDs reportedly are used as tri-party collateral for repurchase transactions among private parties, but in small volume; dealers are said to be interested in using their inventories of CDs to collateralize transactions with the Desk. Another advantage of CDs is their relatively short maturity. Finally, considerable information about the issuers is available, both to the public and to regulators. Participation by the Federal Reserve in both the outright and repurchase markets for CDs could stimulate development of these markets.

The Federal Reserve could also consider purchases of eurodollar CDs, which are dollar-denominated CDs issued by large, well-rated international banks outside the United States. U.S. and Japanese banks used to dominate the market for eurodollar CDs, but European banks are currently the most prominent issuers. Large offshore banks, as well as the overseas branches of large U.S. commercial banks, view eurodollar CDs as an attractive source of dollar funding. An estimated \$160 billion of eurodollar CDs were outstanding in late 2000.

Eurodollar CDs are negotiable instruments, but secondary market trading is rather inactive and illiquid. Most trading is through brokers; activity is heaviest in London and

6. Precise figures are not available because regulatory reporting does not allow certificates of deposit to be separated from other time deposits.

sizable in New York. Like domestic CDs, eurodollar CDs are purchased to an important extent by money market mutual funds. Because of requirements for physical delivery, only a small volume of repurchase agreements collateralized by eurodollar CDs is outstanding.

Federal Funds and Eurodollar Time Deposits

Two large and relatively liquid markets that would in some ways be convenient for Federal Reserve operations are the federal funds market and the eurodollar time deposit market. Both of these are primarily interbank markets, and the instrument in each is a direct placement of funds on an uncollateralized basis, either overnight or for some fixed term. In the federal funds market, however, several entities other than depository institutions participate, including the government-sponsored enterprises—the Federal National Mortgage Corporation (Fannie Mae), the Federal Home Loan Mortgage Corporation (Freddie Mac), and the Federal Home Loan Banks—and international organizations such as the International Monetary Fund. All told, several hundred institutions appear to be active in the federal funds market.

Brokers play an important role in both markets, although a substantial amount of direct trading also occurs. These markets are relatively transparent, in that bid and offer quotes are widely available. However, the credit quality of participants is not uniform, and some entities must pay rate premiums that can vary with economic and financial conditions. Quotes on brokers' electronic display screens do not reveal the credit quality of the institution making the bid or offer.

Trades in the federal funds market are (essentially by definition) settled over Fedwire, while trades in the eurodollar time deposit market ordinarily are settled over the Clearing House Interbank Payments System (CHIPS), in both cases ordinarily on a same-day basis for overnight trades.

Given the central role that the federal funds rate has played in the implementation of U.S. monetary policy, the Federal Reserve has considerable expertise in the federal funds market. Moreover, the eurodollar time deposit market is closely related to the federal funds market in that the underlying instruments are very close substitutes.

Because placements of funds under eurodollar time-deposit arrangements and through federal funds transactions do not involve a negotiable instrument, no repurchase market is associated with these transactions.

Commercial Paper

Commercial paper (CP) is another unsecured debt instrument. About 1,200 nonfinancial and financial corporations and special-purpose financing entities are active issuers of CP. Investors in CP include money market mutual funds, corporations, and various types of financial institutions. The total amount of CP outstanding was roughly \$1.5 trillion in late 2000. Most CP is issued with relatively short maturities; the maturity of the largest

share is overnight, followed by clusterings at the fifteen-, thirty-, sixty-, and ninety-day marks.

The largest CP issuers place their paper directly with investors. The remainder sell CP through a few investment banks. The market for placements of new paper is highly liquid out to about thirty days. During the third quarter of 2000, new issuance of all CP averaged \$123 billion per day, a very substantial volume compared with markets for many other financial instruments. However, activity in the secondary market is quite limited.

The credit quality of most CP issuers is actively monitored by the major rating agencies. To achieve a top credit rating, a CP program must be backed by a committed line of credit from a highly rated lender. For most issuers, such lines protect the lender against temporary market illiquidity that would prevent the issuer from rolling over the paper rather than against a deterioration in the credit quality of the issuer—that is, most CP backup lines are structured so that the issuer cannot draw on the line in the event of a material adverse change in its financial condition.

CP has several advantages as a potential asset for Federal Reserve purchase. The advantages are, first, that the primary market is large, liquid, and transparent. Second, the large number of issuers would permit considerable diversification. Third, the instrument is quite short term and is thus relatively liquid (in the sense of providing liquidity through rapid turnover of the portfolio) and subject to little market risk. Fourth, public credit ratings are readily available.

The challenges of investing in CP are the need to manage credit risk and to select among the issues of competing borrowers. Another concern is that the secondary market (in contrast to the primary market) is rather illiquid; therefore the Federal Reserve might need to purchase new issues (from dealers or directly from issuers), and the Federal Reserve's liquidity needs would have to be met through the maturity structure of the CP portfolio or through investments in some other liquid instrument. (Of course, as mentioned above in the section on market liquidity, the entire SOMA need not be invested in liquid instruments in order for the System's liquidity needs to be met.)

Because of the absence of an active secondary market for CP in which actual transaction prices can be observed, ensuring that transactions in the primary market take place at market prices that properly account for credit risk could be difficult. Of course, as with other asset types, more transparency and liquidity might result from interest on the part of the Federal Reserve. A further drawback of CP as a Federal Reserve asset is that it is issued only by the largest firms, so Federal Reserve purchases could be seen as favoring a particular group of issuers.

The existence of a repurchase market for CP, although apparently relatively small, suggests that the System could engage in repurchase transactions against CP and thereby, perhaps, stimulate development of that market.

As with other asset types, CP could be purchased through a mutual fund. This approach would reduce some drawbacks associated with purchasing CP outright, such as liquidity concerns, and would delegate responsibility for individual credit judgments to asset managers. Also, the operational burden associated with rollovers would be reduced (see the section below on mutual funds).

Agency Securities

Ginnie Mae Securities

The Government National Mortgage Association (Ginnie Mae) is the only federal agency (other than the Treasury) whose obligations are fully guaranteed as to principal and interest by the U.S. government and that also has a large volume of securities outstanding. Ginnie Mae guarantees the full and timely payment of principal and interest (net of servicing fees) due on securities issued by state housing agencies and Ginnie Mae–approved private lenders. The securities guaranteed by Ginnie Mae are collateralized by mortgage pools formed by mortgage bankers and other private entities. The underlying mortgages are insured by the Federal Housing Administration or guaranteed by the Department of Veterans Affairs or the Farmers Home Administration.

The outstanding amount of mortgage-backed securities (MBS) guaranteed by Ginnie Mae (hereafter, Ginnie Mae MBS) was about \$585 billion in late 2000.⁷ The market is deep, transparent, and reasonably liquid. As obligations guaranteed by the U.S. government, Ginnie Mae MBS are free of credit risk. Ginnie Mae neither guarantees nor issues straight debt securities.

Because mortgagors have call privileges, MBS expose the investor to prepayment risk. (Presumably, investors are compensated for this risk through a higher expected return on these securities.) Except for Treasury securities with a set call period, the Federal Reserve has not previously purchased securities with this characteristic on an outright basis. Prepayments would complicate the management of banking system reserves. Variations in prepayment speeds also would affect the Federal Reserve's (and ultimately the taxpayers') realized return on these securities.

Usually, the complications resulting from prepayments would not be especially large because the Federal Reserve should be able to develop procedures that would allow it to obtain precise figures on prepayments at least several days in advance.⁸ These figures would be folded into the usual process of projecting factors affecting the supply of reserves. Thus, prepayments usually could be offset fairly smoothly through subsequent open market purchases. At times, however, especially when long-term interest rates are declining, the volume of prepayments could pick up sharply. In these circumstances, the necessary volume of offsetting open market operations could be quite large if the System's holdings of MBS were sizable.

7. Data from the Bond Market Association web site www.bondmarkets.com.

8. This would be possible because servicers hold prepayment funds in escrow for about two weeks before disbursing the funds to investors.

The prepayment complication mainly affects MBS held outright.⁹ However, the System is also exposed to prepayment risk under a repurchase agreement collateralized by MBS if the counterparty defaults on its obligation to return cash. This risk exists with the MBS that the System now holds under repurchase agreements, of course, and is greater for longer-term repurchase agreements.

Pricing of MBS is necessarily based on complex prepayment and interest rate models. No single model is widely accepted, and hence no consensus view exists regarding the price–yield relationship. Still, market prices are transparent.

In the primary market, settlement is on a monthly schedule while, in the secondary market, the settlement schedule is the same as for other corporate securities ($t + 3$); these conventions suggest that any outright purchases would need to be part of a forward planning strategy. Also, operational complexities are more extensive than for many other securities because of the need to account for interest accrual and prepayment of principal.

In sum, the System could purchase Ginnie Mae MBS, both outright and, as has been the case since October 1999, under repurchase agreement. Price and prepayment risk and operational complexities for outright purchases could be managed.

Obligations of the Government-Sponsored Enterprises

Broad and liquid markets exist for the obligations of the so-called government-sponsored enterprises (GSEs), the largest of which are the housing-related agencies--Fannie Mae, the Federal Home Loan Bank System (FHLB), and Freddie Mac. The GSEs both issue direct debt and guarantee MBS. Issuance is very large and, particularly for debt, quite regular. The outstanding debt at the end of September 2000 was approximately \$600 billion for Fannie Mae, \$575 billion for the FHLB, and \$400 billion for Freddie Mac. Fannie Mae and Freddie Mac also issue large volumes of MBS, with about \$1 trillion and \$790 billion, respectively, outstanding as of September 30, 2000. Taken together these amounts roughly equal, and may soon surpass, the total amount of marketable Treasury debt outstanding.¹⁰

Other GSEs that issue debt (or have debt outstanding) include the Farm Credit Banks, the Student Loan Marketing Association (Sallie Mae), and the Resolution Funding Corporation.¹¹ The amount of outstanding debt of these entities is more limited and will not be discussed in detail because of the smaller sizes.¹² In principle, however, there

9. The operational prepayment problem would be limited if the Federal Reserve was to buy MBS through a mutual fund; in this case, the investor would delegate the responsibility for managing prepayments to the mutual fund operator, which could reinvest prepayments in securities.

10. Data on GSE issuance from third-quarter reports of the respective agencies and from www.bondmarkets.com.

11. Sallie Mae will be completely privatized by 2008.

12. Debt of the Farm Credit Banks is about \$71 billion; debt of Sallie Mae is about \$42 billion; and debt of the Resolution Financing Corporation is about \$30 billion (Salomon Smith Barney, "Issuers in the Agency Debt Market," *2000 Guide to Agency Debt Securities*, p. 12).

seems no reason that they could not play a proportionately smaller role in a portfolio that included obligations of, or guaranteed by, GSEs.

GSE debt issues generally trade at relatively narrow spreads over Treasuries, although those spreads have fluctuated somewhat over the past year or so. Perhaps the most liquid of the GSE securities are the short-term benchmark bills, which are replacing a portion of the discount notes traditionally offered by the GSEs.¹³ A number of GSEs offer these products, which are similar in structure to Treasury bills. Issuance of some bills is as frequent as weekly; maturities include one, two, three, six, and twelve months. A Dutch, or single-price, auction technique is used and authorized dealers can participate. Secondary market prices are available on electronic screens displaying market and trading information. However, discount notes continue to be used and can be issued for a term as short as overnight or as long as one year.

Weekly issuance of the benchmark bills by Fannie Mae and Freddie Mac was an estimated \$20 billion in late 2000. These two GSEs had an estimated \$240 billion of bills outstanding as of the end of that year.¹⁴ Total agency bills of the major issuers, including their discount notes, were about \$445 billion at the end of September 2000, while debt of the major issuers that had maturities out to one year was estimated to be about \$590 billion at that time.¹⁵ Weekly secondary market trading volume of the primary dealers in all short-term agency bills and discount notes (including some non-GSE securities, considered below) averaged about \$260 billion through October 2000 and secondary market prices are transparent.¹⁶ Over the same period, weekly trading volume in Treasury bills and other short-term Treasury issues by the same group was about \$125 billion.¹⁷

The GSEs also have been working to create benchmark longer-term securities by establishing regular issuance patterns and larger issues and, in the process, striving for more liquid issues. Outstanding long-term debt of the agencies at the end of 1999 was estimated at just under \$1 trillion.¹⁸ Prices of these securities also are widely available.

Mortgage-backed securities issued by the housing GSEs are considered to be of high credit quality but, because of prepayment risk, have investment and risk characteristics

13. The term "benchmark bills" is used here to cover both Fannie Mae's benchmark bill program and Freddie Mac's reference bill program. Fannie Mae's program began in November 1999, and Freddie Mac's began in January 2000.

14. Stone and McCarthy Research Associates, "The Agency Market in 2001: Supply, Spreads & Politics" (December 2000).

15. Stone and McCarthy Research Associates, "Agency Focus: A Look at Dealer Data for Short-Term Agencies" (November 2000); and the third quarter 2000 reports of, and discussions with, Fannie Mae, the FHLB, and Freddie Mac.

16. Federal Reserve Bank of New York, Markets Reports Division, FR2004 Reports (November 8, 2000).

17. Federal Reserve Bank of New York, Markets Reports Division, FR2004 Reports (November 8, 2000).

18. Salomon Smith Barney, "Growth of the Agency Debt Market," *2000 Guide to Agency Debt Securities* (p. 19).

that are substantially different from those of straight debt. Market prices for MBS can also be viewed on electronic screens displaying market and trading information.

An issue for the Federal Reserve is how it should view the credit status of, and other risks associated with, GSE debt and MBS. The GSEs, to varying degrees, have private elements in their organization, but they also have important linkages to the government. For example, they have credit lines with the Treasury (\$2.25 billion for Fannie Mae, \$4 billion for the FHLB, and \$2.25 billion for Freddie Mac), and their securities are exempt from registration with the Securities and Exchange Commission. Some market participants appear to believe that the U.S. government would not allow the GSEs to fail; that is, they perceive a strong implicit guarantee. The triple-A ratings assigned by Moody's Investors Service and Standard & Poor's reflect the perception of this implicit guarantee.

The effective subsidy to the operations of the GSEs that results from the perception of an implicit government guarantee likely affects credit allocation among sectors of the economy. In addition, the implicit subsidy no doubt has supported the GSE's large scale of operations, which, in turn, may be seen as posing a significant systemic risk. The System's outright purchase of GSE obligations (or even its continued use of these obligations in repurchase agreements) could enhance the liquidity of GSE obligations and thereby inappropriately foster the ability of the GSEs to expand their operations; this expansion could further affect credit allocation and increase systemic risk.

A related issue is that, if the Federal Reserve was a large holder of GSE obligations, some market participants might believe that the government would be even more inclined to support the GSEs in the event of financial problems. Such concerns might suggest that any role for GSE assets in System transactions should be limited and established only as part of a System program of diversification.

The Federal Reserve's repurchase operations currently use the senior debt and mortgage-backed securities of the GSEs, along with Ginnie Mae mortgage-backed securities.¹⁹ The markets for these securities are increasingly active. Currently, however, repurchase (as well as outright) activity in GSE MBS is concentrated in only a handful of dealers. SOMA management addresses market risk of MBS collateral through haircuts and price monitoring.

Other Agency Obligations

Securities that are issued or guaranteed by other agencies of the United States also are eligible for purchase by the Federal Reserve.²⁰ Among these agencies, the Tennessee Valley Authority (TVA) has the largest volume of outstanding debt—about \$26 billion in

19. The percentage of Federal Reserve repurchase operations backed by MBS has varied widely. On average, between October 1999 and mid-November 2000, 31 percent of accepted collateral was MBS. The System currently holds \$130 million of GSE debt issues that were purchased outright.

20. The primary distinction between GSEs and non-GSE agencies is that GSEs have some form of private ownership.

late 2000. By statute, however, the TVA's total debt outstanding is limited to \$30 billion. Thus, TVA securities would be a candidate for meeting only a small and declining proportion of the Federal Reserve's portfolio needs.

Ranked by the amount of outstanding obligations, the next largest category in this class comprises loans fully guaranteed as to principal and interest by the Small Business Administration. Only \$22 billion of such loans were outstanding in late 2000. Next are the obligations of the U.S. Postal Service; Merchant Marine bonds; and notes and guaranteed participation certificates of the Export-Import Bank. Outstanding amounts for each of these entities were less than \$5 billion in 2000. Prices of these securities can be posted on electronic screens displaying market and trading information, but frequently no bids or offers actually appear. Given the inactivity of this market, prices that are posted may not be indicative of levels at which business can actually be transacted.

Given the small amount of outstanding obligations of such non-GSE agencies, these obligations could at most be only a small part of a diversified portfolio of outright holdings and of repurchase collateral. (TVA debt is currently acceptable as collateral in the System's repurchase operations, but the repurchase market for such debt is relatively inactive.) One potential avenue for System purchases of these securities is through purchases of mutual fund shares.

Municipal Securities

According to the Federal Reserve's flow of funds accounts, the face value of all outstanding long-term municipal and private-purpose tax-exempt debt at year-end 1999 was \$1.2 trillion. The municipal bond market is highly illiquid. Bonds usually trade actively at most for a few months after issuance and then are "put away" in investment portfolios. Only about 1 percent of the approximately 1.3 million outstanding issues is traded on a given day.

The municipal bond market also lacks price transparency. Real-time tradable quotes are not available. Price quotes for issues must be obtained by contacting a dealer. Improvements in price transparency could be expected if the Federal Reserve were to make such transparency a requirement for participation.

Outright purchases of municipal securities by the Federal Reserve would pose a number of challenges. In light of the characteristics of the municipal market, a portfolio of municipal bonds likely would be quite illiquid, unless holdings were restricted to a small set of very large issues. This fact would not necessarily preclude the use of municipal securities but could limit the maximum size of a portfolio of municipal securities. Federal Reserve earnings on municipal issues would tend to run significantly lower than earnings on taxable securities of comparable risk and maturities because earnings of municipals are tax exempt. The tax exemption potentially disadvantages the Treasury, although the importance of this consideration is not clear, particularly if portfolio

earnings remain sufficient to finance System operations.²¹ Finally, the System would need to guard against political and public pressures to buy the obligations of particular states, municipalities, and other political units.

The secondary market in municipals is illiquid. The Federal Reserve could consider purchasing the obligations directly from issuers in the primary market, but doing so could raise a host of difficult issues. The Federal Reserve could have difficulty ensuring that it was purchasing at market prices, and it could be exposed to charges of credit allocation to particular states, cities, and other political subdivisions.

The acquisition of municipal securities under repurchase agreements could be considered, but a repurchase market in municipal debt has not developed to any great extent.²² According to market sources, the tax treatment of such transactions, including the nondeductibility of interest from many municipal repurchase transactions, has made it uneconomical for firms to use the repurchase market to fund positions in these securities. The low level of dealer inventories of short-term municipal securities also may limit the suitability of these securities as collateral for System repurchase agreements unless the System's involvement spurred a considerable increase in market activity and dealer inventories. However, a repurchase market possibly could develop in an environment in which Treasury debt has disappeared and investors are searching for higher-quality collateral.

Corporate Bonds

Corporate bonds, also referred to as debentures or notes, are long-term debt instruments of corporations. More than \$3 trillion of corporate bonds were outstanding in late 2000. The maturity of corporate bonds when issued ranges from one to thirty years but is typically about ten years. Corporate bonds are usually unsecured, but occasionally such bonds provide the holder with a claim to specific corporate assets. A variety of other features, such as bond insurance, put or call options, sinking funds, and unusual coupon structures, also are employed. The credit quality of corporate bond issues ranges from triple-A to very-low-rated, or “junk,” issues. The corporate bond market is thus rather heterogeneous and, partly in consequence, not very transparent: Most bonds do not have executable quotes, and many have stale prices on electronic screens displaying market and trading information.²³ Moreover, the market is relatively illiquid. (Again, however, a relatively low degree of liquidity need not completely preclude investment by the Federal Reserve in such assets.) The vast majority of corporate bond trades takes place over the counter rather than on organized exchanges. Daily secondary-market trading

21. However, purchases of tax-exempt issues by the Federal Reserve could push other investors into taxable markets, and some of the reduction in revenues to the Treasury thus might be made up.

22. A report in 2000 of recent tri-party repurchase activity at a major clearing institution indicated that about \$1.4 billion, or 0.33 percent, of the day's tri-party collateral was arranged with municipal securities.

23. An important initiative underway by the National Association of Securities Dealers, backed by the Securities and Exchange Commission, seeks to institute real-time, or close to real-time, public disclosure of corporate bond transactions. Assuming that this initiative succeeds, it is quite likely that pricing transparency of the corporate bond market will be improved greatly.

volume for all corporate bonds (estimated to be about \$10 billion) is far smaller than the corresponding volume in the government securities market. Most of the trading takes place in a small percentage of "bellwether" investment-grade bonds, of which a large volume is outstanding. The issue size and trading volumes in the market for low-rated issues are much smaller than they are in the investment-grade market.

The small but growing repurchase market in corporate bonds is almost exclusively limited to high-quality investment-grade bonds.

As with the assets already discussed, the Federal Reserve would need to make decisions regarding eligibility and selection among a large pool of heterogeneous issues. Even though public ratings services could assist with some dimensions of these decisions, the exercise would still be challenging. These difficulties might be mitigated somewhat if activity was restricted to repurchase transactions. As with other instruments, the System's involvement in this market could prompt additional growth in repurchase agreements. The relative opacity of prices in the cash market and the relative trading illiquidity, apart from that of a few large issues, would likely constrain the System's participation in the corporate bond market. But also as with other assets, participation by the System might spur improvement in these dimensions. Some, but not all, of the difficulties of transacting in this market would be reduced if participation took place through mutual funds.

Asset-Backed Securities

Asset-backed securities (ABS) are securities in which the payment of principal and interest depends on the revenue stream derived from a designated asset or pool of assets. Most ABS are backed by a clearly delineated, existing pool of loans that is isolated from the credit risk of the issuer through the sale of the assets to a special-purpose vehicle. In late 2000, about \$800 billion to \$900 billion of ABS were outstanding. While ABS are backed by a wide range of asset types, the majority are backed by credit card debt, automobile loans, and home equity loans.

ABS issuance is concentrated among a relatively small number of firms, the most prominent of which are the finance subsidiaries of large automobile companies, certain firms that originate or purchase home equity loans, and large credit card banks and firms. Anecdotal evidence suggests that insurance companies, commercial banks, and money fund managers are the primary investors.

The majority of ABS carry the highest credit rating from at least one rating agency. These ratings are achieved through credit enhancements such as subordination, over-collateralization, and bond insurance.

Several dealers make markets in ABS. However, price quotes are not necessarily firm ("tradable"). Anecdotal information suggests that between \$400 million and \$500 million of ABS trade in the secondary market on a given day (about 1/20 of 1 percent of the total outstanding). The repurchase market for ABS also is very small.

Federal Reserve investment in ABS would pose a number of challenges. The instruments are relatively complex, and the market is illiquid and not especially transparent. As with most assets discussed above, the Federal Reserve would need to choose among issuers, and it would need to keep the size of transactions and the diversification of holdings at levels that would avoid significant effects on the allocation of credit. Purchases of asset-backed securities under repurchase agreements would be more straightforward and likely could be accommodated using procedures similar to those the System uses today for other instruments.

Foreign Sovereign Debt

The Federal Reserve could invest in the debt of foreign sovereigns using the proceeds from foreign currency swaps or as separate transactions; the former case is discussed in the following section. Also, the System could invest in foreign sovereign debt on an outright basis or through dollar-based repurchase transactions.

The outstanding amount of non-Treasury sovereign bonds was estimated in early 2000 at more than \$9 trillion, of which more than \$7 trillion was denominated in euros and yen.²⁴ Daily trading volumes, of course, are much smaller.

As with GSE obligations and municipal debt, and in contrast to Treasury debt, foreign sovereign debt is heterogeneous, and the System would need to address which debt was acceptable for the SOMA. Such decisions could be sensitive, both politically and financially. Although imperfect, credit ratings would be one way to distinguish among the debt issues of various sovereigns. However, credit ratings of foreign governments already are somewhat controversial, and reliance on them by the System would tend to increase their importance in the market.

One practical approach would be to restrict System purchases to those securities denominated in currencies already held by the System because staff members at the Desk have some expertise in these markets. Thus, sovereign debt denominated in euros and yen would be considered for purchase, subject to meeting additional eligibility criteria. For example, both for outright purchase and for repurchase, the FOMC might wish to restrict its purchases to securities with particular credit ratings, a certain maximum remaining maturity, and with some minimum amount outstanding. A decision rule would be needed to guide individual purchase and sale decisions among acceptable sovereigns and their various products. This rule could distinguish between outright and repurchase transactions.

In late 2000, seven of the major foreign industrialized countries had outstanding short- and long-term debt issues that carried the highest credit ratings issued by Moody's and Standard and Poor's. These countries, listed in decreasing order of amounts of debt outstanding, were Germany, France, the United Kingdom, the Netherlands, Austria, Switzerland, and Norway, and taken together, their debt outstanding totaled

24. Merrill Lynch, *Size and Structure of the World Bond Market: 2000* (April 2000).

approximately \$2.5 trillion.²⁵ Another fourteen countries (including Canada, Italy, and Japan) had short-term debt that received the highest credit ratings of both agencies and totaled about \$6.2 trillion.²⁶ Among the most liquid of sovereign debt markets are those for the obligations of Germany, Italy, and Japan. In most countries, secondary market trading of sovereign debt takes place over the counter through a dealer network. Price transparency varies from country to country but in broad terms is relatively high.

Typically, sovereign debt must be held in custody with an institution in the country of residence. However, global custodians can facilitate these arrangements. Also, it might be possible for the System to have cash and custody accounts with individual central banks in the respective countries. Most transactions would settle between two and five days after the trade was arranged.

Dollar-denominated repurchase transactions could use foreign sovereign securities as collateral. Such transactions do not have much of a market currently, but they are not without precedent. Euro-denominated collateral has been accepted by the Bank of England for its domestic repurchase operations since May 1999, albeit on a quite limited basis; the potential difficulties faced by the Bank of England in these operations are reduced by the fact that settlement for the two legs of the transaction takes place in essentially the same time zone. Differences in market convention would need to be resolved for yen-denominated debt, which is traded in the Japanese repurchase market. Because dollar-denominated repurchase transactions would not involve a cash leg denominated in a foreign currency, they would not create a foreign currency position for the Federal Reserve and thus would not constitute foreign exchange intervention.

U.S. dollar repurchase agreements with foreign-denominated securities would involve margining for currency risk as well as price risk for the collateral (in local terms); the resulting haircuts would thus likely be larger than for repurchase agreements using the same collateral but with the corresponding local currency.²⁷ (Five percent is a commonly used haircut in cross-currency repurchase transactions in the market.) Thus, a market for these repurchase agreements might be limited even though a deep market for repurchase agreements in the local currency already existed. At the same time, large complex financial organizations increasingly are searching for ways to use their portfolios globally and might be interested in the expanded repurchase possibilities.

The size of the System's purchases of foreign sovereign debt, outright or under repurchase, could be constrained by the size of the local markets. The Federal Reserve would not want its investments in foreign currencies to have significant effects on exchange rates or conditions in financial markets denominated in those currencies beyond those arising from changes in the stance of U.S. monetary policy. If the amount of

25. Estimates made by Patricia Zobel and Mathieu deOlivera, Federal Reserve Bank of New York.

26. Zobel and deOlivera.

27. Another complication is that dealers must either offset the transactions with a foreign exchange swap to get their funding back to the currency of the collateral or book additional foreign exchange risk, which absorbs capital.

collateral available to another central bank in its own money market operations was constrained by Federal Reserve operations, foreign governments and central banks might object to such activity. In some circumstances, particularly in countries in which national debt was in relatively short supply, the Federal Reserve could be pressed to abstain from such transactions or to coordinate them in some fashion with foreign monetary authorities, perhaps on a day-to-day or week-to-week basis. Under current market settlement conventions, such repurchase agreements would have a forward settlement date, likely at least one day after the contract date, even if the Desk was to operate in the time zone of the local market for the collateral.

Foreign Exchange Swaps

The Federal Reserve could use foreign exchange swaps to add reserves on a temporary basis. Because of the automatically reversing nature of the transaction, the practice would not change the underlying foreign exchange exposure of the SOMA and thus should not be viewed as foreign exchange intervention. Dollars would be sold for a foreign currency on a spot basis in association with an agreement to resell the foreign currency on a forward basis. The foreign exchange swap market was estimated, according to the 1998 triennial survey of the Bank for International Settlements (BIS), to have an average daily volume of more than \$700 billion. The vast majority of these transactions now involve U.S. dollar exchanges with euros, other currencies in the European Monetary System, yen, and sterling.

A byproduct of reserve provision through foreign exchange swaps is the need to invest the foreign currency at settlement through the time the swap matures. The transaction would require an investment decision and the establishment of related settlement and custody arrangements. This transaction need not be complicated, as illustrated by the ability to invest currency in a fixed-term deposit at the BIS.²⁸ An alternative to a traditional investment would be to lend the foreign currency on a collateralized basis in the corresponding domestic money market through a repurchase transaction (global custodians might be able to facilitate such transactions). Or, the proceeds could be deposited in a private bank. Investments, whether outright or through repurchase transactions, would need to be consistent with the relative sizes of the relevant markets, as noted in the previous section. This constraint might define the desirable size of particular foreign exchange swaps.

No foreign currency exposure is created in a foreign exchange swap, which limits market risk, although the possibility exists that a counterparty could fail to return the dollar balances on the forward leg of the transaction. In addition, a foreign exchange swap carries an implicit interest rate risk on the investment of funds in the foreign currency, just as with dollar assets. Settlement, or "Herstatt" risk is another issue, although improvements in international settlements arrangements are expected to reduce or eliminate this difficulty.

28. However, the BIS might have only a limited capacity to absorb such deposits if the Federal Reserve engaged in a large volume of foreign exchange swaps.

The Federal Reserve should be able to make clear public distinctions between transactions conducted as aspects of routine open market operations, designed to affect domestic banking system reserves, and transactions implemented in pursuit of foreign exchange policy objectives. And, as with investments in foreign sovereign debt, the Federal Reserve would want to take care that its transactions would not be so large as to be a meaningful source of price support for the liabilities of foreign banks or sovereigns or to affect financial conditions in the foreign countries more broadly. Confining any such transactions to highly liquid markets and limiting their size through overall portfolio diversification should help minimize any such effects.

Corporate Equity

Equities confer an ownership interest in a corporation and represent claims on its earnings and assets. The U.S. equity market is huge: The total market capitalization of publicly traded corporations was approaching \$20 trillion in late 2000. The number of publicly traded corporations is nearly 10,000, of which about 70 percent are actively traded. Most trading takes place on the New York Stock Exchange or in the Nasdaq Stock Market. The market is quite transparent, with price quotes widely available.

Households directly hold about 40 percent of the outstanding U.S. equity shares in terms of value. Mutual funds hold a little less than 20 percent. Private and state and local government pension plans together hold nearly 25 percent. The only other major large equity-holding sectors are insurance companies and foreign investors, each with about 6 to 7 percent.

An active market does not exist for equity repurchase agreements. Active futures contracts exist for the S&P 500, S&P 100, Nasdaq 100, and Dow Jones industrial average. Options on futures contracts and on large individual issuers also are actively traded.

Direct purchases of equities would expose the Federal Reserve (and thus the taxpayer) to the market risks of the individual firms, risks that, except for the lowest-rated credit obligations, are considerably higher than those for debt instruments because of the lower priority of equity holders in bankruptcy. Diversification could reduce this risk somewhat. The System would likely face a tradeoff between further managing its risk through the use of derivative instruments, such as futures and options, and incurring the related increase in complexity and the attendant responsibility to explain publicly its use of such instruments. As with purchases of any non-Treasury asset class, the Federal Reserve would want to ensure that purchases did not disproportionately affect the prices of firms of different sizes and in different sectors, thereby altering the relative cost of capital and distorting the allocation of resources. Although this issue, in principle, could be addressed partly by structuring the System's purchases to replicate a stock index, such an approach likely would involve only a fraction of the thousands of traded stocks, which could elicit a reaction from those entities whose shares were not included in the System's holdings.

Mutual Funds

Most mutual funds are highly regulated companies that invest in a diversified portfolio of securities. The funds vary by management style and objective. They also have varying structures: open-end funds, closed-end funds, unit investment trusts, and exchange-traded funds. The open-end structure is the most common.

Mutual fund shares can be issued only by investment companies registered with the U.S. Securities and Exchange Commission. Individuals are the predominant investors in mutual fund shares. Shares of open-end funds are sold to investors either directly or through a sales force typically consisting of stockbrokers. Other types of mutual funds are sold virtually exclusively through brokers. The market for mutual funds is extremely large: Assets underlying mutual fund shares were valued at more than \$7 trillion in late 2000.

Mutual fund shares that do not trade publicly are required to determine their net asset value--the price at which shares transact--at the end of each business day. Exchange-traded funds and closed-end funds, which trade publicly on secondary markets like corporate equities, are priced continually throughout a trading day. Prices of all types of mutual funds are readily available on an ex-post basis, and mutual fund shares are very liquid (except perhaps in times of unusual stress in financial markets).

The credit and market risks of a mutual fund share are based on the underlying assets held in the fund. The diversification of holdings in the fund can considerably reduce investors' exposure to such risks, although the degree of diversification that is achieved by funds that specialize in particular segments of the capital markets is intentionally limited.

As discussed above, investing directly in assets issued by private corporations or municipal governments could pose substantial challenges for the Federal Reserve. Arguably, these risks could be mitigated significantly by investing in such assets through mutual funds. By delegating investment decisions to mutual fund managers, the Federal Reserve's discretionary influence on the demand for, and the prices of, the assets of individual issuers would be reduced. Consequently, any pressures to support individual issuers by buying their assets might be lowered.

Purchasing assets through mutual funds also would have important operational advantages for the Federal Reserve relative to direct purchases. The transactions and monitoring necessary to obtain a suitably diversified portfolio of assets could be delegated to mutual fund managers, and thus the demands on the Federal Reserve's internal resources would be kept low relative to the amount of assets under control. At the same time, however, the Federal Reserve would be paying mutual fund managers for their services. Mutual funds that cater to institutional investors and those funds that charge fees on a sliding scale based on the size of the investment likely would be less costly than retail-type mutual funds. The System would need to assess whether the benefits of management by private entities would outweigh the management charges. An important consideration in this calculus is the Federal Reserve's own costs in managing portfolios of private instruments.

Another issue is the procedure for the purchase of mutual funds. The price of a share of open-end funds is determined at the end of the day by the closing prices of their underlying assets. Thus, to ensure that it was obtaining the fund shares at a market price, the Federal Reserve (like other mutual fund investors) would need to rely in part on the daily valuation procedure rather than on its current auction procedure for the purchase of assets. And if instruments held in a mutual fund were inactively traded, the Federal Reserve might be unable to make its own assessment of their value.

A more serious issue posed by the lack of an auction procedure for mutual funds is that a method would need to be established for allocating purchases among various funds. Because funds differ in their asset allocations, even within a given class of funds, they cannot be compared directly by price. One possibility would be to allocate purchases in proportion to the existing size of the eligible funds. Another possibility would be to give preference to those funds within a given asset class and investment style that charge the lowest management fees. Regular performance reviews would be necessary to affirm or adjust existing allocations.

In any case, delegating the selection of assets to private managers would not completely insulate markets and issuers from the Federal Reserve's transactions. The Federal Reserve still would need to choose the broad asset classes (corporate equity, corporate bond, commercial paper, CDs, and so on) to purchase through mutual funds. It would need to decide on minimum acceptable asset quality. And, by definition, it would not be making financing directly available to those sectors and entities in the economy that commonly do not issue traded securities. Also, the Federal Reserve would need to make decisions as to the eligibility of individual funds and fund managers and to formulate investment guidelines for asset managers.

Within the overall structure of mutual fund offerings, money market mutual funds could be given particular consideration by the Federal Reserve. Money market mutual funds invest only in short-term assets, such as commercial paper, certificates of deposit, eurodollar deposits, discount notes of GSEs, repurchase agreements, and Treasury bills. Money market mutual funds thus have notable advantages relative to bond and stock mutual funds. Given the short term of their assets, their shares are highly liquid. For the same reason, money funds are subject to very little market risk, are relatively homogeneous compared with bond and stock mutual funds, are numerous, and have relatively low management fees. At the same time, the return on money funds over the course of an interest rate cycle would probably be less than what could be earned on bond and stock mutual funds over time; the significance of this consideration, however, is limited, in part because the higher expected return on capital market funds would be accompanied by higher risk.

If the Federal Reserve decided to purchase bond and stock mutual funds, it might wish to restrict its purchases to index funds. Index mutual funds, by definition, seek to replicate the return on a particular market index. Purchasing index funds would have the advantage of minimizing the effects of System operations on relative prices within a given sector, for example, large-capitalization stocks, small-cap stocks, all stocks,

corporate bonds, or money market instruments. However, the System still could be exposed to criticism for limiting its purchases only to certain sectors or for holding funds that happen not to invest in someone's preferred obligation.

The System might want to invest in a fund that would track an index encompassing all U.S. securities markets. This approach would help minimize both the effects of System portfolio decisions on the relative prices of private securities and the political and public pressures that the System would face. Of course, such a fund still would not invest in the obligations of entities that do not usually issue marketable securities, for example, small firms.

Currently, no such broad funds exist. The System would need to consult with industry representatives to determine the feasibility of instituting such funds and could well need to play some role in their eventual development. This level of involvement might be seen as greater than is appropriate for a central bank. And because such a fund is not currently available, the question remains as to whether, upon its inception, it would become actively traded. If it did not, the System would essentially be the only holder of the instrument, an unsatisfactory outcome if only because the System would not be assured that it was transacting at market prices.

Mutual fund shares apparently have no active market in repurchase agreements, perhaps in part because fund shares (other than perhaps those for exchange-traded funds) are not negotiable instruments. Still, the economic equivalent of a repurchase agreement could be achieved trivially by simultaneously entering orders to buy a certain number of shares as of a certain date and to sell the same number of shares on a specified later date.

Gold

Gold has distinct advantages and disadvantages as a potential asset for the Federal Reserve. On the one hand, it is a primitive form of money, a traditional reserve asset for monetary authorities, and, as a commodity, free from credit risk. On the other hand, it is subject to considerable market risk, both because its price tends to fluctuate substantially in response to various market forces and, potentially, because its price can be affected by shifting political and economic circumstances in a small number of gold-producing countries. Moreover, it does not earn an explicit return, although some return perhaps could be obtained by lending gold holdings in the market. (Indeed, partly because of its lack of explicit return, a number of monetary authorities have been selling gold in recent years.) Given the highly uncertain real returns of holding gold, preserving the budgetary independence of the central bank implies that gold should make up at most only a small fraction of the central bank's assets.

The largest spot market for gold is in London. That market is relatively liquid and transparent. However, the approximately \$7 billion typically traded per day suggests that the market may not be deep enough for frequent, sizable transactions by the Federal Reserve. Transactions generally settle on a $t + 2$ basis.

A swap market exists in which one can purchase gold spot and sell it forward in an analogue to a repurchase transaction. Daily volume in this market was estimated to be between \$500 million and \$750 million in 2000. Again, this relatively low volume may not be enough to make participation by the System worthwhile. Involvement by the Federal Reserve could, however, prompt some increased market activity in both the spot and swap gold markets.

The need for physical delivery makes gold relatively cumbersome as a System asset. A purchase of gold would require delivery from its likely point of origin in London or Zurich to, say, the Federal Reserve Bank of New York. And, whether gold held in New York could be lent in the gold loan market, centered in London, is questionable. Alternatively, gold could be stored in London, either in warehouses or at the Bank of England, in which case the Federal Reserve would need to absorb the cost of storage and insurance (or bear the risk of loss).

Appendix 2.A

Section 14 of the Federal Reserve Act—Selected Passages Authorizing Purchases in the Open Markets

SECTION 14--OPEN MARKET OPERATIONS

Purchase and Sale of Cable Transfers, Bank Acceptances and Bills of Exchange

Any Federal reserve bank may, under rules and regulations prescribed by the Board of Governors of the Federal Reserve System, purchase and sell in the open market, at home or abroad, either from or to domestic or foreign banks, firms, corporations, or individuals, cable transfers and bankers' acceptances and bills of exchange of the kinds and maturities by this Act made eligible for rediscount, with or without the indorsement of a member bank.

Dealings In, and Loans On, Gold

Every Federal reserve bank shall have power:

(a) To deal in gold coin and bullion at home or abroad, to make loans thereon, exchange Federal reserve notes for gold, gold coin, or gold certificates, and to contract for loans of gold coin or bullion, giving therefor, when necessary, acceptable security, including the hypothecation of United States bonds or other securities which Federal reserve banks are authorized to hold;

Purchase and Sale of Obligations of United States, States, Counties, etc., and of Foreign Governments

(b)(1) To buy and sell, at home or abroad, bonds and notes of the United States, bonds issued under the provisions of subsection (c) of section 4 of the Home Owners' Loan Act of 1933, as amended, and having maturities from date of purchase of not exceeding six months, and bills, notes, revenue bonds, and warrants with a maturity from date of purchase of not exceeding six months, issued in anticipation of the collection of taxes or in anticipation of the receipt of assured revenues by any State, county, district, political subdivision, or municipality in the continental United States, including irrigation, drainage and reclamation districts, and obligations of, or fully guaranteed as to principal and interest by, a foreign government or agency thereof, such purchases to be made in accordance with rules and regulations prescribed by the Board of Governors of the Federal Reserve System. Notwithstanding any other provision of this chapter, any bonds, notes, or other obligations which are direct obligations of the United States or which are fully guaranteed by the United States as to the principal and interest may be bought and sold without regard to maturities but only in the open market.

(2) To buy and sell in the open market, under the direction and regulations of the Federal Open Market Committee, any obligation which is a direct obligation of, or fully guaranteed as to principal and interest by, any agency of the United States.

Purchase and Sale of Bills of Exchange

(c) To purchase from member banks and to sell, with or without its indorsement, bills of exchange arising out of commercial transactions, as hereinbefore defined.

3. DISCOUNT WINDOW ALTERNATIVES TO OPEN MARKET OPERATIONS

Under conditions of a declining volume of Treasury securities outstanding, the Federal Reserve would have to replace its holdings of such securities with other assets to avoid an unintended reduction in total Federal Reserve credit and the monetary base. Discount window loans could serve as an alternative asset, although today such loans constitute less than 1 percent of total Federal Reserve credit, whereas the Federal Reserve's holdings of U.S. government securities constitute about 90 percent.¹

In the early years of the Federal Reserve System, discount window loans constituted the largest share of Federal Reserve credit. Discounts and advances reached 82 percent of Federal Reserve credit in 1921 and never fell below 37 percent during the 1920s.² Other countries have also used central bank loans as a primary source of central bank credit at various times in their histories. In fact, the use of open market operations by many central banks around the world is a relatively new development in the history of central banking.

This chapter considers the extent to which Federal Reserve lending could again be employed as an important source of Federal Reserve credit and thereby supplement, although not necessarily replace, open market operations. The two options we consider involve modifications to current institutional arrangements but do not require changes to current law.³ Federal Reserve discount window lending might accomplish one or more of the following objectives: (1) replace some or all of the more than \$500 billion of Treasury securities the Federal Reserve holds on its balance sheet, (2) provide a mechanism to increase Federal Reserve assets to support the secular expansion of currency, (3) provide a mechanism to expand and contract Federal Reserve assets to support the seasonal fluctuations in currency demand within each year, and (4) provide a

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1. For example, in the week ended December 6, 2000, discount window loans were only 0.03 percent (\$190 million) of total Reserve Bank credit of about \$572 billion.

2. Bernard Shull, "Report on Research Undertaken in Connection with a System Study," in *Reappraisal of the Federal Reserve Discount Rate Mechanism*, vol. 1 (Board of Governors of the Federal Reserve System, August 1971), p. 37.

3. Changes to the Federal Reserve Act in 1999 allowed discount window loans made under section 10B to serve as backing for Federal Reserve notes. Those changes eliminated what otherwise would have been a significant legal impediment to programs that would significantly expand the aggregate volume of discount window credit, such as those considered here.

sufficiently elastic supply of reserve balances to minimize day-to-day variations in the federal funds rate around the intended, or target, level set by the Federal Open Market Committee (FOMC).

In exploring ways to achieve these objectives, we focused on advances to depository institutions (hereafter, banks, a term intended to encompass commercial banks, thrift institutions, and credit unions) under section 10B of the Federal Reserve Act. Under section 10B, Reserve Banks can accept any assets satisfactory to them as collateral for discount window advances (see appendix 3.A). Advances under section 10B therefore have the greatest potential for increasing discount window credit as a source of Federal Reserve credit. Currently, most assets that banks hold are acceptable to Reserve Banks as collateral, with appropriate haircuts, but many of these assets cannot be used in open market operations.

Bank assets as of mid-2000 totaled approximately \$7 trillion. Although not all of these assets were eligible to be pledged as collateral at the discount window, the eligible assets were nonetheless also in the trillions of dollars, an amount far in excess of the credit that the Federal Reserve is likely to need to provide during the next few years.

The lendable value of collateral pledged at the discount window (that is, the value net of haircuts) was about \$450 billion, somewhat less than the total value of Treasury holdings in the System Open Market Account (SOMA) and far less than the total value of eligible assets on bank balance sheets.⁴ Experience that was gained ahead of the century date change indicates that these pledged amounts can respond quickly to changed circumstances, even under the present regime of a highly administered discount window. In response to prospective funding needs around the century date change, total pledged collateral expanded \$300 billion (nearly 75 percent) to a historic peak of \$700 billion from late October 1999 to year-end 1999. But even this expanded total likely was limited because it was intended only to support temporary borrowing under existing discount lending programs and the Special Liquidity Facility.

We have taken into account several assumptions established for the overall framework of this study. One was that the discount window alternatives to current open market operations should not involve a subsidy to banks. Thus, alternatives that would have the Federal Reserve lend at interest rates below market rates were excluded from consideration. Another assumption was that the intended federal funds rate would continue to play the central role in the implementation of monetary policy.

We also assumed that, at least initially, the Federal Reserve would make no significant changes in its existing policies and procedures for valuing, applying haircuts to, and managing collateral. Whether an expanded discount window program would require a

4. Only \$4 billion of the lendable value consisted of Treasury securities, which would disappear if Treasury debt is paid off.

reevaluation of these policies and procedures is discussed below in the section on collateral requirements and haircuts.⁵

Before we addressed alternative Federal Reserve lending facilities, we considered whether the three existing discount window facilities (adjustment, seasonal, and extended credit) could be expanded to meet some or all of the study's objectives. We believe that such an expansion would not be feasible under the current administration of the discount window without creating a subsidy to borrowers. Adjustment credit is for transitory funding needs, extended credit is for exceptional circumstances, and seasonal credit is for the seasonal borrowing needs of small banks. We concluded that the study's objectives were more likely to be achieved by developing a new lending facility.⁶ In the discussion that follows, the existing discount window lending programs are left intact. We recognize, however, that a new lending program may eventually lead the Federal Reserve to reconsider the design of its existing lending facilities.

ALTERNATIVE FEDERAL RESERVE LENDING FACILITIES

We considered two new, alternative lending facilities: (1) an auction credit facility and (2) a nonadministered credit facility. In the first alternative, the Federal Reserve would conduct auctions of advances and set the quantity of credit; the auction would determine the lending rate. In the second alternative, the Federal Reserve would extend credit without the administrative rules of the existing discount window, and the lending rate would be set at the FOMC's target federal funds rate. Each of these alternatives generally would achieve the objectives cited above for a new Federal Reserve lending facility.

Auctions of Federal Reserve Advances: The Auction Credit Facility

An auction credit facility could supplement open market operations and the Federal Reserve's existing lending arrangements while allowing only strong financial institutions to bid for discount window advances, with a limit on the total amount of advances each institution could have outstanding at one time (see also appendix 3.D).⁷ The borrowing limits, called credit limits, are not expected to significantly constrain the ability of the auction credit facility to supply a relatively large proportion of total Federal Reserve credit. Even if limits were placed on the amount that individual institutions could borrow through the auction credit facility, as suggested later and in appendix 3.D, the 100 largest banks alone could borrow a total of more than \$440 billion. This amount exceeds the

5. Also see appendix 3.D on "Practical and Operational Issues of Expanded Use of Discount Window Credit" and appendix 3.E on "Assessment of Discount Window Alternatives in Terms of the Study's Overall Principles."

6. Also see the discussion in appendix 3.B.

7. For domestic financial institutions, "strong financial institutions" means well-capitalized depository institutions with current CAMELS ratings of 1 or 2 and with investment-grade ratings issued by public rating agencies, or well-capitalized depository institutions with CAMELS ratings of 1 or 2 that are considered equivalent to investment grade. CAMELS is the acronym for a consolidated rating of six supervisory criteria: capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk; the ratings range from 1 (best) to 5. For foreign banking organizations, comparable eligibility criteria would apply.

current lendable value of collateral pledged by these 100 banks, which is about \$350 billion. However, banks would likely expand pledged collateral if the auction credit facility is introduced, as they did in 1999 when the Special Liquidity Facility was introduced.

Loans made under the auction credit facility would not be subject to the discount window administration and monitoring used in the existing adjustment credit and extended credit programs. In particular, banks whose bids are accepted will be free to re-lend the funds in the federal funds market to take advantage of any arbitrage profits that exist. Banks would generally be prohibited from repaying loans early, a restriction consistent with the current practice of the Federal Reserve Bank of New York's Domestic Trading Desk (the Desk), in which it arranges its repurchase agreements almost exclusively with fixed terms to preserve the predictability of reserve supplies.⁸

Establishing an Auction Credit Facility

The Board of Governors would have to amend its Regulation A (Extensions of Credit by Federal Reserve Banks) or promulgate a new regulation to establish an auction credit facility. The boards of directors of the Reserve Banks would have to vote to establish, and the Board of Governors would have to approve, such a framework for lending, a procedure that was used to establish the seasonal lending facility and the Special Liquidity Facility for the century date change. Because discount window lending is discretionary for individual Reserve Banks, the board of directors at each Bank would have to then authorize participation in advances auctioned under the auction credit facility, and each board would retain the authority to terminate its authorization.

The retention of a short-term adjustment credit facility would preserve a mechanism for a discount lending rate to be determined by the Reserve Banks' boards of directors and the Board of Governors. The auction credit facility would be consistent with the operation of either the existing adjustment credit facility or a penalty-rate Lombard facility.

A key element in the operation of the auction credit facility would be decisions about the size and timing of its auctions. Because the facility would supplement open market operations, the size and timing of auctions would need to be closely coordinated with Desk operations. The Desk, operating under the guidance of the FOMC, would seem to be in the best position to make these decisions, and its doing so would help the FOMC carry out its responsibilities for monetary policy. Allocating responsibility to the Desk for setting the size of each auction would presumably have to be part of the auction credit facility's framework that would be established by the Reserve Banks' boards of directors subject to the approval of the Board of Governors.

8. In principle, banks could be given the option of repaying loans early if that would help foster the reserve conditions the Federal Reserve desired during the term of the extension of Federal Reserve credit. But this is not critical to the discussion of the basic framework of the auction credit facility.

Implementing the Auction Credit Facility

To implement the auction credit facility, the Federal Reserve would announce in advance that, under a new lending facility, it plans to substitute advances for some of the Treasury securities on its balance sheet. The substitution could be accomplished either by selling some Treasury securities from the portfolio or by allowing some to mature. In either case, the Federal Reserve would, in advance of the auction, tell banks the amount of advances it wants in place of its outright holdings of Treasury securities. The advance announcement would give banks time to prepare their bids. The auction of advances could be centralized, and the advances could be part of a pool in which each Reserve Bank participates, much as each Bank today participates in SOMA transactions (see appendix 3.D).

In the auction, the bid of each participating bank would specify the amount it wished to borrow and the interest rate it was willing to pay. The bid would have to take into account a credit limit established by the Federal Reserve on the total amount of advances that each bank could have outstanding at any one time. This credit limit (discussed further below) might be some multiple of an eligible bank's capital. The total amount that each bank could borrow, therefore, would be equal to this credit limit or to the lendable value of the total collateral pledged by the bank, whichever was lower.

Banks could submit multiple bids, as is the case for bids on new Treasury issues. The auction would allocate a set amount of Federal Reserve advances to the highest bidders for a pre-determined term. The interest rate on the advances would be determined in the auction. Either a uniform price auction or a discriminating price auction could be used. So long as the Federal Reserve did not set a minimum acceptable bid for the auction, it would succeed in substituting Federal Reserve advances for Treasury securities in its portfolio.

The loan rate would not be a subsidy rate because it would be determined in the auction and thus would be close to the interest rates on other sources of funds, such as managed liabilities. One might argue that some potential subsidy remains because all eligible banks could pay the same auction loan rate even though some are less creditworthy than others. This concern could be mitigated (although perhaps not eliminated) by restricting eligibility to strong financial institutions and by requiring sufficient collateral to secure them.

The average interest rate on auction advances would probably become a rate that financial markets would track, just as the average refinancing rate of the European Central Bank is monitored in Europe. Bids made in the auctions would also convey some market signals to the Federal Reserve about reserve conditions.

Just as the Federal Reserve now has to roll over its holdings of maturing Treasury securities and term repurchase agreements to avoid a contraction of total Federal Reserve credit, the Federal Reserve would have to regularly roll over its maturing advances by

conducting periodic auctions.⁹ In addition, auction sizes could be increased as needed to meet the requirement that the secular growth of currency be accompanied by an equal expansion of Federal Reserve credit. The size of the auctions could be further varied over the year to accommodate seasonal changes in the demand for currency.

We considered auctions of advances with different maturities and auctions at different intervals (see appendix 3.B). Ultimately, we focused on regular auctions of longer-term advances with a view to the replacement of Federal Reserve holdings of longer-term Treasury securities.¹⁰ In principle, daily auctions of overnight advances could also be held, but they would not be identical to daily open market operations in managing short-term reserve needs and could be cumbersome compared with open market operations. The auction credit facility alternative, however, need not attempt to manage short-term reserve positions to play a significant role in supplying a base of credit to support the Federal Reserve's liabilities (currency and reserves). Consequently, our discussion of the auction credit facility focuses on weekly or monthly auctions of longer-term advances, which could be used to supplement ongoing open market operations.

The maximum term for most advances made under section 10B of the Federal Reserve Act is limited to four months.¹¹ The Federal Reserve might consider holding auctions of three-month advances since that term to maturity is quite common among financial instruments. Alternatively, auctions of varying sizes for one-month, two-month, and three-month advances would allow the Federal Reserve even greater flexibility in managing seasonal variations in the funding needs of banks. In general, the auction bids and the resulting interest rate would reflect the market's expectations of the current and expected future levels of short-term interest rates over the term of the loan through the usual term structure relationship.¹²

If auctions were held weekly, the size of each auction needed to maintain a given amount of Federal Reserve credit would be smaller than if auctions were conducted less frequently. Weekly auctions would also provide greater flexibility in managing the Federal Reserve's balance sheet. Unless they were held daily, however, auctions of longer-term advances could not by themselves provide a sufficiently elastic supply of reserve balances to minimize day-to-day variations in the federal funds rate around the FOMC's target level. Open market operations would continue to play that role under the auction credit facility.

9. For example, auctioning \$10 billion of three-month (thirteen-week) advances each week would allow the Federal Reserve to replace a total of \$130 billion in its holdings of Treasury securities on an ongoing basis after the first thirteen weeks of auctions, so long as maturing advances continued to be rolled over.

10. See the section of appendix 3.B on "Introducing an Auction Credit Facility" for an example of how such auctions of advances could be introduced into the banking system.

11. Except for advances secured by one- to four-family mortgages, in which case it can be any maturity prescribed by the Board of Governors; see appendix 3.A, note 3.

12. For example, the term federal funds rates for September 1, 2000, for two-week, one-month, and three-month terms were 6.56 percent, 6.56 percent, and 6.60 percent, respectively, somewhat higher than the 6.50 percent target federal funds rate on overnight funds on that date. (In comparing interest rates, note that federal funds borrowing is unsecured, whereas Federal Reserve advances are collateralized.)

Providing longer-term Federal Reserve credit via an auction credit facility is not intended to supply adjustment credit late in the day to banks that, say, fail to receive an expected transfer of funds or suffer an operational failure. The so-called “safety valve” role played by the existing adjustment credit facility would remain to serve such needs because these two forms of discount window lending are not perfect substitutes.¹³

Although the discussion of the auction credit facility in this paper is in the context of the Federal Reserve's current interest rate targeting approach to monetary policy, an auction of a fixed quantity of Federal Reserve advances could easily be incorporated into a reserves targeting strategy.

Federal Reserve Advances without the Usual Discount Window Administration: The Nonadministered Credit Facility

A second alternative for expanding Federal Reserve lending is to supplement the existing lending arrangements with what we will call a nonadministered credit facility. The nonadministered facility would make overnight advances only to strong financial institutions at an interest rate equal to the FOMC's intended federal funds rate and without the “administration” that characterizes the existing discount window programs.¹⁴ Eligible banks would be able to borrow overnight repeatedly. In effect, the Federal Reserve would set the price at which it would elastically provide advances. This is essentially a description of a Lombard-style lending facility in which the rate is set equal to the monetary authority's target interest rate instead of at a penalty level.¹⁵

The nonadministered facility would make overnight advances against acceptable collateral, with a limit on the total amount of advances each depository institution could have outstanding at one time.¹⁶ As with the auction credit facility, these individual credit limits would not be expected to significantly constrain the ability of the nonadministered facility to supply a relatively large proportion of total Federal Reserve credit.¹⁷ Because

13. Small banks can currently borrow adjustment credit for as long as a week or more, provided they meet the Regulation A requirement that alternative sources of funds are not reasonably available to them. For such small banks to continue to use adjustment credit on those terms after the introduction of the auction credit facility would require that the facility not be considered a reasonably available alternative source for them. The Board of Governors could clarify Regulation A on this issue.

14. The eligibility criteria for participation in the nonadministered facility (discussed further below) would be the same as for the auction credit facility: Domestic financial institutions would have to be well capitalized, have investment-grade ratings (or the equivalent), and have CAMELS ratings of 1 or 2; foreign banking organizations would have to meet comparable eligibility criteria.

15. We considered other Lombard-style facilities that would provide longer-term advances instead of overnight advances at an administered rate, but doing so has several disadvantages that led us to focus on overnight advances (see appendix 3.B for details).

16. We also considered and ultimately rejected variations on this nonadministered credit facility in which the advances were longer term (see appendix 3.B for details).

17. Even if limits were placed on the amount individual institutions could borrow through the nonadministered facility as suggested later and in appendix 3.D, the aggregate amount that just the 100 largest banks could borrow would currently (as of late 2000) exceed \$440 billion. This exceeds the current lendable value of collateral pledged by these 100 banks, which is about \$350 billion. However, banks would likely expand pledged collateral if the nonadministered facility were introduced, as they did when the Special Liquidity Facility was introduced in 1999.

the nonadministered facility elastically provides overnight loans at a fixed rate equal to the target federal funds rate, the nonadministered facility would likely replace open market operations as the marginal source of funds to the banking system.

In contrast to the auction approach, the nonadministered facility would set the price at which the Federal Reserve provides loans. Banks would know with certainty the cost of the Federal Reserve advances made under the nonadministered facility because the FOMC announces its target federal funds rate.

Participating banks would be able to borrow overnight repeatedly. With no administrative rules and with the cost of nonadministered facility funding set at the target federal funds rate, the facility would come to be viewed by eligible banks as a significant source of funds for persistent needs, seasonal needs, and the management of their reserve positions. In turn, the facility would likely generate an increase in Federal Reserve loans (collateralized by a variety of assets) whenever reductions in the Federal Reserve's holdings of Treasury securities or an increase in demand for reserves put upward pressure on the federal funds rate.

Just as the Federal Reserve now has to roll over its maturing holdings of Treasury securities to avoid a contraction of total Federal Reserve credit, the Federal Reserve would have to regularly roll over its nonadministered facility loans as they came due. With a potentially large number of borrowers, arranging the loans and positioning the collateral for rollovers could be quite costly unless the processing of discount window loans becomes more automated than it is today (see appendix 3.D).

Establishing and Implementing a Nonadministered Credit Facility

The establishment of a nonadministered credit facility would proceed along the same lines as those given above for the establishment of an auction credit facility. If the existing adjustment credit facility was retained, there would still be a mechanism for a discount window lending rate to be determined by the boards of directors and the Board of Governors. To the extent that the nonadministered facility and the adjustment credit facility are perceived to be close substitutes, however, the use of the adjustment credit facility could languish.

Implementing the nonadministered facility would entail significant changes in the Federal Reserve's current procedures for conducting monetary policy. In essence, the nonadministered facility would become the key vehicle by which the Federal Reserve targets the federal funds rate. Eligible banks would be able to borrow overnight funds from the nonadministered facility at the target federal funds rate. Because no eligible bank would borrow overnight funds at rates above the federal funds target, the target federal funds rate would become the cap on the actual federal funds rate.

For example, if the Desk provides less reserves during a maintenance period than it otherwise would have provided at the target rate, the actual federal funds rate will tend to rise above the target rate. Eligible banks would then borrow from the nonadministered facility to satisfy their demand for reserve balances and redistribute funds to other banks seeking reserves. In such a fashion, the nonadministered facility could successfully

increase advances to banks to offset a reduction in the Federal Reserve's holdings of Treasury securities that led to a tendency for short-term interest rates to rise.

Indeed, the nonadministered facility would operate best in an environment in which the banking system is left with a “structural” reserve deficiency, which would, in effect, ensure that banks in the aggregate will borrow substantial amounts each day to meet their requirements. Eligible banks would adjust their borrowing from the nonadministered facility if the actual federal funds rate rises or falls relative to the target federal funds rate (the cost of borrowing from the nonadministered facility). This behavior would also tend to set a floor on the federal funds rate because any oversupply of reserves by the Desk would lead to reductions in outstanding borrowings from the nonadministered facility.

As with other discount window loans, advances from the nonadministered facility would be posted to the borrower's reserve account at the close of business. The nonadministered facility would quite likely increase the current tendency for banks to run short on reserves through much of a maintenance period. Indeed, with banks effectively able to choose the level of balances they hold at the end of each day by adjusting the amount they borrow at the nonadministered facility, banks probably would hold just enough on nonsettlement days to mitigate their risk of overdrafts and on settlement day increase their balances to meet their reserve requirements. This strategy would minimize the risk of becoming locked-in to positive excess reserve positions early in a maintenance period and would also ensure that banks would not suffer penalties for overnight overdrafts or reserve requirement deficiencies.

Most if not all active participants in the current federal funds market would be eligible to borrow from the nonadministered facility, and therefore the nonadministered facility would essentially replace the interbank market with an elastic supply of funds at an administered interest rate. In this case, the Desk's open market operations might no longer play a central role in implementing monetary policy. The current distribution of funds through the federal funds market would change significantly, as banks eligible to borrow at the nonadministered facility would redistribute interbank funds to other institutions seeking funds. Eligible banks would no longer have much incentive to make private-sector arrangements to meet expected funding needs because advances from the nonadministered facility would be readily available to them. In addition, because eligible banks could borrow continually despite the overnight maturity of the nonadministered advances, funding from the nonadministered facility would effectively become term funding at a floating rate (the target federal funds rate). Use of such floating-rate term funding could alter bank exposure to interest-rate risk.

As noted, the nonadministered facility would provide only overnight loans and only at the target federal funds rate. In contrast, normal transactions in the federal funds market, even those involving open market operations, always contain some uncertainty about the actual cost of obtaining funds. Hence, banks might find that loans from the nonadministered facility are more attractive than other sources of funds that have the same expected cost of borrowing, and this preference might be considered to reflect an implicit subsidy in the nonadministered facility loans. However, the difference between the nonadministered facility and other sources of funds would not likely be so large that it

would represent a large subsidy. One might also argue that lending by the nonadministered facility carries a potential subsidy because all eligible banks will pay the same rate even though some are less creditworthy than others. This concern might be mitigated by restricting eligibility for loans to strong financial institutions and by requiring sufficient collateral to secure the advances (effectively making them very low risk). The concern would not be eliminated, however, if some banks rated CAMELS 2 do not typically have access to funds at the target federal funds rate.

Potential Effects of a Nonadministered Credit Facility

Because its loans are overnight, the nonadministered facility would curtail the role of the existing adjustment credit facility. In addition, because it would lack the administrative rules of the adjustment credit facility, the nonadministered facility would place a cap on the nonpecuniary costs that eligible banks would be willing to bear to avoid borrowing at the adjustment credit facility. Also, under Regulation A, banks can obtain adjustment credit only if all other reasonably available sources of funds are exhausted. For banks to continue to use adjustment credit after the introduction of the nonadministered facility would require that the nonadministered facility not be considered a reasonably available alternative source of funds. The Board of Governors could clarify Regulation A on this issue. If the adjustment credit facility becomes less active in this new nonadministered facility framework, that could also call into question the policy importance of setting a basic discount rate on adjustment credit.

As essentially a Lombard-style facility, with a rate set equal to the intended federal funds rate, the nonadministered facility would circumscribe the Federal Reserve's ability to replace the existing adjustment credit facility with a Lombard facility that employed a penalty discount rate.

Finally, adopting a nonadministered facility might also circumscribe the FOMC's ability to switch from targeting an interest rate to targeting reserves in the implementation of monetary policy. Use of the nonadministered facility is not consistent with a reserves target for monetary policy.

CENTRAL BANKING PRINCIPLES AND RELATED KEY POLICY ISSUES

The auction and nonadministered credit facilities raise a number of key policy issues related to the four general principles for managing Federal Reserve assets laid out in chapter 1. To recall, those principles are as follows:

1. The Federal Reserve must have effective control over the stock of high-powered money and the size of its balance sheet. This principle is often called instrument independence.
2. The Federal Reserve should structure its portfolio and undertake its activities so as to minimize their effect on relative asset values and credit allocation within the private sector.

3. The Federal Reserve should manage its portfolio to minimize risks in a manner consistent with achievement of its goals and to maintain sufficient liquidity to conduct potentially large actions on short notice.

4. The Federal Reserve should place a high priority on transparency and accountability.

According to chapter 1, the first principle is of fundamental importance, whereas the central bank has some latitude in satisfying the remaining three principles. As discussed in greater detail below, we find that incorporating several risk-limiting restrictions into the auction and nonadministered credit facilities could make them generally consistent with these four principles, although some areas of concern remain, and some of the policy issues associated with these programs have no easy answers.

The System's existing framework for valuing and managing collateral is consistent with the collateral criteria outlined in chapter 1, and the auction and nonadministered credit facilities would use that framework. The key difference between the existing discount window programs, on the one hand, and the auction and nonadministered facilities on the other is the much greater scale of lending that would be conducted by the alternative facilities; that greater scale might lead the Federal Reserve to reexamine some of its existing approaches to collateral.

Issues related to the collateral criteria as well as to the four principles are discussed below (although in this context convenience dictates that the principles be taken up in a different order than that in chapter 1).¹⁸

Maintaining Instrument Independence

Under its current interest rate targeting strategy, the Federal Reserve allows the size of its balance sheet to be determined by the demand for Federal Reserve credit that is consistent with the targeted level of the federal funds rate. Nevertheless, the Federal Reserve has the ability to change the size of its balance sheet through open market operations and can offset unexpected changes in factors affecting the supply of funds to the financial system by conducting offsetting transactions in Treasury securities or in repurchase agreements.

One assumption of this study is that the FOMC would continue to target the federal funds rate, in which case the auction and nonadministered credit facilities would likewise operate in the environment of that targeting strategy. In a broad sense, then, the auction credit facility and nonadministered facility would be little different from current open market operations in their control over the size of the Federal Reserve's balance sheet.

Nevertheless, the two alternatives would work in ways different from each other and from the existing facilities. The auction credit facility by itself would not be able to make the same day-to-day adjustments to the Federal Reserve's balance sheet as open market

18. Several issues are not discussed in this summary, including internal controls and settlement risk, which are addressed in appendix 3.E.

operations unless auctions of longer-term advances were held daily. But the discussion of the auction credit facility envisioned that it would only supplement ongoing open market operations, so those operations would continue to provide day-to-day adjustments in the Federal Reserve's balance sheet. The Federal Reserve could also exert control over its balance sheet by varying the amount of advances being auctioned.

The amount of advances from the nonadministered facility that appear on the Federal Reserve's balance sheet would, on the other hand, be determined by demand that is driven by the level of the intended federal funds rate.¹⁹ The FOMC would control the amount borrowed from the nonadministered facility indirectly, through its control over the federal funds rate target. Hence, the Federal Reserve would still be able to adjust the size of its overall balance sheet under the nonadministered facility, although in a different manner than in the case of the auction credit facility.

Managing Federal Reserve Credit Risk

Any program that significantly expands discount window lending will involve more credit risk to the Federal Reserve for several reasons. First, the dollar amount of discount window credit extended by the Federal Reserve would be much larger than under existing discount window programs. Second, in comparison with U.S. Treasury securities, advances to discount window borrowers have lower credit quality. Third, under either the auction credit facility or the nonadministered facility the Federal Reserve could have credit exposure to a far larger number of institutions than is the case with discount window lending today or than is the case when conducting open market operations with a relatively small number of primary dealers.²⁰

Issues surrounding collateral are among the factors that could increase the Federal Reserve's credit risk. For example, secured lending arrangements are legally more complex than the repurchase transactions typically used in open market operations. Also, the collateral eligible to secure Federal Reserve advances, such as loans, are less liquid than the types of collateral now used in repurchase transactions. Furthermore, if a bank indebted to either the auction or nonadministered credit facility became insolvent, the Federal Reserve might not be able to collect or sell the collateral unless it could reach a "takeout agreement" with the insolvent bank's federal insurer or acquiring financial institution. Under such an agreement, the insurer or acquirer would cover the insolvent bank's obligations to the Federal Reserve in return for release of the collateral pledged by

19. With the nonadministered facility, the FOMC would set the intended federal funds rate, and the nonadministered facility would supply whatever quantity of advances would be demanded at that interest rate target. In contrast, with the auction credit facility, the FOMC would set the intended federal funds rate, and the auction would offer a fixed quantity of advances that would generally meet only a portion of the aggregate reserve needs in the system. The remaining needs would be met through open market operations that follow current procedures.

20. However, if borrowing from the Federal Reserve under the auction or nonadministered credit facilities involves increasing returns to scale for banks, the number of participants in these two facilities could be about the same as the number of primary dealers. This small group of participants would likely consist of large banks that would redistribute their borrowings to other banks through the federal funds market.

the insolvent bank. As discussed below, the Federal Reserve has generally been able to manage its credit risk exposure to banks. For example, the Federal Reserve suffered no losses of this sort during the waves of bank failures in the 1980s and early 1990s.

Discount window advances to financially strong banks might be viewed as relatively safe. The Federal Reserve has access to detailed supervisory information about banks and can also use general financial information and market data to assess their health. The Federal Reserve takes collateral to secure discount window loans. And the Federal Reserve's position in the event of insolvency is stronger in the case of a bank failure than it would be in the case of a business failure in which the Federal Reserve held a debt instrument and had to file a claim under the commercial bankruptcy code.

In private credit markets, lenders recognize that they have imperfect information about the financial situation of borrowers and commonly employ a variety of measures to manage their credit risk and to avoid attracting only risky borrowers. Similar prudential measures applied to an expanded discount window lending program could be effective in mitigating the Federal Reserve's credit risk and would also help address concerns of moral hazard. Such measures include stringent eligibility requirements; credit limits based on the borrower's financial condition; collateral requirements and the appropriate valuation of collateral; regular monitoring of the borrower's financial condition; and clear "exit strategies."

Eligibility Requirements

Eligibility to borrow from the auction credit facility or nonadministered facility could be restricted only to well-capitalized banks with investment grade ratings and current CAMELS ratings of 1 or 2.²¹ Expanding eligibility to institutions rated CAMELS 3 would increase risk to the Reserve Banks and does not appear necessary to permit a substantial increase in advances on the Federal Reserve's balance sheet.

Foreign banking organizations could be eligible for the program under parallel requirements. One approach might be to subject them to the same capital and investment grade requirements for eligibility and use the SOSA (strength-of-support assessment) ratings for foreign banking organizations as substitutes for CAMELS ratings. However, further analysis would be necessary before deciding how best to grant foreign banking organizations access to potentially large amounts of funding from the Federal Reserve.

21. This definition would include those banks with investment ratings from public rating agencies and banks considered to be equivalent to those rated as investment grade; see appendix 3.D. As of the third quarter of 2000, more than 7,000 commercial banks had a CAMELS rating of 1 or 2; this group held more than 80 percent of total commercial bank assets. Not all of these banks, however, had pledged collateral to qualify for loans from the discount window. Close to 2,600 commercial banks have done so, including all of the 100 largest banks. Of course, many thrift institutions and credit unions could be eligible, but many of them may not be interested in participating in an expanded discount window facility, particularly in advances from an auction credit facility.

Credit Limits

To further limit risk to the Federal Reserve Banks, credit to an individual institution could be constrained to the lesser of the lendable value of its pledged collateral or a credit limit based on its financial strength. This basic structure would be consistent with the Board's payment system risk (PSR) policy. Under current PSR policy, daylight overdraft caps for individual institutions are based on such factors as an institution's capital, current financial condition, internal control strength, and regulatory rating and the institution's stated request for a given level of potential credit. The PSR intraday credit limit is a multiple of the institution's risk-based capital level; the credit limits of the current PSR program are 1.5 times capital for those banks with high caps.²² This limit seems appropriate for the auction and nonadministered credit facility programs, and we use it below for illustrative purposes.

Collateral Requirements and Haircuts (Margins)

Requiring borrowing banks to pledge collateral against their discount window advances provides another layer of protection against credit risk. Standards for acceptance of collateral, including sound practices for valuing collateral and diversification of the types of collateral accepted, are important.²³ The Federal Reserve currently has standards for the valuing and acceptance of collateral that could be followed in an auction credit facility or nonadministered facility. Under the existing collateral acceptance standard, assets are acceptable if they are not subject to classification or criticism (when regulatory quality standards are applied), are legally eligible for holding by the depository institution, and are assets in which the Reserve Bank can perfect a security interest.

The Federal Reserve's current approach in determining a lendable value of collateral for assets that have readily available market prices is to apply standard haircuts to the assets' market value. Other assets (such as loans) are classified as either of "minimal" or "normal" risk and then, within each risk category, are further categorized by maturity. A standard haircut is then applied to the book value of all assets in each risk and maturity category.

The haircuts (or margins) applied in determining lendable values for collateral are intended to take into account interest rate risk, credit risk, and liquidity risk by incorporating the following factors: (1) changes in asset prices from duration and convexity calculations, (2) interest rate volatility, (3) credit spread volatility, and (4) liquidity differences between marketable and nonmarketable assets.²⁴ Margins are

22. See "Guide to the Federal Reserve's Payment System Risk Policy" (<http://www.federalreserve.gov/paymentsystems/psr/default.htm>) and appendix 3.D.

23. Issues of collateral composition, collateral management, and loan maturity are discussed in appendix 3.D.

24. The current valuation process, including pricing and the application of prescribed margins, for all collateral (regardless of who holds it) is facilitated by a common automated process that uses information from an outside vendor. Certain custodians of collateral, such as the Depository Trust Company (DTC), offer pricing services. Other than the DTC, only a relatively small amount of pledged collateral is now held by third parties, and the DTC generally handles various types of marketable securities, not nonmarketable loans that might be pledged as collateral.

reevaluated every twelve to eighteen months, or more frequently as changes in market or financial conditions warrant. Margins determine the maximum lendable value for each type of asset pledged; lower lendable values may be established, depending on whether the characteristics of the assets pledged by a bank vary from the characteristics within the standard categories listed.

In general, these procedures seem consistent with those covered in appendix 3.D of chapter 1. If an expanded discount window lending program is adopted, especially an auction credit facility that offers longer-term advances (up to four months), the methodology for establishing margins and valuing collateral would have to be reevaluated because the current approach was formulated predominantly for very short term discount window lending. In addition, the Federal Reserve may want to consider reevaluating margins more frequently than is done now. The basic framework of the current approach to valuing collateral seems sound and broadly applicable to an auction credit facility or a nonadministered facility, but significant staff resources might be required to reevaluate the methodology for establishing margins and to put in place the processes for reevaluating margins more frequently. In addition, resources would be required to automate the procedures for handling and monitoring collateral for discount window loans, especially because the scale of lending from an auction or nonadministered credit facility would be so much larger than existing discount window lending. The effort and resources required to prepare for auction lending might be more substantial because the auction credit facility would involve longer-term lending, whereas current discount window procedures were established primarily for overnight lending.

The implications of collateral requirements and credit limits for the Federal Reserve's capacity to extend credit under the auction and nonadministered credit facilities can be illustrated with the limit (two-week average net debit cap) of 1.5 times capital used for intraday credit for banks choosing a high cap. This limit for individual banks implies an aggregate credit limit for eligible banks of about \$550 billion as of June 30, 2000 (see appendix 3.D), or about 10 percent of banks' loans and securities. For just the largest fifty banks, the lendable value of collateral pledged is currently \$283 billion, and the aggregate credit limit for those rated CAMELS 1 or 2 would be \$386 billion (although some of the collateral pledged might also be required to support adjustment credit borrowing). Thus, while individual credit limits would mitigate risk to the Federal Reserve, they would still allow a substantial amount of loans to be placed on the Federal Reserve's balance sheet to replace holdings of Treasury securities. For instance, if the Federal Reserve wanted to replace as much as \$250 billion (nearly half) of the Treasury securities on its balance sheet with advances under the auction or nonadministered credit facilities, it could do so using only the largest fifty banks and without requiring additional collateral.

Condition Monitoring

To control its risk and risk to the payment system, the Federal Reserve currently monitors all banks that hold accounts at the Federal Reserve as well as others that are eligible to borrow or open accounts. The financial condition of these institutions is assessed regularly, and they receive increased scrutiny if their condition deteriorates to any material degree. The Federal Reserve regularly tracks capital ratios, supervisory exam

ratings, and other regulatory information, and much of this information is readily available in automated systems such as the National Examination Database and the Common Loans Automated System. Moreover, discount window officers and other staff at the Reserve Banks typically maintain close contacts with other federal and state regulators to stay abreast of developments that may not be fully reflected in supervisory databases.

The Federal Reserve would have to continuously monitor the financial condition of institutions that borrow from the auction or nonadministered credit facilities. The number of borrowers from these two facilities could be far larger than the number of primary dealers with which the Desk now deals in conducting open market operations. The introduction of a new lending program with the proposed eligibility criteria would establish a conservative financial threshold that may require changes in monitoring processes and could increase costs in this area. Over the course of a business cycle, some banks would move from a CAMELS 2 to a CAMELS 3 rating and would thus have to be excluded from the list of eligible participants in the two facilities. Loss of access to the facilities would be an additional factor that could complicate deliberations of examiners about whether to downgrade a bank from CAMELS 2 to CAMELS 3.

In addition, more frequent monitoring of all eligible banks would be required because ratings by examiners and private ratings firms may lag changes in banks' actual condition. This issue becomes even more important if banks whose financial conditions deteriorate are more likely to seek Federal Reserve credit, perhaps as private sources of funds become less available to them. All of these considerations suggest that introducing an auction credit facility or a nonadministered credit facility would likely require the Federal Reserve to devote more resources to monitoring the condition of its counterparties.

Exit Strategies

Regardless of the Federal Reserve's best efforts to minimize credit risks, loans from the auction and nonadministered credit facilities would inevitably be extended to some depositories whose financial condition would later deteriorate. The Federal Reserve should plan in advance for its handling of such an eventuality. Simply calling outstanding loans to institutions that become less than well capitalized may not be desirable. In many instances, this action could well create a liquidity disruption for the borrower that would be difficult for it to overcome. An alternative might be to inform each borrower that if it drops below any of the basic eligibility criteria, it would be allowed access to the auction and nonadministered credit facilities for only a fixed period, and that during this period it would be allowed to maintain only its existing level of borrowing. Such a rule would be analogous to that by which access to the brokered deposit market is regulated. The length of the restricted-borrowing period may have to depend on the maturity of the loans extended. For instance, lending by the nonadministered facility would be for overnight, so even when a bank was regularly rolling over a substantial amount of nonadministered facility advances, the overnight maturity of the advance would allow the Federal Reserve to insist that the bank find alternative sources of funds fairly quickly and terminate its access to the nonadministered facility.

In contrast to the loans from the nonadministered facility, advances from the auction credit facility could have maturities of up to four months.²⁵ Any bank that had just borrowed three-month funds from the auction credit facility would have ninety days to unwind its funding, during which time it couldn't borrow further from the auction credit facility. Such a long period may not present the Federal Reserve with significant risks if the bank has simply moved from a CAMELS 2 to a CAMELS 3 rating and is not in danger of failure. In addition, the credit limits discussed earlier would prevent a bank from having a majority of its funding from the Federal Reserve, so that finding an alternative to funding from the auction credit facility would seem reasonably likely over a transition period of several weeks or months. After the transition period expired, any institution still wanting to borrow at the discount window would have to do so under the extended credit program.

Of course, if the status of an institution is downgraded to undercapitalized or critically undercapitalized, the situation would need to be immediately handled in a manner consistent with the lending guidelines of the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA).²⁶ In such circumstances, the Federal Reserve may be able to choose only between calling the advance and thereby perhaps forcing the closure of the institution or exceeding the FDICIA guidelines and thereby potentially incurring both a liability and heightened congressional scrutiny.

The Federal Reserve could face significant embarrassment if a bank failed with a large amount of advances from the Federal Reserve. In such a case, the Federal Reserve's claim on the collateralized advances would also harm the position of the FDIC. Given the requirements of FDICIA, adoption of an auction credit facility or a nonadministered credit facility would likely place a greater responsibility on bank regulators to ensure that banks with large amounts of loans from those facilities do not become undercapitalized or critically undercapitalized.

Providing for Adequate Liquidity of the Federal Reserve's Balance Sheet

Chapter 1 makes several points about the liquidity of the Federal Reserve's portfolio of assets. First, liquidity must be sufficient to allow the Federal Reserve to add or drain reserves in large amounts on short notice without large changes in the assets' market values. Second, the principal liquidity concerns stem from short-term needs to alter the size and composition of the portfolio and not from longer-term changes in the size of the portfolio. Third, since 1976, the size of the portfolio typically changed no more than

25. Four months is the limit generally permitted under the Federal Reserve Act (see appendix 3.A).

26. The guidelines apply to two sorts of Federal Reserve lending: (1) with maturities in excess of 60 days in any 120-day period to a depository institution that is undercapitalized or significantly undercapitalized or has a CAMELS rating of 5 and (2) to a critically undercapitalized institution after the five-day period that begins on the day the depository institution becomes critically undercapitalized. Although the FDICIA guidelines permit lending to troubled institutions in some cases, the guidelines are designed to place any such lending under greater scrutiny, and deviations from the guidelines can make the Federal Reserve Board liable, up to a limit, for any consequent increase in the FDIC's resolution costs. The Board's liability is limited to the lesser of the interest on the Federal Reserve's loan or the increase in the FDIC's resolution costs (see appendix 3.A).

about 1.5 percent each day, although the size changed as much as 15 percent on very rare occasions. As of this writing (2000), a 1.5 percent change amounts to about \$8 billion and a 15 percent change amounts to about \$80 billion. The questions these concerns raise in regard to the auction credit facility and nonadministered credit facility are (1) Would these facilities allow short-term changes of up to 15 percent in the size of the Federal Reserve's portfolio ? and (2) Would the market value of the Federal Reserve's assets be significantly affected by changes of that magnitude?

Liquidity with the Auction Credit Facility

As discussed above in the section on instrument independence, the Federal Reserve could change the amount of advances being auctioned to change the size of the Federal Reserve's portfolio. To some extent, the desired degree of liquidity of the Federal Reserve's asset holdings could be ensured by structuring the Federal Reserve's portfolio of auction facility loans in such a way that a significant portion matures regularly. If advances became a sizable portion of the Federal Reserve's balance sheet, and if auctions were frequent (such as weekly or daily), then historically typical changes in the Federal Reserve's portfolio (about \$8 billion) would appear to be quite manageable. The Federal Reserve would seem to be able to manage even large short-term changes in the size of its portfolio with such a facility, although probably not as large as \$80 billion over a period as short as a week.

But if auctions were infrequent, the auction credit facility would not be able to make short-term adjustments as quickly as changes in outright holdings of, or repurchase arrangements in, securities acquired via open market operations. If the Federal Reserve's emergency lending increased between the dates of the credit facility auctions, for instance, the federal funds rate might fall below the FOMC's target unless open market operations were used to offset the emergency credit extended.

Short-term adjustments in the amount of auction facility advances on the Federal Reserve's balance sheet would not substantially change the market value of the Federal Reserve's portfolio of advances. The longest maturity under consideration here is four months. Because of the short maturity, the market value of such advances would change little even in response to relatively large swings in interest rates. Shifts as large as \$80 billion in the composition of the Federal Reserve's portfolio would be likely to arise only in a financial crisis, which would probably generate effects on market interest rates that would be independent of any adjustments in the size of credit facility auctions.

Liquidity with the Nonadministered Credit Facility

The nonadministered credit facility would provide whatever overnight advances banks demand at the target federal funds rate. An increase in demand at even the high end of the historic range of daily changes in the size of the Federal Reserve portfolio (\$80 billion) might be accommodated without much direct impact on other market interest rates. Conversely, a sudden sharp decline in the demand for advances could be readily accommodated if nonadministered advances were a substantial share of total Federal Reserve credit because such advances would be overnight loans. For instance, if the "normal" level of outstanding advances from the nonadministered facility is \$200 billion, then \$200 billion of nonadministered facility loans would mature each day. If the Federal

Reserve had to extend a very large amount of emergency loans, say \$80 billion, the redistribution of those funds among banks would reduce the demand for Federal Reserve credit (at the target federal funds rate) by \$80 billion. Banks would simply choose to roll over \$80 billion less in overnight nonadministered loans that day. Consequently, short-term adjustments in the amount of nonadministered advances would likely have only small effects on the market value of the Federal Reserve's assets. Adjustments as small as \$8 billion would likely have no effect, and even adjustments as large as \$80 billion might have very little effect, because of the nonadministered facility's ability to accommodate shifts in demand. Shifts as large as \$80 billion seem unlikely, however, except in a financial crisis, in which case the effects on the financial market may be driven by factors that will generate broader effects on market interest rates.

Transparency and Accountability

The Federal Reserve publishes weekly reports of its holdings of discount window loans. Under each of the discount window alternatives envisioned here, it would continue to disclose its holdings to be consistent with the principles of central bank transparency and accountability. In the case of the auction credit facility, the Federal Reserve would also announce in advance the amounts of each auction and afterward would report the accepted bids; the Federal Reserve could announce other auction details as well, as it now does when the Desk conducts auctions of repurchase agreements. Consequently, the auction credit facility and the nonadministered facility would be no less transparent than the current discount window facilities and SOMA operations.

The auction credit facility would allocate advances through a market-based price mechanism, and the nonadministered facility would do so through an administered price (the target federal funds rate). The public, however, would know both loan rates.

Effects on Risk-Taking and on Risks to the FDIC

The Federal Reserve should be concerned not only about the risks its loans pose to its own portfolio but also about the effects they may have on the risk-taking incentives for banks and the associated risks to the FDIC.

Effects on Banks' Incentives to Assume Credit Risk

The Federal Reserve could require collateral on advances from the auction or nonadministered credit facilities that would be sufficient to make them virtually riskless. Even then, however, such advances could be relatively more attractive to riskier depository institutions and might also encourage risk-taking. Without limits on access to the credit facilities, the weakest institutions might find that they could gamble to improve the value of their equity by borrowing at the discount window facilities and investing the proceeds in risky assets.²⁷ This course of action would channel collateral to the Federal

27. The nonadministered facility might also involve adverse incentives for banks with regard to their reserve management and payment system practices. As long as a bank had sufficient collateral pledged with the nonadministered facility, it would have little reason to worry about the effects of intraday overdrafts of its reserve balance apart from the charges for such overdrafts--the bank could simply borrow

Reserve to the disadvantage of the FDIC and unsecured creditors. The failure of a bank that held a large amount of advances from the discount window would, of course, have direct repercussions on the FDIC's insurance fund. In addition, however, the failure might subject the Federal Reserve to substantial criticism for having provided the advances to the institution.

The potential for such problems would be mitigated to a large extent by stringent eligibility criteria for participation in the auction and nonadministered facilities. Even under stringent requirements, however, the funding costs available to eligible institutions would vary somewhat. The Special Liquidity Facility (SLF), for example, was an attractive source of funds for some depository institutions that easily met its criteria for financial soundness, even though the SLF interest rate was 1-1/2 percentage points above the target federal funds rate. Furthermore, CAMELS ratings and capital categories may not reflect the current condition of the borrower. Although most banks that fail have poor CAMELS ratings, some--especially those involved in fraud--have had relatively high ratings on record at the time of failure.

Adverse risk-taking effects of advances from the auction and nonadministered facilities could also be contained by the credit limits discussed above that restrict how much each institution could borrow. Such individual limits would have the effect of capping the amount of each bank's liabilities that could come from Federal Reserve advances.

Effects on Banks' Incentives to Assume Liquidity Risk

An additional risk that may be exacerbated by the auction and nonadministered credit facilities would stem from their reliability as a source of funds for banks, especially for those in deteriorating financial condition.²⁸ Depository institutions manage liquidity risks in a variety of ways; these include holding positions in liquid assets such as Treasury securities, managing the maturity structure of their liabilities, and arranging contingency funding lines. The auction facility and especially the nonadministered facility would create a new funding source for banks that could be tapped to meet sudden funding needs. In effect, the new facilities would provide a measure of liquidity "insurance" for banks; in doing so, they would tend to undercut the incentives for banks to maintain a high level of preparedness to meet unexpected funding needs by other means. This aspect of the moral hazard problem would be mitigated by the credit limits noted above. Banks that had used up all or most of their borrowing capacity under the facilities would have to satisfy an unexpected funding need elsewhere.

Nevertheless, some banks might rely to a significant degree on the new facilities. If one of these banks experienced financial difficulties, especially if they were sudden, the facilities' advances may need to be converted to extended credit. In the event of a further deterioration in an institution's condition, FDICIA guidelines strongly encourage the

at the nonadministered facility at the end of the day to cover any overdraft (see the discussion in appendix 3.D).

28. If the Federal Reserve pursues the implementation of alternative credit facilities, supervisory staff should be consulted on concerns they might have about institutions having a significant share of their liabilities in advances from the new facilities.

Federal Reserve to call its loans. In that case, however, the institution would be unable to quickly replace Federal Reserve credit with other liabilities and thus would put the Federal Reserve in an awkward position.

Risks to the FDIC

A significant rise in the share of bank liabilities that are Federal Reserve advances could increase the risks faced by the FDIC. The exact effect would depend on how the increase is accommodated on the banks' balance sheets.

If the composition of assets is held constant, the risk to the FDIC would increase the most if institutions used Federal Reserve advances to replace uninsured nondeposit liabilities (such as subordinated debt). In that case, liabilities that had a junior claim to those of deposits in the event of default would have been replaced with fully collateralized Federal Reserve advances that would have a senior claim to deposits.

If Federal Reserve advances replaced uninsured deposits, such as large time deposits, the risk faced by the FDIC would still increase but less than if Federal Reserve advances replaced subordinated debt. The increase in risk would be less because uninsured deposits, which have the same priority as insured deposits in insolvency proceedings, provide less of a buffer to the FDIC than nondeposit funds. On the other hand, if Federal Reserve advances replaced insured deposits, the risk to the FDIC in terms of expected loss would fall because the amount of insured deposits would decline. However, the remaining insured deposits would be relatively disadvantaged by the senior claim of the Federal Reserve, and thus the expected loss per dollar of deposits would rise. Federal Reserve advances, particularly from the auction credit facility, would appear to resemble managed liabilities more closely than insured deposits, so it seems likely that the advances would replace uninsured deposits and thus would increase the expected future losses of the deposit insurance fund.²⁹

How the Credit Facilities May Lower Risk

The auction credit facility and the nonadministered credit facility may provide incentives for banks to improve their financial condition. In particular, loss of eligibility to participate in the credit facilities would be costly for a bank. The bank would have to seek alternative sources of funds and might also view its loss of access as a loss of the Federal Reserve's "stamp of approval." As a result, creation of these facilities may cause banks to increase their efforts to maintain a strong financial condition in order to remain eligible.

Avoiding Credit Allocation and Distortions to Relative Prices

Providing Federal Reserve credit through a new discount window facility rather than by holding Treasury securities is likely to have only marginal effects on the average level of

29. The FDIC recognizes the risk posed by collateralized claims. In its August 2000 "Options Paper," the FDIC states that "if the banking industry as a whole increases its use of secured borrowing, the BIF [Bank Insurance Fund] and SAIF [Savings Association Insurance Fund] are exposed to higher levels of risk" (p. 73).

interest rates and the equilibrium values of other key macroeconomic variables. Simply put, the fundamental structure of the macroeconomy is not directly affected by the central bank's choice of assets to hold on its balance sheet. On the supply side, production is determined by the application of labor, capital, and technology. On the demand side, household and business spending decisions are governed largely by factors such as current and expected income and profits, wealth, and costs of credit. Although the Federal Reserve's choice of assets may affect the *relative* costs of credit, it is unlikely to have significant effects on the *average* cost of credit that balances long-run aggregate supply and aggregate demand.

Effects on Financial Intermediation

Implementing alternative discount window facilities could well have some impact on overall patterns of financial intermediation and also on relative interest rates. Although the motivation for this study is the question of accommodating a decline in the stock of Treasury securities, we wish to analyze here the effects of a change in the way the Federal Reserve provides reserves rather than the effects of a declining stock of Treasury securities. We do so by asking how the substitution of advances to banks for some or all of the Treasury securities held by SOMA would change financial sector equilibrium *relative to what it would otherwise have been* apart from any effect on market interest rates arising from a change in the total stock of Treasury securities. In this way, the analysis focuses on the effect of changes in the way the Federal Reserve provides Federal Reserve credit to the banking system. In this analysis, the Federal Reserve's replacement of Treasury securities with advances to depositories will force the private sector to hold more Treasury securities than would be the case if the Federal Reserve did not reduce its holdings of Treasury securities. And in effect, the Federal Reserve's advances would provide the means by which the private sector finances its additional holdings of securities.

Clearly, however, this basic change could be reflected in overall patterns of financial intermediation in many different ways. At one extreme, the size of bank balance sheets would increase one-for-one with the increase in the Federal Reserve's advances. The increase in the balance sheets would arise if banks purchased all of the Treasury securities shed by the Federal Reserve; alternatively, households and other intermediaries might acquire all the Treasury securities and reduce their holdings of other assets that, in turn, would be acquired by banks.

At another extreme, the size of banks' balance sheets would be unchanged if banks' managed liabilities declined one-for-one with the increase in Federal Reserve advances. In this case, investors that had previously held banks' managed liabilities would directly or indirectly purchase the net increase in Treasury securities outstanding.

Some result between these extremes is presumably most likely. In this more general case, the Federal Reserve's advances to depositories would be partially offset by a runoff of other bank liabilities, partially invested in Treasuries, and partially invested in new assets, so the size of the banking system would increase but by less than the amount of the advances. After all, the cost of raising additional bank capital would constrain the ability of a bank to increase the size of its balance sheet.

Similarly, the size of other financial intermediaries could increase. For example, money market mutual funds might attract some of the investors that formerly had held deposits at banks and use their funds to purchase a portion of the net increase in Treasury securities outstanding. (See appendix 3.C for a more complete discussion of the possible outcomes.)

Ultimately, the changes in the patterns of financing will be determined simultaneously with relative asset returns as the economy adjusts fully to the Federal Reserve's new operating procedures. In any mildly complex general equilibrium model, it is impossible to unambiguously determine how interest rates will be affected by replacing some or all of SOMA's Treasury securities with advances. The effect on relative interest rates will depend on the slopes of asset demand and supply curves which, as discussed in appendix 3.C, depend on the degree of asset substitutability and on differences in the cost structures of various kinds of financial intermediaries. Any such analysis is further complicated by the Lucas critique, which cautions that such a major change in Federal Reserve behavior might make past behavior of economic agents a poor guide for likely future behavior. Still, it seems useful to sort through some of the factors that seem likely to affect the final pattern of interest rates.

When Federal Reserve advances are increased, the associated reduction in the Federal Reserve's holdings of Treasury securities and the increase in the public's holdings of Treasury securities would tend to increase the public's demand for bank credit and reduce its willingness to hold banks' liabilities.³⁰ The implications for relative interest rates will depend on the degree of substitutability among the affected financial assets. With a high degree of substitutability, the effects on interest rates will be small. However, insofar as financial assets are imperfect substitutes, the changes in supplies of, and demands for, funds arising from the change in Federal Reserve procedures would have some influence on relative rates.

On the liability side of banks' balance sheets, Federal Reserve advances will, to some extent, substitute for other sources of bank funds. As noted above and in the analysis in appendix 3.C, advances from the auction and nonadministered credit facilities would create an alternate funding source for banks that would probably be closer in nature to managed liabilities, such as large time deposits, than to core deposits. Consequently, these new discount window lending programs, other things equal, would probably lead to a decline in banks' demand for managed liabilities and thereby perhaps put downward pressure on interest rates on managed liabilities, at least in the short run. But this effect could be offset to some extent by the reduction noted above in the public's willingness to hold banks' liabilities.

The new credit facilities would also have some effect on the lending programs of the Federal Home Loan Banks (FHLB) for two reasons: (1) FHLB loans are likely to be collateralized with some of the same types of bank assets as are discount window advances and (2) FHLB advances to banks and Federal Reserve advances to banks would

30. Again, this comparison is independent of any change in the total stock of Treasury securities.

become closer substitutes than they are today. FHLB loans would likely decline in those maturity ranges used by the new credit facilities.

Would banks' loan rates be affected? As noted above, an auction credit facility program could result in some net reduction in banks' marginal funding costs and hence lead them to increase the size of their balance sheets. If banks' marginal funding costs decline somewhat, competition could be expected to put some downward pressure on bank loan rates. So at the margin, the spread between bank loan rates and rates on market sources of short-term borrowing such as commercial paper might narrow.

Another avenue by which the new credit facilities could affect loan rates might be a reduction in the liquidity risks faced by banks when originating loans, which might then lead to reductions in banks' loan rates (essentially through a decline in the liquidity premium embedded in loan rates). As noted above, the new credit facilities would expand the ability of banks to pledge loans to the Federal Reserve to obtain discount window credit; by pledging more loans, they might be able to scale back their other arrangements for contingency sources of funds. The value of the expanded ability to pledge a loan would depend on the cost to the originating bank of maintaining other contingency sources, the ability of the bank to meet the Federal Reserve's financial soundness criteria, and the bank's not being constrained by the Federal Reserve's limit on the amount of advances it could borrow (the credit limit discussed earlier). The value could be appreciable for smaller depository institutions, which often do not have a wide variety of contingency funding alternatives. Because advances from the auction credit facility would not be available on demand, the expanded ability to pledge loans would be less valuable under that facility than under the nonadministered facility.

Financial Effects and Collateral

An important question is whether the Federal Reserve's haircuts on collateral could distort the choices that depositories make to invest in particular types of assets and thereby affect their interest rates.³¹ For example, to maximize the value of its access to Federal Reserve credit, an institution without ready access to other funding sources might be tempted to invest in assets to which the Federal Reserve has assigned fairly small haircuts (high lendable values). In addition, if the Federal Reserve's haircut represented an overestimation of the true lendable value of an asset in light of the relevant interest rate risk and credit and liquidity risks (that is, if the haircut was "too small"), then a bank might have an incentive to pledge such an asset, and perhaps seek additional amounts of such an asset, to obtain what the bank would perceive to be a "cheap" source of funding. In either case, the expanded discount window facility might affect the bank's decision on the margin to make an additional loan.

Other than ensuring that haircuts are set appropriately in determining the lendable value of collateral, what would reduce the likelihood of such distortions? As discussed earlier, access to either of the new credit facilities could be restricted to institutions that are well

31. This issue is apart from the possibility that lower marginal funding costs or a reduction in liquidity risk could result in lower loan rates.

capitalized and have strong supervisory ratings. This requirement should ensure that institutions eligible for advances from the auction credit facility would also have ready access to other funding markets. The limit on the amount of outstanding credit available to an individual bank from either of the new credit facilities, discussed earlier in regard to managing the Federal Reserve's credit risk, could help keep such advances to a relatively small share of a bank's assets. That is, the credit limit rather than the availability of collateral would generally become the binding constraint and would thus go a long way toward ensuring that the Federal Reserve's valuations of collateral would have little or no effect on banks' lending decisions.

Pursuing the example used earlier to illustrate this point, a reasonable credit limit could be similar to the System's PSR net debit cap (for banks with high caps) of 1.5 times a bank's capital (see appendix 3.D). For a well-capitalized bank, this limit might translate to a maximum level of Federal Reserve credit equal to 15 percent of total assets. Even if for some reason only half of a bank's assets were attractive or acceptable to use as collateral against advances from the new credit facilities, a credit limit that amounted to 15 percent of total assets would still be more of a constraint on the ability of a bank to secure Federal Reserve credit than would the availability of collateral. In this case, even a very large haircut of 30 percent applied against half of a bank's total assets would imply that the lendable collateral value would amount to 35 percent of its total assets—more than enough to secure the maximum amount (15 percent of total assets) that could be borrowed from the Federal Reserve. Moreover, a bank would care little if the Federal Reserve's haircuts were 40 percent or 10 percent, because in either case, the lendable collateral value of its assets would still far exceed the maximum amount of Federal Reserve credit the bank could obtain.

Hence, at the margin, a bank with more than enough collateral to secure the maximum amount of Federal Reserve credit available to it would have little or no incentive to consider Federal Reserve haircuts in booking new loans. To fund a marginal increase in new loans, it would not need to pledge the marginal dollar of new loans as collateral. In this case, a bank's decision to book an additional dollar of new loans that might carry a large haircut versus booking an additional dollar of new loans with a small haircut will have no bearing on the bank's cost of funding at the margin and, hence, no bearing on its profits at the margin.

The foregoing discussion assumes that banks could pledge any type of asset they wished to secure Federal Reserve credit. Naturally, they would then tend to pledge those assets on their balance sheet that were "cheapest to deliver," that is, easiest or least costly for them to pledge from an operational perspective. If the pledging costs for other types of assets on banks' balance sheets were quite high, banks might have some incentive at the margin to invest in more assets of the type that are cheapest to deliver. This incentive would be tempered considerably by the fact that the financially strong institutions that would be allowed to borrow from either of the new facilities would also generally have ready access to other wholesale funding sources and would readily tap those funding sources if the collateral pledging costs associated with advances from the Federal Reserve became too onerous.

The type of asset that is cheapest to deliver seems to vary from one bank to another. Thus, although the types of collateral pledged by an individual institution may vary within a narrow range, the aggregate pool of collateral is fairly well diversified.

Even if depository institutions would tend to pledge less liquid collateral when borrowing from one of the new credit facilities because such assets cannot readily be pledged when borrowing from other sources, the loans made by the Federal Reserve to these institutions would still be of high quality. Relatively short-term, senior loans to investment-grade depositories would have an extremely low probability of default. In the probably rare case of default, the Federal Reserve would be unlikely to take a loss because the loans would be overcollateralized, and, in view of the Federal Reserve's supervisory role and contacts with other regulators, the Federal Reserve would, under most circumstances, have time to demand more collateral if necessary from an institution whose condition was deteriorating.

To eliminate the "cheapest to deliver" phenomenon for an auction credit facility, the Federal Reserve could hold separate auctions of advances against different types of collateral. This could be done using broad classes of assets, such as auctions for marketable securities and nonmarketable loans, or against narrower classes of assets, such as separate auctions for different types of securities and for different types of loans. This segmentation would give the Federal Reserve more control over the quantity of different types of collateral that it receives to secure advances from the auction credit facility. Presumably, the auction credit rates for different classes of collateral would then appropriately reflect the differences in pledging costs—assets that are more costly to pledge would tend to have lower auction credit rates than assets that are relatively easy to pledge.

Although separate auctions would have some benefits, they would also have some drawbacks. First, they might increase the likelihood that supply constraints would restrict the feasible size of any auction. Second, such auctions could be misinterpreted as a form of credit allocation.³² Third, such auctions would reduce the probability that the Federal Reserve's credit limits would always be the binding constraint for banks; if the availability of collateral rather than the credit limit becomes the binding constraint, as argued above, the Federal Reserve's collateral haircut policies might influence banks' investment decisions. That is, if the auction credit rate on a particular class of collateral represented a reduction in marginal cost of funding for a particular asset, banks could well be tempted to invest in more of that particular asset.

More generally, holding separate auctions of Federal Reserve credit against narrow classes of nonmarketable assets would create a connection between a bank's management of its assets and its management of its liabilities, a connection that does not generally exist at present. That is, in funding nonmarketable instruments for which there are no active repurchase markets, banks currently simply seek out the least expensive source of funding—such as large time deposits and federal funds—and these funds may be used to

32. Furthermore, such auctions could increase the likelihood of political pressures for favorable treatment of selected classes of bank assets.

finance any asset. By contrast, auctions of Federal Reserve credit against narrow classes of collateral would directly identify particular liabilities as funding sources for particular assets. At the very least, this identification would mark a departure from banks' past experience and, as noted above, could lead to distortions in asset-liability management decisions.

Credit Allocation

The discount window alternatives considered here might expand the size of the depository institution sector, potentially at the expense of nondepository financial intermediaries. This effect could raise a concern that the Federal Reserve was allocating credit in favor of the depository sector and lead to public debate about "winners" and "losers" from this change in the implementation of monetary policy. Nonetheless, making advances to depository institutions might actually help to insulate the Federal Reserve from the criticism that it is engaging in credit allocation.

Federal Reserve advances are extensions of Federal Reserve credit to the borrowing depository institutions, not to the ultimate borrowers to whom those depository institutions lend. The depository institutions, not the Federal Reserve, make the ultimate decisions about which sectors receive financing. Thus, use of either of the two discount window alternatives appears consistent with the approach suggested in chapter 1, namely that the risk of affecting relative prices across private assets could be reduced by strategies employing substantial diversification. In the case of the new credit facilities, the diversification would be across depository institutions' holdings of securities and loans.

SUMMARY

Both the auction credit facility and the nonadministered credit facility would generally enable the Federal Reserve to replace Treasury securities on its balance sheet with other assets, specifically with discount window advances. Doing so would increase the overall magnitude of the credit risk to the Federal Reserve, however, because the scale of discount window lending would be far larger under either of the new facilities than it is under existing discount window facilities. The scale of lending under the new facilities would also pose some challenges for managing collateral. Certainly an increase on the order of billions of dollars in advances outstanding to individual depository institutions would raise the Federal Reserve's concern about the risk of default. As a result, if the Federal Reserve were to implement either of the new facilities, it would undoubtedly want to reassess the methodology for determining haircuts, reevaluate these haircuts more frequently than the current intervals of twelve to eighteen months, and more closely monitor the value of the collateral pledged by a borrowing bank as well as the bank's health.

Although an expanded discount window facility could affect some asset prices, the extent of the effects may be small under the discount window alternatives considered here. In particular, strict eligibility requirements, credit limits on individual borrowers, and collateral requirements would help to mitigate any financial market effects. They would

also help to mitigate any increases in moral hazard, in risk to the FDIC, and in credit risk to the Federal Reserve.

In contrast to the auction credit facility, the nonadministered credit facility would significantly alter the interbank funding market as well as the roles of the various Federal Reserve policymaking bodies. The nonadministered facility would likely displace the Desk as the marginal source of reserves to financial institutions and would substantially alter banks' reserve management practices. The nonadministered facility might also displace most adjustment credit borrowing and thereby diminish the policy significance of the roles of Reserve Bank directors and the Board of Governors in setting the discount rate on adjustment credit. The auction credit facility, on the other hand, would not fundamentally change the interbank market and would involve relatively little change in the relative roles of the Board of Governors, the FOMC, and the Reserve Bank boards of directors.

If the Federal Reserve decides to introduce an auction credit facility or a nonadministered credit facility, it could begin by implementing one of the two types on a small scale to gain operational experience (an approach followed by the Treasury in 2000 in regard to its debt buyback program). The operational issues are numerous: the precise nature of the credit limits and eligibility requirements that would be applied; whether the methodology for determining collateral haircuts should be revised; how automated systems could be developed to support either of the two facilities; the method of auctioning advances; and the procedures for coordinating auctions of advances with Desk operations.

Beyond such operational issues, a small-scale facility would also provide a great deal of information about its effects on banks' behavior and on financial markets more generally. The System would be able to develop a better sense of the number and types of depositories that would participate, the extent to which an auction credit facility or nonadministered credit facility would affect bank's asset and liability management decisions, and whether overall patterns of financial intermediation and relative interest rates would be affected to a significant degree. As noted above, even in the context of fairly simple economic models, it is not possible to say with certainty what the final market outcomes would be. Moreover, there could well be significant unanticipated effects on financial markets or on the behavior of individual banks. Experience gained on all these issues from implementing a small-scale facility would inform the subsequent design of a full-scale auction or nonadministered credit facility.

Appendix 3.A

Current Discount Window Lending Arrangements

This appendix describes, in general terms, the statutory and regulatory basis for current discount window arrangements.¹ Statutory references to discount window lending address a variety of issues, including the technical aspects of the Reserve Banks' authority for discounts and advances, limitations on lending to institutions in weak financial condition, criteria determining access to the discount window, requirements for establishing discount rates, the availability of discount window loans as collateral to back Federal Reserve notes, and general requirements concerning the use of discount window credit. The Board's Regulation A defines the Federal Reserve's three basic lending programs and provides further guidance to Reserve Banks in their administration of the window more generally.

KEY STATUTORY PROVISIONS RELATED TO DISCOUNT WINDOW LENDING

The Federal Reserve Act authorizes Reserve Banks to extend credit to member banks either in the form of discounts of "eligible" paper or in the form of advances. A discount is similar in some respects to a repurchase agreement. In a discount arrangement, the Federal Reserve extends credit to a borrower by purchasing eligible paper at a discount from the borrower, with an agreement that the paper will either be delivered back to the borrower in return for payment of the outstanding loan or else retained by the Federal Reserve Bank until maturity. At the time of the founding of the Federal Reserve System, such extensions of credit were viewed as an important element of the so-called real bills doctrine, under which the central bank was to provide an "elastic currency" by lending against self-liquidating paper—principally short-term loans to businesses that were directly tied to commercial activity. As a result, section 13(2) of the Federal Reserve Act—the basic authority for Federal Reserve discounts to member banks in ordinary circumstances—limits discounting to obligations arising out of commercial transactions with maturity at the time of discount of ninety days or less.²

An advance is simply a loan secured by a pool of collateral. The basic authority for Reserve Banks to extend advances to member banks in ordinary circumstances is contained in sections 13(8) and 10B of the Federal Reserve Act. In extending an advance, the Federal Reserve acquires a security interest in the collateral pledged to secure repayment of the loan. Under section 13(8), Reserve Banks may extend advances with certain maturity restrictions against selected, rather narrow collateral categories, primarily government securities and assets that Reserve Banks are eligible to purchase under section 14(b) of the Federal Reserve Act. By contrast, under section 10B, Reserve Banks may extend advances to member banks against any satisfactory collateral. The Federal Reserve currently accepts a wide variety of instruments as collateral under section 10B, including customer notes, mortgages on one- to four-family homes, commercial real estate loans, credit card receivables, collateralized mortgage obligations, asset-backed securities, and a host of other common debt obligations. In general, almost any asset of adequate quality that

NOTE. James A. Clouse prepared this appendix.

1. This appendix is not a comprehensive analysis or discussion of all of the various authorities in the Federal Reserve Act under which Federal Reserve Banks may discount or otherwise lend.

2. Various other provisions cover discounting agricultural paper, "sight drafts," and banker's acceptances, but these would appear to be of limited use to the Federal Reserve in today's financial environment.

banks are allowed to hold in their portfolios may be pledged as collateral at the discount window. Advances under sections 13(8) and 10B are subject to certain maturity restrictions.³

FDICIA Limitations on Advances

In light of the difficulties in the banking industry during the 1980s and early 1990s, the Congress sought ways to speed the resolution of troubled depositories and to reduce the public costs of resolving those that failed. The basic framework for accomplishing this objective is laid out in the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA). FDICIA includes certain restraints on Federal Reserve lending to financially weak institutions. The restraints were intended to contribute to increased market discipline and to reduce resolution costs to the FDIC by avoiding situations in which Federal Reserve lending might effectively fund the flight of uninsured depositors from a failed institution

Under FDICIA, the Federal Reserve may lend to an undercapitalized depository institution for more than 60 days in any 120-day period beginning on the date the institution is determined to be undercapitalized only if (1) the head of the institution's federal regulator certifies in writing that the institution is viable or the Federal Reserve conducts its own examination of the institution and the Chairman of the Board of Governors certifies in writing that the institution is viable⁴ or (2) if the Federal Reserve elects to treat the institution as critically undercapitalized and any lending to the institution is subject to the limitations for critically undercapitalized institutions.

If the Federal Reserve lends to a critically undercapitalized depository institution beyond a five-day period beginning on the date it is determined to be critically undercapitalized, the Board of Governors may incur a limited liability to the FDIC.⁵ Any such lending to critically undercapitalized depositories must be reported to the Congress within six months. The Board of Governors' Regulation A states that Reserve Banks must consult with the Board of Governors before extending credit to critically undercapitalized depositories beyond the FDICIA limitations.

Access to the Discount Window

Access to the discount window historically was a privilege extended only to commercial banks that were members of the Federal Reserve System. With the passage of the International Banking Act of 1978 (IBA), branches and agencies of foreign banks operating in the United States gained access to the discount window. The IBA resulted in section 13(14) of the Federal Reserve Act, which specifies that any branch or agency of a foreign bank operating in the United States that

3. Under section 13(8), advances for periods up to fifteen days may be extended against Treasury securities and selected other asset categories. Advances for periods up to ninety days may be extended on collateral of the type that is eligible for discount or that may be purchased outright under the provisions of section 14(b). Under section 10B, advances may be extended against a member bank's time or demand notes that have maturities of up to four months and that are secured by satisfactory collateral. Advances against a member bank's time notes that are secured by mortgages on one- to four-family homes may have such maturities as are prescribed by the Board.

4. Such viability certifications apply for only sixty days; additional waiver periods require additional certifications.

5. The Board incurs a liability to the FDIC equal to the lesser of the "excess loss" to the FDIC associated with the Federal Reserve's lending or the interest on the Federal Reserve's loan. Excess loss is defined as the loss in excess of that which the FDIC would have realized had it liquidated the institution as of the end of the five-day period after the institution became critically undercapitalized. As with other Board expenses, Board liabilities under this provision would be charged against the combined income of all Reserve Banks before payment is remitted to the Treasury.

maintains reserves may have access to the discount window on the same terms as member banks. Access to the discount window was further broadened with the 1980 passage of the Monetary Control Act, which added section 19(b)(7) to the Federal Reserve Act. Section 19(b)(7) requires that any depository institution holding transaction accounts or nonpersonal time deposits (in other words, reservable liabilities) be given the same access to the discount window as member banks.

Discount Rates

Section 14 of the Federal Reserve Act indicates that Reserve Banks must establish rates of discount every fourteen days (or more frequently), subject to review and determination by the Board of Governors. When a change in the discount rate is requested by a Reserve Bank and approved by the Board of Governors, section 201.51 of Regulation A is revised accordingly.

“Emergency” Lending

The Federal Reserve Act also authorizes Reserve Banks to extend credit to individuals, partnerships, and corporations in certain circumstances. This lending authority is subject to strong limitations, however, and lending of this type has not occurred since the Great Depression. Section 13(13) authorizes Reserve Banks to extend advances to individuals, partnerships, and corporations against Treasury (and agency) securities for periods up to ninety days. The Board’s Regulation A specifies several conditions for section 13(13) advances: (1) they must be done in consultation with the Board, (2) they can be provided only when market funding sources are not available, and (3) in the judgment of the Reserve Bank, failure to provide such credit would have adverse effects on the economy. As a practical matter, given the requirements of Regulation A, the possibility of extending advances under section 13(13) seems rather remote in that any institution holding Treasury securities, for example, would be expected to sell those securities or use them in the marketplace for funding before turning to the discount window.

Under section 13(3), the Federal Reserve may, under quite restrictive conditions, extend credit to individuals, partnerships, and corporations in the form of discounts against a wide range of collateral. Before the enactment of FDICIA, the collateral eligible to be discounted under section 13(3) was generally limited to the types of assets that could be discounted in normal circumstances, that is, those defined by section 13(2). FDICIA altered the language of section 13(3) to allow for a rather broad range of collateral to be available for discount. But by statute, such lending is available only in “unusual and exigent circumstances” after approval by at least five members of the Board of Governors and only when adequate funding is not available from other sources. Regulation A specifies the additional lending criterion that the failure to extend such credit could have significant adverse consequences for the economy. For all loans to individuals, partnerships, and corporations, Regulation A requires that the rate charged be above the highest rate in effect for advances to depository institutions.

Discount Window Loans as Collateral for Federal Reserve Notes

Section 16 of the Federal Reserve Act specifies, among other things, the types of assets that may be used to back Federal Reserve notes. Before 1999, only discount window loans extended under section 13 of the Federal Reserve Act were available to back Federal Reserve notes. Now, under section 16, loans extended under the authority of section 10B (also sections 10A and 13A) may be used to back the currency. This change was implemented partly to address the potential for large volumes of discount window lending associated with the century date change. But the change is equally important for the consideration of discount window alternatives in this study because—at least under current law—any plan for replacing a significant volume of Treasury

securities in the System Open Market Account must identify alternative assets that could be used to back Federal Reserve notes.

REGULATION A: BOARD GUIDANCE TO RESERVE BANKS ON DISCOUNTS AND ADVANCES

The Board's Regulation A, among other things, defines the terms and conditions that apply to three regular lending programs—the adjustment, seasonal, and extended credit programs—and provides guidance to Reserve Banks on other aspects of the administration of the discount window.

The adjustment credit program is designed principally to assist depository institutions in meeting short-term funding needs. Credit is ordinarily provided at the basic discount rate, but a higher rate may be charged in certain circumstances, such as for funding shortfalls associated with a major operational or computer problem at the borrowing institution. In considering requests for adjustment credit, Reserve Banks must determine whether the request is appropriate and whether the borrower has pursued all reasonably available alternative sources of funds in the market. For large institutions that have regular access to national money markets, this requirement generally implies that advances are available only for brief periods—typically overnight. Smaller institutions that lack regular access to funding markets might be allowed to borrow more frequently and for somewhat longer periods. At one time, the Federal Reserve relied fairly heavily on a set of internal frequency guidelines to determine whether borrowing behavior was inappropriate. In recent years, borrowing frequencies have fallen considerably, and banks rarely exceed the frequency guidelines that were established in the early 1980s. Banks may be asked to supply to the Federal Reserve the daily balance sheet data for any maintenance period in which they have borrowed so that discount officers can assess whether borrowers were making inappropriate use of discount window loans.

Traditionally, adjustment credit has been viewed as the “safety valve” in the reserve market, acting as a passive source of additional reserves at times when market conditions are tight. The willingness of banks to turn to the discount window for adjustment credit has a direct bearing on the efficiency of adjustment credit in fulfilling this safety-valve role. Since the mid-1980s, banks appear to have become less willing to turn to the discount window, possibly thereby contributing to increased volatility in the federal funds rate at times. Some evidence indicates that the reluctance to borrow may have become less pronounced in recent years, but it still seems to be more prevalent than during the early 1980s.

The seasonal credit program is designed to address the funding needs of smaller institutions with a regular pattern of intra-yearly swings in their deposits and loans. Only institutions with less than \$500 million in total domestic deposits are eligible for the program,⁶ and most participants in the program are small agricultural banks (less than \$100 million in domestic deposits) in the midwestern Federal Reserve Districts. To qualify for the program, borrowers must demonstrate a seasonal funding need that lasts for at least four weeks, and they are required to meet a portion of that funding need from market sources. Since 1992, the rate charged on seasonal credit has been based on the average of the federal funds rate and the ninety-day certificate of deposit rate over the previous reserve maintenance period.

6. The requirement is contained in an S-letter dated March 19, 1985, from the Board of Governors (S-2487).

The extended credit program is designed to assist institutions in making longer-term balance sheet adjustments. Borrowers are expected to first exhaust all other market funding sources, and they are closely monitored while borrowing. The rate charged on extended credit is set at 50 basis points above the rate on seasonal credit.

Appendix 3.B

Basic Framework of the Discount Window Alternatives

We initially considered whether Federal Reserve loans could be increased substantially through the existing discount window programs as a way to offset a decline of Federal Reserve holdings of Treasury securities. We concluded that such an increase would not be consistent with the study's working assumptions. In general, the current discount window facilities tend to discourage borrowing from the Federal Reserve, not encourage it. Adjustment credit is intended for transitory funding needs; extended credit is intended for exceptional circumstances; and seasonal credit is intended for the seasonal borrowing needs of small depository institutions. The current discount window facilities for adjustment credit and extended credit involve a substantial degree of administration and monitoring by the Federal Reserve, which place nonpecuniary costs on borrowing institutions.

For banks to expand substantially their requests for Federal Reserve loans in this environment would require a significant increase in the spread between the actual federal funds rate and the basic discount rate to overcome rising nonpecuniary costs. The Federal Reserve could force the issue by cutting back nonborrowed reserves relative to required reserves, thereby pushing up the federal funds rate relative to the basic discount rate and forcing banks to seek adjustment credit. Actual borrowing would necessarily have to rise in this case. But experience suggests that banks would bid up the federal funds rate to well above the Federal Open Market Committee's (FOMC's) target level (thereby significantly widening the actual spread) before they would voluntarily borrow large quantities of funds at the existing discount window facility. Alternatively, the Federal Reserve could set the discount rate well below the target federal funds rate to induce greater borrowing. However, neither outcome is consistent with the study's working assumption that Federal Reserve lending should not involve a subsidy.

A fundamental change in the administration of the current discount window would be necessary to alter the need for a wide spread. But eliminating discount window administration and monitoring to encourage expanded borrowing by depository institutions when the basic discount rate is typically below the federal funds rate raises the usual concerns about lending at a subsidy rate and conflicts with the study's working assumption that any major expansion of Federal Reserve lending should not be done at a subsidy rate.

For these reasons, the existing discount window facility was deemed unlikely to serve as an effective vehicle for greatly expanded Federal Reserve lending as Treasury debt declines. A fundamental structural change seems necessary if Federal Reserve lending is to take on a substantially larger role in supplying Federal Reserve credit. Consequently, we concluded that, within the context of the study's working assumptions, the study's objectives were more likely to be achieved by developing a new lending facility. The following discussion assumes that the existing discount window lending programs are left intact. We recognize, however, that a new lending program may eventually lead the Federal Reserve to reconsider the design of its existing lending facilities.

ALTERNATIVE FEDERAL RESERVE LENDING FACILITIES

We eventually focused on two discount window alternatives: (1) auctions of Federal Reserve advances in which the Federal Reserve sets a quantity of credit and the lending rate is determined in the auction and (2) a credit facility in which Federal Reserve advances are made without the

administrative rules of the existing discount window and the lending rate is set equal to the intended (or target) federal funds rate. Both alternatives could be structured to achieve, to a large extent, the study's objectives.

Auctions of Federal Reserve Advances: The Auction Credit Facility

One alternative for expanding Federal Reserve lending as the Federal Reserve's holdings of Treasury securities decline would be to supplement existing lending arrangements with an auction facility that would allow only strong financial institutions to bid for discount window advances, though with a limit on the total amount of advances each depository institution could have outstanding at one time, as discussed in appendix 3.D.¹ The loan rate for these Federal Reserve advances would be determined in the auction. Loans made under this auction credit facility would not be subject to the discount window administration and monitoring used in the existing adjustment credit and extended credit programs. Most of the features of the auction credit facility are discussed in the main text of this chapter.

Introducing an Auction Credit Facility

As a way to introduce an auction credit facility and provide some transition to a longer-term auction program, auctions could initially be held just before the beginning of the two-week reserve maintenance period, thereby providing two-week loans instead of overnight loans. (For instance, the auction could be on the Monday, Tuesday, or Wednesday before the beginning of a reserve maintenance period.) In this case, to help depository institutions (hereafter, banks, a term intended to encompass commercial banks, thrift institutions, and credit unions) understand the Federal Reserve's objective when this new facility is first introduced, the Domestic Trading Desk could provide the markets with its estimates of reserve supply and demand for the two-week maintenance period, including its estimate of the aggregate amount of open market operations needed to balance supply and demand at the target federal funds rate—that is, the amount of open market operations that, when added to the amount of Federal Reserve advances auctioned, would balance supply and demand at the target federal funds rate, on average, over the two-week period.

During the reserve maintenance period over which the auctioned two-week Federal Reserve advances would be outstanding, other fluctuations in estimates of the demand and supply of reserves could be managed by the Desk's normal open market operations, but the open market operations would always provide fewer nonborrowed reserves (fewer by the amount of Federal Reserve advances auctioned) on average over the two-week maintenance period than it would if it were *not* auctioning advances. Because borrowing in the term federal funds market would be an alternative to bidding for funds through an auction credit facility, the auction-clearing interest rate for two-week Federal Reserve advances would likely be close to the going rate on two-week term federal funds or to rates on similar managed liabilities. (Note that the two-week term federal funds rate on September 1, 2000, was 6.56 percent, somewhat higher than the 6.50 percent target federal funds rate on that date.) If market participants expected the FOMC to change its target federal funds rate during the two-week reserve maintenance period, the bids in the auction would also reflect the market's expectation of how the federal funds rate would likely change over the term of the loan.

1. For domestic financial institutions, "strong financial institutions" are well-capitalized depository institutions with investment-grade ratings and current CAMELS ratings of 1 or 2. "Investment grade ratings" refers to investment ratings from public rating agencies and to depository institutions considered equivalent to those rated as investment grade. For foreign banking organizations, comparable eligibility criteria would apply.

As banks become accustomed to the auctions conducted for this new credit facility, and if the outstanding volume of Treasury debt continues to decline, the Federal Reserve could gradually increase the size of these auctions. As long as the amount auctioned grew gradually, it seems likely that banks could adjust to this new framework for supplying Federal Reserve credit to the financial system. Allowing banks time to gain experience with this auction system by starting out with small auctions would eventually allow the Federal Reserve to consider conducting much larger auctions. This line of reasoning suggests that the Federal Reserve might consider starting such an auction program well before the amount of Treasury debt outstanding has declined substantially. Over time, the Federal Reserve could introduce auctions at different frequencies (weekly, monthly, and so forth) as well as auctions of advances having longer or multiple maturities.

The Auction Credit Facility and Daily Open Market Operations

For an auction credit facility to approximate current open market operations, it would essentially have to conduct daily auctions of overnight advances. In principle, the Federal Reserve could hold daily auctions of overnight loans at the beginning of each day (similar to conducting open market operations at 9:30 a.m. each day). The maturity of such loans and the frequency with which auctions were held would have to balance several factors, including the operational costs associated with holding auctions of a given size and the desired degree of liquidity or flexibility in the size of the Federal Reserve's balance sheet.² In principle, such daily auctions, which might be used to manage short-term reserve needs, could be held in conjunction with other auctions of advances with longer terms that would be intended to replace Federal Reserve holdings of longer-term Treasury securities; the procedure would be similar to that in open market operations of longer-term repurchase agreements. However, daily auctions of advances would not be exactly the same as open market operations because advances typically do not provide immediately available funds to the financial system; they instead extend credit at the close of business (after the close of the Federal Reserve's Fedwire, typically after 6:30 p.m.).³ In addition, each auction could involve many more counterparties than do open market operations, which involve a relatively small number of primary dealers. Expanding discount window lending in a framework in which the Federal Reserve auctions very large volumes of overnight credit in the form of advances might be quite cumbersome. Instead, it seems operationally more convenient for the Federal Reserve to auction advances with somewhat longer maturities at regular intervals, perhaps even weekly.

2. The costs of conducting frequent auctions of advances would depend on the extent to which this process could be automated (see appendix 3.D).

3. This convention could presumably be changed if the Federal Reserve wanted to make auction credit facility loans more like open market operations in repurchase agreements or outright transactions. Currently a discount window loan is posted to a bank's reserve account before the close of business only when the bank requests it, and then the discount window loan would still be a twenty-four-hour loan, beginning at whatever time the loan was posted to the reserve account. In open market operations for repurchase agreements that use delivery-versus-payment (DVP) settlement procedures (which settle the same day) and for outright purchases of securities (which settle with a one-day lag), dealers have until 3:30 p.m. to deliver the collateral on the repurchase agreement or the securities to the Federal Reserve. In the case of DVP, reserves are credited immediately. In practice, dealers usually deliver collateral on DVP repurchase agreements by late morning or early afternoon of the same day, and on outright purchases usually by midmorning of the settlement day. In open market operations that use tri-party settlement, which the Desk has been using for repurchase agreements since 1999, one net transaction is made at 4:00 p.m. each day between the Federal Reserve and each of the two clearing banks.

Auctions of Longer-term Advances

The auction credit facility alternative need not attempt to manage short-term reserve positions to be helpful in replacing Treasury securities on the Federal Reserve's balance sheet, because the auction credit facility could be designed to complement, rather than replace, the Desk's open market operations. Conducting regular auctions of longer-term advances could play a significant role in supplying a base of Federal Reserve credit to support the Federal Reserve's liabilities (currency and reserves).

For example, the Federal Reserve could auction \$10 billion of three-month (thirteen-week) advances each week. That would allow the Federal Reserve to replace a total of \$130 billion in its holdings of Treasury securities on an ongoing basis after the first thirteen weeks of auctions. That amount of Federal Reserve credit, \$130 billion, would continue on the Federal Reserve's balance sheet as long as the weekly auctions of \$10 billion continued. Such ongoing weekly auctions would also give the Federal Reserve a source of liquidity in its balance sheet, because each week \$10 billion of auction credit facility loans would run off. In the event the Federal Reserve needed to quickly reduce the size of its balance sheet (perhaps because of the extension of an emergency loan to a troubled depository institution), the \$10 billion in auction credit facility advances that would run off the Federal Reserve's balance sheet each week could be used to make such an adjustment.

Note that to replace the more than \$500 billion of Treasury securities currently held in the System Open Market Account would require weekly auctions of three-month advances of more than \$35 billion. The Treasury has regularly auctioned about \$20 billion of three- and six-month bills each week, and Fannie Mae and Freddie Mac also conduct weekly auctions for sizable amounts, but not as much as \$35 billion. Federal Reserve auctions of advances of between \$10 billion and \$20 billion each week, however, would amount to between \$130 billion and \$260 billion of Federal Reserve assets on an ongoing basis, which would put a sizable dent in the Federal Reserve's need to replace its holdings of Treasury securities.

Auctions Based on Different Tranches of Eligible Collateral

An additional option would be to conduct separate auctions for different pools (or tranches) of collateral. For example, the Federal Reserve could restrict eligible collateral in one subset of an auction to the more-liquid or more-marketable types of collateral eligible for discount window borrowing and hold a separate auction for less-liquid or nonmarketable types of eligible collateral. Indeed, tranches for each auction could be delineated even more finely for various categories of collateral, yielding a large number of separate sub-auctions within the auction framework. Holding separate auctions for different tranches of collateral could increase the Federal Reserve's operational costs of implementing the auction credit facility. And holding auctions for narrower collateral pools might increase the likelihood that supply constraints for collateral would restrict the feasible size of any auction. There is also some risk that auctions based on narrow categories of collateral could be misinterpreted as a form of credit allocation.

In the absence of separate auctions based on different tranches of collateral, banks would probably submit their less-liquid and less-marketable assets as collateral to the Federal Reserve. As long as banks have an abundance of collateral that could be used to secure advances from the auction credit facility, however, they would probably post as collateral those less-liquid or less-marketable assets that are operationally easiest for them to deliver. If they are not set appropriately, the differential haircuts the Federal Reserve applies to different types of assets might influence the types of collateral pledged. Nevertheless, the Federal Reserve's exposure to risk would be limited by the specification of haircuts in combination with counterparty limitations

on lending to individual institutions and strict eligibility requirements for banks' participation in the auction credit facility.⁴ (Appendix 3.D includes further discussion of segregated auctions.)

Would Auctions of Federal Reserve Advances Achieve the Intended Objectives?

At this level of abstraction, and before discussing the operational or practical issues regarding such a facility, an appropriate question is whether the auction of Federal Reserve credit described here would achieve some or all of the objectives for a new lending facility.

1. Could such auctions replace some or all of the more than \$500 billion of Treasury securities the Federal Reserve already holds on its balance sheet?

Yes. An auction credit facility could be designed to replace Federal Reserve holdings of Treasury securities with Federal Reserve loans. But under current law (for advances under section 10B of the Federal Reserve Act), the longest term for these loans could be only four months unless the Board chose to lengthen the maturity of advances secured by one- to four-family mortgages (in which case the Board could set any maturity it chose). In contrast, open market operations can now add Treasury securities to the Federal Reserve's balance sheet with maturities as long as thirty years.

2. Could such auctions provide a mechanism to increase Federal Reserve assets in order to support the secular expansion of currency?

Yes. For example, the sizes of the auctions could be increased during the year to support the annual expansion of currency in circulation. Auctions of longer-term Federal Reserve credit might be used in much the same way that longer-term repurchase agreements, or perhaps bill passes, are used now in open market operations. But they could not be used to make the kinds of permanent additions that are achieved in open market operations when the Desk does coupon passes, in which it can purchase marketable assets with maturities as long as thirty years.

3. Could such auctions provide a mechanism to expand and contract Federal Reserve assets to support seasonal fluctuations in currency demand?

Yes. It could do so, for instance, by varying the amounts of auctions in different months or quarters during the year.

4. Could such auctions provide a sufficiently elastic supply of reserve balances to minimize day-to-day variations in the federal funds rate around the FOMC's intended, or target, level?

Yes, to some extent, but probably not by themselves. The auction lending facility could be designed to complement open market operations in addressing reserve needs and thereby help the Desk target a level of the federal funds rate. Conducting daily auctions of Federal Reserve credit to target the federal funds rate on a short-term basis, however, would not work exactly like open market operations, which provide immediately available funds, unless changes were made in the availability of such advances. In addition, the number of participants in auction credit facility auctions is potentially much larger than the number of primary dealers with which the Desk trades in open market operations. Furthermore, if the Federal Reserve were to auction overnight advances, the auction credit facility and the adjustment credit facility would be close substitutes for overnight funds. Use of the adjustment credit facility might dwindle further, which over time might significantly diminish the perceived importance for the conduct of monetary policy of the roles of the Reserve Bank boards of directors and the Board of Governors in setting the basic discount rate on adjustment credit.

4. See appendixes 3.D and 3.E for more discussion of auctions in relation to eligibility criteria and credit limits.

Is the Auction Credit Facility Consistent with the Working Assumptions of the Study?**1. Would the auction credit facility involve subsidies?**

No. The auction credit facility is a market-based mechanism for providing Federal Reserve credit to financial institutions. Because the auction rates would be determined in the marketplace, no subsidy would be involved. If longer-term loans were auctioned at fixed rates and the FOMC later raised its target level for the federal funds rate above the loan rate, a perception might arise that a subsidy had been created. But market expectations of future monetary policy are built into the structure of interest rates; therefore the fixed loan rate determined in the auction presumably would take into account the possibility that the Federal Reserve would change the target federal funds rate--that is, the auction rate should incorporate expected future interest rates. The longer-term loan rate determined in the auction is not a subsidy rate because the relevant comparison for the auction rate is to market interest rates on other longer-term sources of funds, not to the overnight interest rate on federal funds.⁵ One might argue that not all aspects of subsidy are eliminated because banks might pay the same auction credit facility loan rate even though some are less creditworthy than others; this concern would be mitigated by restricting participation in the auctions to strong financial institutions (see note 1) and requiring sufficient collateral to secure the advances (effectively making them very low risk).

2. Would the auctions allow the Federal Reserve continue pursuing an interest rate targeting strategy in which the FOMC's intended federal funds rate continues to play a central role in the implementation of monetary policy?

Yes, because the auctions would supplement, not replace, open market operations. The Desk's open market operations, which target a level of the federal funds rate, would remain the marginal source of reserves to the banking system.

Would Such Auctions Interfere with the Federal Reserve's Choice of Strategy for Implementing Monetary Policy?

Might an auction credit facility restrict the FOMC's ability to switch from interest rate targeting to reserves targeting in the implementation of monetary policy? The answer is, no. As is evident from the framework laid out above, the auction of a fixed quantity of Federal Reserve advances could be used with either target.

Summary

An auction credit facility would generally meet the objectives for a new lending facility that could expand the amount of loans on the Federal Reserve's balance sheet as its holdings of Treasury securities decline. In addition, an auction credit facility appears to be consistent with the study's working assumptions.

Federal Reserve Advances without the Usual Discount Window Administration: The Nonadministered Credit Facility

A second alternative for expanding Federal Reserve lending as the Federal Reserve's holdings of Treasury securities decline is to supplement the Federal Reserve's lending arrangements with what we will call a nonadministered credit facility, which would make advances only to strong financial institutions at an interest rate equal to the FOMC's intended federal funds rate and without the "administration" that characterizes the Federal Reserve's existing discount window

5. Longer-term advances could alternatively be made at floating rates tied to the target federal funds rate.

programs.⁶ In effect, the Federal Reserve would set the price at which it would elastically provide advances. The nonadministered facility would make Federal Reserve advances against acceptable collateral, with a limit on the total amount of advances each depository institution could have outstanding at one time. (The limits are discussed in appendix 3.D.) These individual limits are not expected to significantly constrain the ability of the nonadministered facility to supply a relatively large proportion of total Federal Reserve credit.⁷ By elastically providing overnight loans at a fixed rate equal to the target federal funds rate, the nonadministered facility would likely become the marginal source of funds to the banking system, whereas the Desk's open market operations provide the marginal source of funds under the current approach to implementing monetary policy (and would so under the auction credit facility that auctions longer-term advances).

Implications for Adjustment Credit.

Because nonadministered lending would be overnight, the nonadministered facility would curtail the role of the existing adjustment credit facility. The nonadministered facility, by design, would not have the administrative rules of the adjustment credit facility, so the nonadministered facility would place a cap on the nonpecuniary costs that eligible banks would be willing to bear to avoid borrowing at the adjustment credit facility. The availability of the nonadministered facility would also seem to make it impossible for eligible banks to meet the requirement (in the Federal Reserve's Regulation A) for obtaining adjustment credit, which is that they have exhausted all other reasonably available sources of funds.⁸ Thus, the current discount window's adjustment credit facility could become less active with the arrival of a nonadministered credit facility, a development that could call into question the importance of the roles of the Reserve Bank boards of directors and the Board of Governors in setting a basic discount rate on adjustment credit.

One way to make adjustment credit and nonadministered credit imperfect substitutes would be to allow access to nonadministered credit only early in the day and to adjustment credit only late in the day. (This procedure is similar to one used by the Bank of England in its monetary policy operations.) If borrowing from the nonadministered facility were allowed, say, only in the morning, then the Desk would want to conduct its open market operations after banks decided whether to borrow from the nonadministered facility. That would allow the Desk to make adjustments to nonborrowed reserves in response to changes in the amount of nonadministered facility loans outstanding. Otherwise, banks might borrow more than the Desk expected from the nonadministered facility, and if they did, the actual federal funds rate would tend to fall below the target federal funds rate by the end of the day. Such a situation could be avoided if the Federal

6. The eligibility criteria for participation in the nonadministered credit facility would be the same as for the auction credit facility: Domestic financial institutions would have to be well capitalized, be of investment grade, and have CAMELS ratings of 1 or 2; foreign banking organizations would have to meet comparable eligibility criteria. See appendix 3.D for a discussion of eligibility criteria.

7. Given the amount of collateral pledged as of June 30, 2000, the largest 100 banks could borrow about \$350 billion. Even if limits were placed on the amount individual institutions could borrow through the nonadministered facility, as suggested in appendix 3.D, the aggregate amount that just the largest 100 institutions could borrow would exceed \$440 billion. Banks would likely expand pledged collateral if the nonadministered facility were introduced, as they did when the Special Liquidity Facility was introduced in 1999.

8. Small banks may currently obtain adjustment credit for as long as a week or more, provided they meet Regulation A's requirement of having exhausted reasonable alternative sources of funds. Continued use of adjustment credit by small banks after the introduction of the nonadministered facility would require that the nonadministered facility not be considered a reasonably available alternative source of funds for those institutions.

Reserve had a "deposit facility" similar to those used by the European Central Bank and other countries. Then banks could return excess reserves to the central bank late in the day if the federal funds rate fell below the deposit facility's interest rate. A deposit facility is not investigated further here because the Federal Reserve's authority to pay interest on reserves may require a statutory amendment.

Two Variations on the Nonadministered Credit Facility

We considered and ultimately rejected two variations on the version of the nonadministered credit facility just discussed: a version in which the advances would be of longer term, and a version in which the outstanding amount of credit from the nonadministered facility would be kept below the level of total demand for Federal Reserve credit.

Longer-term advances from the nonadministered facility. To provide a more stable source of Federal Reserve credit to the financial system, to reduce the costs of rolling over large amounts of Federal Reserve advances at frequent intervals, and to avoid the possibility that the nonadministered credit facility would interfere with the functioning of the adjustment credit facility, the Federal Reserve could consider extending the maturity of the advances granted by the nonadministered facility. The advances might be for three months, as was discussed for the auction alternative. Even with such longer-term loans, the amount of Federal Reserve credit extended by the nonadministered facility would still be demand-determined, with the lending rate set in advance.

Having the central bank target a longer-term interest rate, such as a three-month rate, would be possible so long as it was not also trying to set a shorter-term rate. If the Federal Reserve were also trying to target an overnight federal funds rate (perhaps using open market operations to do so), then the Federal Reserve would essentially be setting the term structure of interest rates over a portion of the yield curve. If this term structure was different from the market-determined structure, the volume of longer-term advances would rise or fall considerably, depending on whether the three-month nonadministered facility rate was seen as a subsidy rate or a penalty rate. Even a three-month floating-rate loan tied to the overnight federal funds rate could involve some distortions if the spread of the nonadministered facility's rate above overnight rates were not in accord with market spreads.

If instead the Federal Reserve offered longer-term advances at a fixed rate from the nonadministered facility and did not attempt to target the overnight federal funds rate using open market operations, then statements about the stance of monetary policy would have to be couched in terms of the longer-term rate at the nonadministered facility. The overnight federal funds rate would be determined in the marketplace, although it would be influenced by the target level of the nonadministered facility rate.

Limiting the nonadministered credit facility. We also considered a variant of the nonadministered facility in which the maximum quantity of its credit would be fixed at a level well below the total demand for Federal Reserve credit; this feature would ensure that open market operations would continue to be the marginal source of funds to the financial system. In this version of the nonadministered facility, the Federal Reserve would be offering a fixed quantity of Federal Reserve advances at a fixed price, and the facility would become similar to a former program of the European Central Bank (ECB), in which it offered a fixed amount of repurchase agreement tenders at a fixed price. The ECB discontinued that program in 2000 because of problems caused by overbidding. This version of the nonadministered facility also bears some resemblance to the Bundesbank's rediscount facility that rationed certain amounts of credit to banks at a fixed rate, although the rediscount rate was below market.

Fixing the amount of credit available from the nonadministered facility poses the problem of allocating the credit among banks. One possibility is to do so on the basis of their capital. Any nonprice mechanism would, however, raise questions of fairness. Consequently, although such a nonprice allocation scheme may be feasible, we were led to consider the obvious alternative of allocating the fixed amount of advances via a market mechanism, but that simply brought us back to the auction alternative (the auction credit facility) described above.

Because neither of these two variations of the nonadministered facility appears to be clearly superior to the original version or to the auction alternative, they were not developed further.

Would a Nonadministered Credit Facility Achieve the Intended Objectives?

Before discussing the operational or practical issues involved in such a facility (see appendix 3.D), we consider whether a nonadministered credit facility would achieve some or all of the objectives for a new lending facility.

1. Could a nonadministered facility replace some or all of the more than \$500 billion of Treasury securities the Federal Reserve already holds on its balance sheet?

Yes. As the Federal Reserve's holdings of Treasury securities decline, the nonadministered facility could serve as an alternative source of Federal Reserve credit. Certainly, eligible banks would use it when the federal funds rate rose above the target federal funds rate. These nonadministered facility loans would be overnight, however, whereas open market operations can be used to purchase marketable assets with maturities as long as thirty years.

2. Could a nonadministered facility provide a mechanism to increase Federal Reserve assets in order to support the secular expansion of currency?

Yes. But it could not be used to make the kinds of permanent additions that are achieved by open market operations when the Desk purchases marketable assets having much longer maturities.

3. Could a nonadministered facility provide a mechanism to expand and contract Federal Reserve assets to support seasonal fluctuations in currency demand?

Yes. Because a nonadministered facility would provide Federal Reserve advances elastically at the target federal funds rate, variations in banks' seasonal demands for reserves would be accommodated by similar variations in the amounts of Federal Reserve advances made through the nonadministered facility.

4. Could a nonadministered facility provide a sufficiently elastic supply of reserve balances to minimize day-to-day variations in the federal funds rate around the FOMC's intended, or target, level?

Yes. In fact, because loans under the nonadministered facility are overnight and made elastically at an interest rate equal to the target federal funds rate, thereby establishing a cap on the actual federal funds rate, the nonadministered facility would be more likely to minimize day-to-day variations in the federal funds rate than either the current procedure for implementing monetary policy or the auction credit facility. By providing advances at the target federal funds rate, the nonadministered facility would not convey to the Federal Reserve any market price signals about reserve conditions, in contrast to current open market operations or to the auction facility's auction process.

Is a Nonadministered Credit Facility Consistent with the Working Assumptions of the Study?

1. Would the non-administered credit facility involve a subsidy?

No explicit subsidy would be present if nonadministered facility loans were overnight because the loan rate would not be below the FOMC's target federal funds rate. On the other hand, because loans from the nonadministered facility would be made at the target federal funds rate, banks would face no uncertainty about the actual cost of obtaining funds, apart from an unexpected policy change in the FOMC's target federal funds rate. In contrast, normal transactions in the funds market, even those involving Desk operations, always contain some uncertainty about the actual cost of obtaining funds. This difference suggests that banks would find loans from the nonadministered facility more attractive than other sources of funds that have the same expected cost of borrowing, and this preference might be viewed as the expression of an implicit subsidy. But the difference would not likely be so large that it would be perceived as a large subsidy.

A potential subsidy might be present in lending to all borrowers at the target federal funds rate because some banks might be less creditworthy than others. That is, the rate at which the Federal Reserve would lend could be lower than the market rate normally required of some banks. Restricting eligibility for nonadministered facility participation to strong financial institutions and requiring sufficient collateral to secure the advances (effectively making them very low risk) would tend to mitigate this concern but might not eliminate it.

2. Does the nonadministered facility accommodate an interest rate targeting strategy in which the FOMC's intended federal funds rate continues to play a central role in the implementation of monetary policy?

Yes. A nonadministered facility would be consistent with an interest rate targeting strategy in which the FOMC determined an intended federal funds rate target. But because the nonadministered facility would lend at the target federal funds rate, and because the nonadministered facility would likely replace the Desk's open market operations as the marginal source of funds to the banking system, the role of the Desk in the conduct of monetary policy might become significantly different than it is today and might diminish over time. The nonadministered facility would represent a fundamental departure from the current approach to implementing policy decisions. Furthermore, some of the institutional framework that supports the current procedures used to implement policy decisions might become superfluous; this framework includes the use of reserve and clearing balance requirements to establish a predictable level of demand for reserves amid uncertainty about payment flows and reserve supply..

Would a Nonadministered Credit Facility Interfere with the Federal Reserve's Choice of Strategy for Implementing Monetary Policy?

A nonadministered facility would be more consistent with an interest rate targeting procedure than a reserves targeting procedure for the implementation of monetary policy, basically because the nonadministered facility is a Lombard-style lending facility that sets the Lombard rate equal to the target overnight interest rate.

Summary

The nonadministered facility would generally meet the objectives for a new lending facility that could expand the amount of loans on the Federal Reserve's balance sheet as its holdings of Treasury securities decline. In particular, the nonadministered facility would increase the precision with which the Federal Reserve hits its federal funds rate target. The nonadministered facility would also be generally consistent with the working assumptions of the study, although it might raise some concern about an implicit subsidy because it would eliminate uncertainty about the cost of funding and would grant all borrowers the same rate. Restricting eligibility for

nonadministered facility participation to strong financial institutions and requiring sufficient collateral to secure the advances from the nonadministered facility would mitigate the concern that some borrowers might be receiving a rate lower than that available to them in the market.

Appendix 3.C

The Potential Effects on Financial Markets and Institutions of Replacing the SOMA's Treasury Securities with Advances of Federal Reserve Credit

This appendix considers the effects of using advances to depository institutions as a replacement for Treasury securities now held by the System Open Market Account (SOMA). Replacing some or all of the SOMA's Treasury securities with advances to banks would likely lead to an expansion of the role of banks, relative to that of the financial markets, in providing funding to nonfinancial firms. That expansion of the banks' role might be accompanied by a change in interest rates on bank loans and deposits relative to yields on market instruments. Nonetheless, replacing the SOMA's Treasuries with advances would be unlikely to change the *average* level of interest rates. Essentially the same conclusions follow when we analyze the effects of accommodating an increase in the demand for currency by expanding advances to banks rather than by purchasing Treasury securities.

The following discussion progresses from "macro" to "micro" issues. The first part presents a general discussion of the likely effects on the financial sector as a whole and of the likely absence of effects on the aggregate economy. The second part analyzes the effects of introducing an auction credit facility or a nonadministered credit facility in the context of a model that disaggregates the financial sector into two components: depository institutions and direct markets. The model provides insight into the reasons the role of depository institutions would likely expand relative to the role of markets. The third part provides additional insight into the possible effects on depository institutions by analyzing the auction credit facility and nonadministered credit facility in a somewhat more detailed model of the banking sector, but it ignores the implications for financial markets. Both models indicate that the banking sector would likely grow. The fourth part expands on the basic conclusions by considering a wider range of bank assets and liabilities and analyzing the likely response of individual banks.

Although the motivation for this study of monetary policy operations is the ongoing decline in the stock of Treasury securities, in this appendix we wish to analyze the effects of a change in the way the Federal Reserve provides reserves rather than the effects of a declining stock of Treasury securities. From an analytic perspective, we do so by asking how replacing some or all of the Treasury securities held by the SOMA with advances to depository institutions would *change* financial sector equilibrium *relative to what it would be otherwise*; that is, we abstract from the effect of the ongoing change in the total stock of Treasury securities on market interest rates to focus on the Federal Reserve's actions.

REPLACING TREASURY DEBT IN THE SOMA WITH ADVANCES TO BANKS IS UNLIKELY TO AFFECT THE AVERAGE LEVEL OF INTEREST RATES OR MACROECONOMIC CONDITIONS

The shift from budget deficits to budget surpluses that occurred during the 1990s (a shift that reflects an increase in effective tax rates and slower growth in federal purchases) appears to have lowered yields on Treasury debt relative to privately issued debt, raised national saving, and contributed to an increase in the share of gross domestic product devoted to real investment. Because we do not have complete markets in state-contingent claims (markets that price each and every risk in all possible future states of the world), a future decline in the stock of Treasury

debt—the "riskless" asset—may have further effects on the average level of interest rates and on the spread between yields on Treasuries and yields on other securities. But replacing Treasury securities in the SOMA portfolio with advances to depository institutions (hereafter, banks, a term intended to encompass commercial banks, thrift institutions, and credit unions) while making no change in the monetary base or in the ultimate objectives of monetary policy seems unlikely to change the average level of interest rates from what it would be otherwise.

To see why, suppose the U.S. Treasury uses \$50 billion of its budget surplus to redeem maturing securities held by the Federal Reserve. To do so, the Treasury moves \$50 billion from Treasury tax and loan accounts to its account at the Federal Reserve. That action reduces the supply of loanable funds and the monetary base by \$50 billion (as shown by shifts labeled 1 in the top and bottom panels of diagram 3.C.1). The Federal Reserve then debits the Treasury's account as the securities are redeemed. Under the current operating procedure the Federal Reserve would acquire \$50 billion of Treasury securities to replace those that matured, and would pay for the new securities by creating new bank reserve deposits, thereby increasing the supply of loanable funds and the monetary base by \$50 billion (diagram 3.C.1, shifts labeled 2). The Treasury's action and the Federal Reserve's response would combine to produce zero *net* change in the supply of loanable funds and the monetary base. None of these actions would affect the demand for loanable funds or high-powered money, so the net effect would be to leave the level of interest rates unchanged.

Suppose that instead of buying additional Treasury securities to replace those that mature, the Federal Reserve were to extend \$50 billion of advances to depository institutions, making the funds available by creating new reserve deposits. The effect would be to increase the supply of loanable funds and the monetary base by \$50 billion, just as if the Federal Reserve had purchased Treasury securities. At this level of abstraction, extending advances to depository institutions to replace maturing Treasury securities in the SOMA has the same effect as buying other Treasury securities to replace those that mature; each action would combine with the Treasury's action to leave the supply of loanable funds, the monetary base, and the average level of interest rates unchanged.

As a result, replacing some or all of the Treasury securities in the SOMA portfolio with advances to banks would be unlikely to affect macroeconomic aggregates in any significant way. There is no reason to think that inflation would change, so long as the FOMC's underlying objectives were unchanged. (Replacing the SOMA's Treasuries with advances to banks would not, by itself, affect money growth or the natural rate of unemployment. Nor would it affect labor markets or firms' price setting behavior.) With no change in the level of nominal interest rates and no change in inflation, the level of real interest rates would also be unchanged. Replacing Treasuries in the SOMA portfolio with advances to banks would not be expected to affect the linkages between spending and real interest rates on the demand side of the economy. On the supply side of the economy, production would continue to be determined by the application of labor, capital, and technology. There is no reason to think that replacing Treasuries in the SOMA portfolio with advances to banks would affect supplies of those factors of production. Taken together, these arguments indicate that there is no reason to expect that a decision to replace Treasury securities now in the SOMA portfolio with advances to banks would, by itself, have first-order macroeconomic effects.

Although replacing Treasury securities in the SOMA portfolio with advances to banks would be unlikely to have noticeable effects at the macro level, it would make some difference at the micro level. If the Federal Reserve was to replace \$50 billion of maturing Treasury securities in the SOMA with advances to banks, the private sector would find itself holding \$50 billion more

Treasury securities than if the Federal Reserve had replaced maturing securities by acquiring other Treasury securities.¹ On the other hand, if the Federal Reserve was to replace maturing Treasury securities by advancing funds to banks rather than by acquiring other Treasury securities in the open market, the private sector would find itself holding \$50 billion less in claims on banks, at least initially.² Thus, the private sector's portfolio adjustments, and their effects on relative interest rates might differ even if there was no effect on the average level of interest rates. Moreover, introducing an auction credit facility or a nonadministered credit facility would likely lead to some change in the size of the banking system and in patterns of financial intermediation.

DEPOSITORIES WOULD LIKELY GROW RELATIVE TO NONDEPOSITORY INTERMEDIARIES IF THE FEDERAL RESERVE WAS TO REPLACE MATURING TREASURY DEBT IN THE SOMA WITH ADVANCES TO BANKS. IN ADDITION, RELATIVE INTEREST RATES MIGHT CHANGE

Although the simple, aggregate representation of the financial sector discussed above provides a useful benchmark, it is highly stylized and cannot answer some important questions. First, would replacing some or all of the SOMA's Treasury securities with advances via an auction credit facility or nonadministered credit facility increase the size of the banking sector? Second, would replacing some or all of the SOMA's Treasury securities with advances to banks affect relative rates of return across financial instruments? The answer to the first question is that the size of the banking sector most likely would increase. The answer to the second question is unclear. The effect on relative interest rates would depend on the degree of substitutability between various financial instruments and perhaps also on differences in the cost structures of various kinds of financial intermediaries.

Analyzing the effects of an auction facility or nonadministered facility program on different financial assets in full general equilibrium models yields few clear-cut results.³ But somewhat simpler models offer useful insights about the forces at work. The following discussion uses two models to investigate the questions posed in the preceding paragraph. The first is a portfolio-balance model of the financial sector that incorporates four types of agents (households, depository institutions, nonfinancial firms, and the Federal Reserve) and five financial instruments (bank deposits, bank loans, Treasury bills, short-term corporate paper, and currency). The second is a more detailed model of the banking industry that highlights some important margins of substitution in that industry but abstracts from the rest of the financial sector. Both models predict an increase in the size of the banking industry. Because the two models make different simplifying assumptions and focus on different margins, it is not surprising that they can lead to somewhat different predictions for relative interest rates.

1. If the Federal Reserve was to acquire new securities via an add-on to a Treasury auction, the effect on the private sector's holdings of Treasury securities would be the same as if the Federal Reserve had acquired them by conducting an open market operation. In the former case, the Treasury would need to issue fewer securities because the Federal Reserve would, in effect, be providing part of the funding the Treasury needed to pay its expenses or to redeem maturing securities.

2. The reason is that an open market purchase of securities by the Federal Reserve (or a redemption by the Treasury) would initially put payment for the securities into sellers' bank accounts. Advances from the Federal Reserve to banks would not generate an initial increase in bank deposits.

3. See Dean Croushore, "A Short-term Model of the Federal Reserve's Portfolio Choice" (Federal Reserve Bank of Philadelphia, October 2000).

Some Observations based on General Intuition

As discussed earlier, a reduction in the SOMA's holdings of Treasury securities offset by an increase in advances to banks would leave private agents holding a larger quantity of Treasury securities than they otherwise would (larger by the amount the Federal Reserve no longer held), and banks' borrowings from the Federal Reserve would increase an equal amount. In general, private agents will respond to the increase in their holdings of Treasuries by attempting to reduce their holdings of financial assets that they consider close substitutes for Treasury securities.

The direction and magnitude of changes in relative rates of return on various financial assets, or in quantities of those assets, that would result from those portfolio adjustments would depend largely on the degree to which households, businesses, and banks were willing to substitute between different types of borrowing and lending. One possibility is that banks, given the opportunity to borrow from the Federal Reserve, would willingly acquire Treasury securities. In this case, banks' assets and liabilities would expand but deposits, loans, and interest rates would not necessarily change.⁴ Another possibility is that households would be quite willing to hold additional Treasury securities and to substitute away from bank deposits (including managed liabilities) and that banks would readily obtain advances from the Federal Reserve to replace the lost deposits. If that occurred, there would be little if any change in interest rates on Treasury bills or deposits and little if any change in the size of the banking system. Or households might be unwilling to hold fewer deposits but quite willing to hold additional Treasury securities and to substitute away from debt issued by nonfinancial firms (substituting away either directly by holding less corporate paper or indirectly by holding smaller money market mutual fund balances). Those nonfinancial firms might readily turn to banks, which would rely on advances from the Federal Reserve to fund the increased demand for loans. In this case, the banking system's total assets and liabilities would expand. How much relative interest rates would change in this case would depend on whether nonfinancial firms consider bank loans and market debt good substitutes or poor substitutes.

In general, we would expect to see a mix of such adjustments. Thus, it seems likely that banks' balance sheets would expand, but by less than the full amount of new Federal Reserve credit they borrow. Whether interest rates on various assets and liabilities would adjust as a result would depend on the degree of substitutability among them.

A Portfolio-Balance Model for Analyzing the Effects of an Auction Credit Facility or Nonadministered Credit Facility on the Financial Sector

To gain additional insight into the potential effects of replacing some or all of the SOMA's Treasury securities with advances to banks, begin with a simplified representation of the financial sector. Consider a portfolio-balance model with four types of agents: households, depository institutions, nonfinancial firms, and the Federal Reserve. As summarized in the balance sheets below, households own currency, Treasury bills, bank deposits, and short-term corporate paper; they may borrow from depositories.⁵ Depositories make loans to households and nonfinancial

4. In a straightforward variant of this scenario, primary dealers might acquire the Treasury securities the Federal Reserve no longer holds, and finance the acquisition by borrowing from banks that raise funds by borrowing from the Federal Reserve via the auction facility or nonadministered facility.

5. Currency plays no role in analyzing the effects of replacing Treasury securities in the SOMA portfolio with advances to banks, but including currency does allow us to use this framework to analyze the implication of using advances to accommodate an increase in the demand for currency.

Households		Depository Institutions	
Currency	Loans from banks	Loans to households	Deposits
Treasury Bills		Loans to firms	Advances
Deposits	Net worth		Owners' equity
Corp. paper			
Nonfinancial firms		Federal Reserve	
Real capital	Loans from banks	Treasury Bills	Currency
Inventories	Corp. paper	Advances to banks	
	Owners' equity		Capital and surplus

firms; they fund themselves with deposits and advances from the Federal Reserve.⁶ Nonfinancial firms own real capital and inventories; they fund themselves with bank loans and directly placed corporate paper. The Federal Reserve owns Treasury bills and makes advances to banks; currency is its liability. Although it is fairly simple, this model has enough detail to shed light on the issue at hand.

As is standard for such models, assume that a private agent's demand for any asset is positively related to that asset's rate of return and to the agent's net worth but negatively related to rates of return on alternative assets and the rate the agent pays on its liabilities. Thus, banks face an upward-sloping supply of funds from households; the same is true of nonfinancial firms. Assume that the Federal Reserve targets the level of interest rates and supplies the quantity of currency that households wish to hold at the target interest rate.

Simplifying assumptions make the problem of finding an equilibrium set of asset quantities and rates of return manageable. Assume that the federal budget surplus is unaffected by the Federal Reserve's choice between making advances to banks or holding Treasury securities. Then the total stock of Treasury bills can be taken as exogenous and the Federal Reserve's holdings determine the quantity that must be held by households. Assume also that both the stock of real capital owned by nonfinancial firms and their desired level of inventories are unaffected by the Federal Reserve's choice. Then the same is true of owners' equity in their firms. These assumptions mean that nonfinancial firms' total financing needs are invariant to the Federal Reserve's choice of holding Treasuries or making advances. Similarly, it is reasonable to treat households' net worth, their demand for currency, and the Federal Reserve's capital and surplus as independent of the composition of the Federal Reserve's assets. If the demand for currency is not

6. As we will see later, allowing banks to hold Treasury bills does not change the qualitative results.

affected by the Federal Reserve's choice between advances and Treasuries, the size of the Federal Reserve's balance sheet is invariant to the choice.

In addition, make four strong behavioral assumptions. First, assume that at the margin banks compete to attract deposits (including managed liabilities) from the cheapest source, so that in equilibrium, the marginal cost of funds (the all-in cost) from any type of deposit equals the marginal cost of funds from all other types. Second, assume that banks display no reluctance to borrow from a new Federal Reserve credit facility that is clearly separate from the current discount window, so that in equilibrium, the rate banks pay for the marginal dollar of advances (i_A) equals the all-in cost they pay for the marginal dollar of deposits (i_D). Thus, $i_A = i_D$ in equilibrium. Moreover, the all-in cost of the marginal dollar of deposits and advances equals the federal funds rate, which the FOMC sets at a level consistent with its macroeconomic objectives. Third, assume that banks set the interest rate on loans (i_L) at a constant markup (m) over the rate they pay on deposits (i_D), so that $i_L = i_D + m$. (In equilibrium, the markup will be just large enough to allow banks to earn the required rate of return on equity.) Finally, assume that nonfinancial firms seek to borrow as cheaply as possible and that they view bank loans and directly issued debt as perfect substitutes at the margin (and that some firms have the choice of borrowing from banks or issuing debt directly in the market), so that interest rates on bank loans (i_L) and directly placed corporate paper (i_{CP}) must be equal in equilibrium; that is, $i_{CP} = i_L$.⁷ A variety of results depend critically on this last assumption. We will relax this assumption later.

Given these simplifying assumptions, finding an equilibrium reduces to finding one interest rate (the rate on bank loans) and four quantities. The four quantities are as follows:

- Banks' loans to households
- Banks' loans to nonfinancial firms
- Corporate paper held by households
- Either the quantity of deposits held by households (if the Federal Reserve offers an auction facility and sets the quantity of advances) or the quantity of advances (if the Federal Reserve offers a nonadministered facility and lends at the target federal funds rate) that is consistent with the federal funds rate set by the FOMC.

An initial equilibrium—before the Federal Reserve replaces Treasury securities held by the SOMA with advances to banks—can be represented by the two panels in diagram 3.C.2. The upper panel represents an initial equilibrium for banks' loans and deposits. Banks face a downward-sloping demand for loans and an upward-sloping supply of funds (deposits and managed liabilities). Given the assumption that the interest rate banks charge on loans is a constant markup above the rate they pay for funds, banks' supply-of-loans schedule lies above and parallel to the line that shows the supply of funds to banks. Initially, the SOMA holds a sufficient quantity of Treasury bills—and thus supplies a sufficient quantity of outside money—to put the supply-of-funds schedule in the correct position to make the federal funds rate, and thus

7. This final assumption seems reasonable if we think of large firms dealing with large banks, though it is not true for all firms. Alternatively, we could assume that money market mutual funds exist in the background, and that managers of money market funds treat corporate paper and wholesale bank deposits as perfect substitutes at the margin. The latter assumption would lock together interest rates on wholesale deposits and corporate paper and, with a constant spread between rates on bank deposits and loans, would also lock together interest rates on corporate paper and loans. Note that none of the results described below would change if we assumed a constant spread between interest rates on loans and corporate paper.

the "deposit" rate, equal to the FOMC's target for the funds rate. The resulting equilibrium determines the total quantities of deposits and loans.

The bottom panel of diagram 3.C.2 represents an initial equilibrium for nonfinancial firms' financing. Firms' total demand for credit is drawn as inelastic, consistent with the empirical evidence that the interest elasticity of business investment spending is low, at least in the short run. Firms face an upward-sloping supply of funds from the public. The equilibrium in this panel shows how much firms borrow directly from the public and how much they borrow from banks. Taken together, the two panels also show how much banks lend to households (banks' total loans minus their loans to nonfinancial firms). We do not wish to focus on the market for Treasury bills, so we do not show that market separately.

The Implications of Replacing the SOMA's Maturing Treasury Securities by Extending Advances via an Auction Credit Facility Depend on the Extent to which Nonfinancial Firms Are Willing to Substitute Bank Loans for Marketable Debt

Suppose the Federal Reserve allows \$50 billion of maturing Treasury bills to run off its balance sheet and replaces them by auctioning \$50 billion of advances to banks. (Some banks will find themselves short of funds and reserves when the Federal Reserve holds fewer Treasury bills and therefore will have an incentive to bid for advances.) What adjustments are households, banks, and nonfinancial firms likely to make? What are the implications of those adjustments for the size of the banking system and for yields on various financial instruments?

As discussed above, by allowing \$50 billion of maturing securities to run off its balance sheet, the Federal Reserve increases the quantity of Treasury bills held by households by \$50 billion (relative to what they would hold if the Federal Reserve did not reduce the quantity of Treasury bills in the SOMA) and—at least initially—reduces "deposits" in the banking system by \$50 billion. That reduction in deposits shifts the supply of funds to banks, and thus banks' supply-of-loans schedule, to the left by \$50 billion—as shown by shift 1 in the top panel of diagram 3.C.3. Faced with a shortage of funds, banks have a strong incentive to bid for the \$50 billion of advances the Federal Reserve wishes to auction. Those advances shift the supply of funds to banks, and thus banks' supply-of-loans schedule, back to the right by \$50 billion (*ceteris paribus*), as shown by shift 2 in the top panel of diagram 3.C.3. (The line showing the supply of funds to banks is suppressed in diagram 3.C.3, to avoid clutter.)

Although banks appear to be in equilibrium at this point, that is not necessarily true of households. Unless households view Treasury bills and bank deposits as perfect substitutes, they will attempt to replenish their deposits, at least in part, by selling corporate paper or borrowing from banks. In general, they will adjust along each margin. To gain insight into the implications of their adjustment, consider special cases before the general case.

First, suppose households seek to replenish their deposit balances (or, equivalently, to finance their acquisition of additional Treasury bills) by holding \$50 billion less of corporate paper. The supply of funds from households to nonfinancial firms shifts to the left by \$50 billion, as shown by shift 3 in the bottom panel of diagram 3.C.3, putting upward pressure on market rates. If the interest rate on bank loans were unchanged, nonfinancial firms would seek to borrow \$50 billion more from banks (so that the total demand for credit from banks shifts to the right by \$50 billion, as shown by shift 4 in the top panel, and would use the proceeds to repay households. Households would deposit the proceeds in bank accounts (because they seek to replenish their deposit balances), generating a \$50 billion rightward shift in the supply of funds to banks (shift 5 in the top panel). The outcome, when households replenish their deposit balances (or

equivalently, finance their acquisition of Treasury bills) solely by selling corporate paper, is that the Federal Reserve's new advances to banks finance a \$50 billion expansion of banks' assets. Because the total supply of funds to banks (from deposits and advances) shifts by the same amount as the total demand for credit from banks, the new equilibrium requires no adjustment in interest rates on corporate paper, bank loans, or deposits.⁸

Alternatively, suppose that households seek to borrow from banks to replenish their deposit balances (or, equivalently, to finance their increased holding of Treasury bills). Begin from the initial equilibrium shown by the dashed lines in diagram 3.C.4. As before, the Federal Reserve's actions in allowing maturing Treasury securities to run off from the SOMA portfolio and replacing them with advances to banks have offsetting effects on the supply of funds to banks (shifts 1 and 2 in diagram 3.C.4). In this case, however, there is no shift in the supply of funds from households to nonfinancial firms, so nonfinancial firms' demand for loans from banks need not change. Although firms' demand for loans does not change, there is a \$50 billion rightward shift in households' demand for loans from banks (shift 3). And as before, there is a \$50 billion rightward shift in the supply of funds to banks, and thus in banks' supply-of-loans schedule, as households replenish their deposits (shift 4). In the new equilibrium, banks' total assets expand by \$50 billion, but there is zero net change in their deposits (including managed liabilities). The new assets are funded by the \$50 billion in new advances from the Fed. As in the previous case, we see equal shifts in the supply of funds to banks and in the total demand for credit from banks, so the new equilibrium requires no change in interest rates on deposits, loans, or corporate paper.⁹

At the other extreme, suppose households seek to adjust their portfolios (or equivalently to finance their purchase of additional Treasury bills) solely by holding fewer deposits, so that the supply of funds from households to banks shifts to the left by \$50 billion. As discussed earlier, that leftward shift in the supply of funds to banks would be exactly offset by the rightward shift resulting from the new advances to banks, with the result that banks' supply-of-loans schedule is unaffected. The supply of funds from households to nonfinancial firms is also unaffected, so firms do not need to borrow more from banks. The outcome is that the increased quantity of Treasury bills held by households displaces \$50 billion of "deposits" at banks, but those deposits are replaced by advances from the Fed. Because there is no net change in the supply of funds to banks or firms, and no change in the demand for credit from banks, the new equilibrium requires no adjustment in interest rates on corporate paper, bank loans, or deposits.

If households adjust along all three margins (that is, if they hold fewer deposits and less corporate paper, and they borrow somewhat more), the outcome will be a combination of the three cases discussed above. In this more general case, banks' balance sheets will expand as they make more loans to households and to nonfinancial firms, but banks' assets will expand by less than the \$50 billion increase in advances because households end up holding fewer deposits than in the initial

8. We would see the same outcome if households sought to finance their acquisition of additional Treasury bills by holding smaller balances in money market mutual funds. Managers of money market funds would respond by holding less corporate paper, and nonfinancial firms would turn to banks.

9. Another special case is that banks rather than households purchase the increase in the supply of Treasury bills that becomes available to the private sector when the Federal Reserve lets some Treasury bills run off from the SOMA portfolio. (This situation could arise if households view Treasury bills as poor substitutes for the other assets they hold but banks view Treasury bills as very good substitutes for loans.) In that case, banks use the new advances to fund the purchase of Treasury bills rather than to fund loans or displace deposits, so banks' balance sheets expand. But because there is no reduction in the quantity of funds that banks devote to loans and no change in the demand for loans, there is no effect on interest rates on loans, deposits, or corporate paper.

equilibrium. The other side of the coin is that nonfinancial firms will shift some of their financing, but less than \$50 billion, from directly placed paper to loans from banks. If households consider Treasury bills good substitutes for corporate paper but poor substitutes for deposits, then replacing Treasury bills in the SOMA portfolio with advances to banks will displace more corporate paper than deposits, so banks' loans to nonfinancial firms will expand appreciably. In contrast, if households view Treasury bills as good substitutes for deposits but poor substitutes for corporate paper, replacing the SOMA's Treasury bills with advances to banks will displace more deposits than corporate paper, so banks' loans to nonfinancial firms will expand only slightly. In either case, there need be no change in interest rates on deposits, loans, and corporate paper because the net shifts in the supply of funds to banks and in the total demand for credit from banks are equal.

The result that interest rates on deposits, loans, and corporate paper remain unchanged and direct financing shrinks (relative to what they would be otherwise) as banks expand depends critically on the assumption that firms consider directly placed debt and loans from banks perfect substitutes at the margin.¹⁰ That is a useful simplifying assumption for analytic purposes, but it may not be empirically correct—especially not for large shifts in funding. If the assumption does not hold, then interest rates on loans and deposits will change relative to interest rates on directly placed corporate paper.

One way to relax the assumption that bank loans and corporate paper are perfect substitutes is to suppose that nonfinancial firms incur nonpecuniary costs when they borrow from banks but not when they sell marketable debt directly to households (so that there is a wedge between the interest rate on directly placed corporate paper and the rate on bank loans) and that the nonpecuniary costs rise with the amount nonfinancial firms borrow from banks. In this case, interest rates on bank loans and deposits could decline, and interest rates on directly placed corporate paper could rise, if the Federal Reserve replaces some of the SOMA's Treasury bills with advances to banks. That change in relative interest rates will occur if households attempt to finance some or all of their acquisition of additional Treasury bills by substituting away from directly placed corporate debt, which seems likely.

To see this effect most clearly, consider the case in which the change in relative interest rates will be largest. Begin from the initial equilibrium shown by the dotted lines in diagram 3.C.5. Assume, as before, that the Federal Reserve lets \$50 billion of maturing Treasury bills run off from its balance sheet and replaces them with \$50 billion of advances to banks. The direct effects of that action are, as before, offsetting shifts in the supply of funds to banks as the initial drop in households' deposit balances (the counterpart to their increased holdings of Treasury bills) is offset by new advances from the Federal Reserve. (To avoid clutter, these offsetting shifts are not shown in diagram 3.C.5.) Consider the extreme case in which households seek to rebuild their deposit balances (that is, to finance their acquisition of additional Treasury bills) entirely by selling corporate paper. The supply of funds from households to banks shifts right as households rebuild their deposits (shift 1 in the top panel of diagram 3.C.5). At the same time, the supply of funds from households to nonfinancial firms shifts to the left (shift 2 in the bottom panel of diagram 3.C.5). The latter shift means that nonfinancial firms will need to borrow more from banks, as shown by the rightward shift in the total demand for credit from banks (shift 3 in the top panel of diagram 3.C.5). In an attempt to avoid the rising nonpecuniary costs associated with borrowing more from banks, however, nonfinancial firms bid up the interest rate on directly

10. The result also depends on the assumption that the loan rate is set at a constant markup over the rate banks pay on (wholesale) deposits.

placed paper, as shown by the upward shift of the interest rate on corporate paper to $i_{CP2} = i_{L2} + d_2$ (in the bottom panel).

That increase in the interest rate on corporate paper has three effects. First, it leads households to shift away from deposits (as shown in the top panel by the leftward shift 4, to the solid line, in the supply of funds to banks) and toward corporate paper (as shown in the bottom panel by the movement up and to the right from point A to point B along the line for the supply of funds from households to nonfinancial firms). Second, it allows nonfinancial firms to avoid borrowing as much from banks as they would otherwise. Third, it reduces the total amount nonfinancial firms seek to borrow (compare point D to point C). Combining these effects, the net outcome is that the supply of funds to banks shifts to the right less than \$50 billion (the \$50 billion of new advances is partly offset as deposits run off in response to the higher yield on corporate paper) and the demand for loans from banks shifts to the right by an even smaller amount (smaller by the amount that nonfinancial firms' total demand for credit declines), as shown by the solid "total demand for bank loans" line (top panel). As a result, the interest rate on loans falls from i_{L1} to i_{L2} (and the rate on deposits falls the same amount) as the supply of funds to banks increases more than the demand for loans from banks, and the interest rate on corporate paper rises as nonfinancial firms "pay up" in a partly successful attempt to avoid borrowing more from banks. The amount that interest rates change will depend on how rapidly the perceived nonpecuniary costs of borrowing from banks rise with the quantity borrowed, and on both the interest elasticity of the supply of funds from households to nonfinancial firms and the elasticity of nonfinancial firms' total demand for credit.

One might also want to relax the assumption that the interest rate on loans is a constant markup over the rate banks pay for funds. The markup might rise with total loans, either because banks have some market power or because the marginal cost of processing loans rises with volume. (The implications of increasing marginal cost is examined in the next part of this appendix.) If the markup rises with the volume of loans, then (all else constant) equal rightward shifts in the demand for loans from banks and in the supply of funds to banks will result in a wider spread between the loan rate and the deposit rate. In general, we would expect a wider spread to result from both an increase in the interest rate charged on loans and a drop in the interest rate paid on deposits; the amount each adjusts will depend on how rapidly the spread widens with increasing volume and on the elasticities of the supply of deposits and the demand for loans.¹¹

Suppose that the spread between the bank loan rate and the deposit rate widens with the volume of loans and that nonfinancial firms perceive that nonpecuniary costs rise when they borrow more from banks. Then a reduction in the supply of funds from households to firms and the resulting need for firms to borrow more from banks could lead to an outcome in which the interest rate on bank loans changes little, if at all, but the interest rate on marketable debt rises and the rate banks pay on deposits falls.

In sum, there are scenarios in which interest rates on bank loans fall as the depository sector expands and other scenarios in which rates on bank loans rise. Whether adjustments in interest rates are large or small might well depend on how much of the SOMA's portfolio of Treasury securities is replaced with auction facility advances to banks. If auction facility advances were to

11. Considering each factor separately, the more the spread widens with an increasing volume of loans, the more the loan rate and deposit rate adjust; the higher the interest elasticity of the supply of funds to banks, the less the deposit rate adjusts; and the higher the interest elasticity of the demand for loans, the less the loan rate adjusts.

replace a relatively small share of Treasuries in the SOMA portfolio, the assumptions that firms view directly placed corporate paper and loans from banks as perfect substitutes at the margin, and that the loan rate is set as a constant markup over the deposit rate, might be close to the truth. In that case, any adjustments in interest rates would be small. But if auction facility advances were to replace the entire SOMA portfolio, the assumptions might not be tenable and adjustments in relative interest rates might be sizable. In either case, however, the analysis seems consistent with the insight that the *average* level of interest rates would not change appreciably.

Replacing the SOMA's Maturing Treasury Securities by Extending Advances via a Nonadministered Credit Facility Has Similar Effects

The preceding analysis was conducted under the assumption that the Federal Reserve sets the quantity of advances to banks and conducts an auction to determine which banks obtain funds and the rate they pay. (Given the simplifying assumptions made earlier, the rate banks pay on advances will turn out to be equal to or close to the target federal funds rate, if the Domestic Trading Desk continues to conduct open market operations so as to make each day's federal funds rate equal to or close to the FOMC's target rate.) A slight variation on the preceding approach will give us insight into the effects of replacing some or all of the SOMA's Treasury securities with advances extended through a nonadministered facility. The implications—for the size of banks and for interest rates on deposits, loans, and corporate paper—of reducing the quantity of Treasury securities held by the SOMA while simultaneously introducing a nonadministered facility are much the same as the implications of introducing an auction facility, —so long as the Desk is hitting the FOMC's target for the funds rate before the nonadministered facility is introduced.

To see this similarity, consider diagram 3.C.6. The initial equilibrium is shown by the dashed supply and demand schedules. The nonadministered facility, through which the Federal Reserve offers advances at the target federal funds rate and supplies whatever quantity of funds banks want to borrow, can be represented by a kinked "supply of funds to banks" schedule in the upper panel. Banks would compete for deposits until they bid up the interest rate (actually, the all-in cost) on deposits to the target funds rate; banks would turn to the nonadministered facility for any additional funds they needed. Thus, the upper part of the supply-of-funds schedule (the dashed part) becomes irrelevant. The kink in the "supply of funds to banks" schedule will occur at the target federal funds rate. Similarly, banks' supply-of-loans schedule, which lies a fixed distance (the fixed markup) above the schedule showing the supply of funds to banks, becomes kinked at an interest rate equal to the target federal funds rate plus the fixed markup.

Starting from that initial equilibrium, suppose the Federal Reserve allows \$50 billion of Treasury bills to run off from the SOMA. Further suppose that the Federal Reserve introduces a nonadministered facility at the same time, so that the supply of funds to banks becomes kinked at the target funds rate as shown by the solid supply schedule in the upper panel of diagram 3.C.6. If households (at one extreme) finance their purchase of additional Treasury bills entirely by substituting away from directly placed corporate paper, as shown by shift 1 in the supply schedule in the bottom panel of diagram 3.C.6, nonfinancial firms' demand for loans from banks will increase by \$50 billion (assuming that they view directly placed debt and loans from banks as perfect substitutes), as shown by shift 2 in the demand schedule in the top panel of diagram 3.C.6. Banks will respond by borrowing enough from the nonadministered facility—\$50 billion—to finance the increase in the demand for loans. (The same is true if households borrow from banks to finance the acquisition of Treasury bills. If banks buy the Treasury bills, they simply finance the purchase by borrowing from the nonadministered facility.) As discussed earlier, there will be

no change in interest rates so long as nonfinancial firms view loans from banks and directly placed debt as perfect substitutes at the margin.¹²

If (at another extreme) households finance their purchase of additional Treasury bills entirely by substituting away from deposits at banks, nonfinancial firms will not need to increase their borrowing from banks, and banks will simply use \$50 billion of advances to replace deposits, with no expansion of their balance sheets.

In general, we would expect households to finance their purchase of additional Treasury bills by substituting away from both deposits and directly placed corporate paper. In that case, banks will use advances in part to replace deposits and in part to fund additional loans so their assets (and liabilities) will expand by less than the increase in advances. In this respect, a nonadministered facility has the same effects as an auction facility.

In sum, the model used above suggests that replacing some or all of the SOMA's Treasury securities with advances to banks via an auction facility or nonadministered facility would likely generate an expansion of depositories' assets, displace some liabilities at banks, and perhaps result in a drop in banks' deposit rates relative to their loan rates and an increase in interest rates on marketable debt issued by nonfinancial firms relative to bank loan rates.

Accommodating an Increase in the Demand for Currency by Extending Advances to Banks rather than by Acquiring Additional Treasury Securities for the SOMA Has Essentially the Same Implications as Replacing Treasury Securities in the SOMA with Advances to Banks

Initially, households satisfy an increase in demand for currency by withdrawing currency from depository institutions. Banks respond by ordering currency from the Fed, so bank reserve deposits at the Federal Reserve shrink along with households' deposit balances. Under current operating procedures, the Desk responds by purchasing Treasury securities in the open market, thereby restoring the supply of bank reserve deposits and also bringing bank deposits back to the initial level as payment for the securities purchased by the Federal Reserve is deposited in bank accounts. The net effect, before any portfolio adjustments, is that the private sector ends up holding more currency but fewer Treasury bills. If the Federal Reserve was to accommodate an increase in the public's demand for currency by extending advances to banks via an auction facility or nonadministered facility, the initial effects on portfolios would be somewhat different. When households withdraw currency from banks, bank reserves and households' deposits would shrink, as above. By extending advances to banks, the Federal Reserve would replenish the supply of bank reserves but would have no effect on the quantity of bank deposits or Treasury bills held by the private sector. In effect, by accommodating an increase in the demand for currency by extending more advances to banks, the Federal Reserve would allow the public to substitute currency for bank deposits. But by accommodating an increase in the demand for currency by purchasing Treasury bills, the Federal Reserve forces the public to substitute currency for Treasury bills.

Notice that the initial changes in agents' portfolios are exactly the same as those discussed in earlier sections of this appendix: When the Federal Reserve increases the supply of bank reserves

12. But as discussed earlier, interest rates on loans or deposits, or both, may change if firms do not view loans and corporate paper as perfect substitutes at the margin, or if the spread between loan rates and deposit rates widens as loan volume increases.

by extending advances via an auction facility or nonadministered facility, the private sector ends up holding more Treasury securities but (initially) fewer bank deposits than when the Federal Reserve buys Treasury securities in the open market. It follows that accommodating an increase in the demand for currency by expanding advances has the same implications for relative interest rates and the size of the banking sector as does replacing maturing Treasury securities in the SOMA portfolio with advances.

A MORE DETAILED MODEL OF THE BANKING SYSTEM AND THE MARKET FOR RESERVE DEPOSITS YIELDS SIMILAR RESULTS AND ADDITIONAL INSIGHTS

The preceding analysis implicitly treated all bank assets and liabilities—indeed, all banks—as homogeneous. Moreover, it ignored the market for bank reserve deposits. Of course, the banking industry and the market for bank reserves would be the key vehicles through which an auction facility or nonadministered facility would operate. In what follows, we focus in more detail on the banking industry, and we introduce a market for bank reserves. In this way, we focus on different issues than we did in the previous discussion.

A More Detailed Model of Equilibrium in the Banking System

Diagram 3.C.7 provides a way of tracing out some of the primary effects on the banking market of introducing an auction facility. The top panel depicts an initial banking industry equilibrium in which banks fund their assets with retail deposits and managed liabilities. The picture juxtaposes the equilibriums in three markets—the markets for bank credit, retail deposits, and managed liabilities—to highlight the relationship between the quantities of and rates of return on bank liabilities and assets that will occur in equilibrium.

Because the banking industry's balance sheet must balance, the quantity of retail deposits plus managed liabilities must equal the quantity of credit that banks willingly supply to private borrowers plus the credit they supply to the Federal Reserve—that is, their holdings of reserves. For the purpose of this analysis, banks' reserve demand is assumed to be completely inelastic and equal to required reserves so that issues associated with the interest elasticity of banks' reserve demand do not complicate the analysis.

The heavy lines in diagram 3.C.7 (top panel) describe banks' preferences regarding deposit funding and credit supply. The banking industry's demand curve for retail deposits (lower left corner) lies below the federal funds rate and is downward sloping, reflecting the costs of servicing such deposits. As a result, the equilibrium interest rate on retail deposits—determined at the intersection of banks' demand for retail deposits and the public's supply of retail deposits—lies below the federal funds rate. The rate on managed liabilities is determined outside the model; banks take it as given.¹³

Although the interest rates banks pay on retail deposits and managed liabilities differ in the diagram, the all-in marginal costs to banks of funds from these alternative sources are identical in equilibrium and equal to the overnight federal funds rate. Retail deposits have a lower explicit interest cost but have associated non-interest costs that make their all-in cost equivalent to borrowing federal funds. Similarly, the explicit rate on managed liabilities is higher than the overnight federal funds rate, but the all-in cost to banks of these two kinds of liabilities is the same because managed liabilities have a longer duration (compared with overnight federal funds),

13. Assuming that banks face an upward-sloping supply schedule for managed liabilities would not change the qualitative conclusions of this model.

which provides banks benefits in terms of reducing balance sheet and liquidity mismatches and their associated management costs and also in terms of cutting non-interest expenses.

Finally, as shown in the upper right portion of diagram 3.C.7, banks provide loans to households and nonfinancial firms and are willing to supply greater quantities of credit as loan rates increase relative to the federal funds rate.¹⁴ This assumption means that the spread between the interest rate on bank loans and the interest rate on managed liabilities will widen if the demand curve for bank loans shifts to the right (in contrast to the assumption maintained in much of the earlier discussion). The equilibrium quantity of credit extended by the banking industry is determined at the intersection of banks' credit-supply schedule and the public's credit demand schedule.

As noted above, the overnight federal funds rate serves as an anchor for interest rates on both retail deposits and managed liabilities (and thus for the interest rate on bank loans) because banks are assumed to view federal funds purchased (sold) as managed liabilities (assets) that entail only minimal non-interest costs. That is, the all-in cost of federal funds purchased is assumed to equal the federal funds rate. In this model, banks may borrow and lend among themselves in the federal funds market. But for the banking industry as a whole, federal funds are not a net funding source—one bank's federal funds sale is another bank's federal funds purchase—and "federal funds" do not appear in the diagram as either an asset or a liability of the banking industry. The federal funds rate in this model is determined in an interbank market as a function of banks' end-of-day demand for reserves and the aggregate supply of reserves provided by the Federal Reserve.

The bottom panel of diagram 3.C.7 shows the initial equilibrium in the reserve market corresponding to the banking industry equilibrium in the upper panel. Banks desire to hold a certain quantity of balances at the Federal Reserve, B^* , in order to meet reserve requirements and avoid overdrafts. Again, for convenience, the demand for reserves in this exercise is assumed to be completely inelastic. The Federal Reserve supplies reserves through its permanent holdings of Treasuries and through repurchase agreements. Together, these two sources of reserves offset the aggregate reserve drain from currency ($-C$ in the diagram) and provide just enough reserve balances to the banking system so that the federal funds rate is maintained at the FOMC's target rate.

Replacing Treasury Securities in the SOMA with Advances to Banks Extended via an Auction Credit Facility Has No Effect on the Market for Reserves but Changes the Equilibrium in the Markets for Loans and Deposits

Diagram 3.C.8 shows how the banking industry and reserve market equilibrium would change with the introduction of an auction facility. We assume that the Federal Reserve sells a quantity of Treasury securities to the nonbank public (or allows maturing securities to run off from its portfolio) and auctions an equivalent amount of auction facility credit to banks. Because essentially only banks can maintain book-entry securities and transaction accounts with the Federal Reserve, the nonbank public must, in effect, purchase Treasury securities through banks. As the public does so, banks initially incur a liability to the Federal Reserve (in the form of a debit to their reserve account), but they also acquire claims on the nonbank public in the form of payments due for Treasuries purchased on their behalf.

14. The terms "loans" and "loan rate" are used here as generic references to bank assets. More accurate, but more cumbersome, terms might be "bank assets" and "marginal rate of return on bank assets."

As shown in the bottom panel of diagram 3.C.8, replacing some of the Treasury securities in the SOMA with advances extended via an auction credit facility has no effect on the reserve market. It simply results in a substitution of loans to banks for Treasury securities as a source of reserves to the banking system. The Desk would continue to provide reserves via temporary operations, just as it does now, in order to target the federal funds rate. However, the sale of the Federal Reserve's Treasury securities would have repercussions for banking industry equilibrium. The nonbank public must settle with banks for the Treasury securities purchased (that is, the public must finance its acquisition of a larger quantity of Treasury securities), and they can do so either by taking out loans at banks or by liquidating deposits at banks or some combination of the two. (If the nonbank public were to hold less corporate paper, then corporations would need to borrow from banks. The implications for the banking system would be the same as if the public had borrowed.)

The top panel of diagram 3.C.8 works through the likely effects for the case in which the nonbank public elects to take out bank loans to cover its purchases of Treasuries. From the banking industry's perspective, this case would be associated with a shift to the right in the demand for credit in an amount equal to the Federal Reserve's sale of Treasury securities. Because the banking industry's supply-of-credit curve is upward sloping, this implies that the new equilibrium quantity of bank credit will not rise by as much as the increase in Treasury securities held by the public and also that interest rates on bank loans will tend to rise.

On the liability side of the balance sheet, managed liabilities play the role of shock absorber in response to Federal Reserve auctions of auction facility credit. In the diagram, banks substitute auction facility credit for managed liabilities one for one. In the new equilibrium, then, the quantity of managed liabilities will fall somewhat, and these funds will, implicitly, finance the portion of the total increase in Treasuries not financed (directly or indirectly) by increased bank lending. If auction credit has characteristics similar to those of other managed liabilities, the auction credit rate and the rate on managed liabilities will be identical. If, on the other hand, auction credit and other managed liabilities are not close substitutes, their rates will differ. In equilibrium, both rates will be set so that their all-in cost is equal to the federal funds rate. The rate on auction credit could be either higher than or lower than the rate on managed liabilities depending on its benefits, at the margin, to banks in terms of liquidity and balance sheet management.

The Effects of a Nonadministered Credit Facility Would Differ from Those of an Auction Credit Facility

The model of the banking industry developed in the preceding section can be used to analyze the effect of introducing a nonadministered facility. Diagram 3.C.9 works through the response of the banking industry to the introduction of a nonadministered facility. As shown in the bottom panel of the figure, in the reserve market, the nonadministered facility acts much like a Lombard credit facility, with the Lombard rate set at the target federal funds rate. Banks will be induced to borrow the difference between nonborrowed reserves and their desired level of reserves, B^* , because failure to do so will force the federal funds rate above the target funds rate, which, in turn, would induce more borrowing from the nonadministered facility. The effect on the banking industry is similar in some respects to that described above for the auction facility. Depending on the public's preferences, the sale of Treasuries to the nonbank public could be represented as a rightward shift in demand for credit from banks. This shift will again lead to an increase in loan rates and some increase in the size of the banking industry. Managed liabilities will again decline because the increase in total bank assets is not as large as the increase in nonadministered facility credit to banks (or in Treasuries held by the public.)

The foregoing analysis assumes that the nonbank public will choose to settle with banks for their purchases of Treasury securities by taking out additional bank loans. Alternatively, the nonbank public could liquidate retail deposits held at banks. As shown in diagram 3.C.10, in this case the size of the banking industry is unchanged because there is now no rightward shift in the demand for credit from banks. Instead, there is a leftward shift in the public's supply of retail deposits. Given banks' downward-sloping demand for retail deposits, this leftward shift will result in some increase in retail deposit rates, so the spread between the federal funds rate and retail deposit rates will narrow. The quantity of retail deposits will not decline by the full amount of the Federal Reserve's sale of Treasury securities, however; banks' managed liabilities will also fall in the new equilibrium.¹⁵

The General Case

Of course, it is possible that the nonbank public would pay for the additional Treasury securities they buy with some combination of increased bank loans and reduced deposit holdings. In this case, the effect of both the auction facility and the nonadministered facility on the size of the banking industry will be somewhere between the two polar cases discussed above. But judging from the diagrams presented here, we should expect to see some increase in banks' total assets, some modest increase in spreads of loan rates over the target federal funds rate, some decline in managed liabilities, and possibly some decline in retail deposits that would be associated with an increase in retail deposit rates. It bears noting that all of the preceding discussion should be regarded as a description of first-round effects. The movements in bank loan rates and retail deposit rates described, for example, would almost certainly have feedback effects on each other and on yields on Treasury securities through the public's preferences for alternative assets. For example, the public's demand for retail deposits is almost certainly affected to some degree by the level of Treasury yields and bank loan rates. If so, some of the first-round movements in interest rates described above would generate shifts in the public's demands for deposit and credit curves which, in turn, would have follow-on implications for the banking industry equilibrium.

In sum, as with the earlier portfolio-balance model, this more detailed model of the banking system suggests that an auction facility or nonadministered facility would likely lead to some expansion of the banking system's assets but would also likely displace some of the banking system's liabilities—managed liabilities in particular. Moreover, this detailed model suggests that interest rates on bank loans might rise relative to rates on deposits (including managed liabilities) and, implicitly, relative to market interest rates on nonfinancial debt; that outcome would be likely if banks face rising marginal costs of processing loans. This model also yields the insight that the market for bank reserves and the markets for bank loans and deposits would clear at the same total quantity of advances from an auction facility or a nonadministered facility.

INTRODUCING EITHER AN AUCTION CREDIT FACILITY OR A NONADMINISTERED CREDIT FACILITY MAY AFFECT ASSET-LIABILITY MANAGEMENT BY INDIVIDUAL BANKS

The model used in the preceding analysis of the banking industry implicitly treated banks as a homogenous group. An extension of that model can shed some light on the possible effect of an auction facility or nonadministered facility on heterogeneous banks. For example, as shown in the top panel of diagram 3.C.11, the shape of the credit-supply curve might be expected to vary

15. The eventual effects on retail deposits and managed liabilities, when the public chooses to fund its purchase of Treasury securities by liquidating retail deposits, are essentially the same under an auction facility as under the nonadministered facility analyzed here.

across banks depending on their relative efficiency in operations, access to funding markets, and other factors influencing the ability to manage assets. It is clear from the diagram that any increase in industrywide loan rates relative to funding costs that results from an auction facility or nonadministered facility (perhaps because of an increase in nonfinancial firms' demand for credit from banks) could have quite different effects on banks depending importantly on the "slope" of an individual bank's credit-supply functions. Given any increase in economywide loan rates, individual banks that would grow the most in response to the introduction of an auction facility or a nonadministered facility are those with "flat" credit-supply functions.

Differences in marginal funding costs across banks might also lead to significant variation across banks in the response of bank size. For example, in the industry equilibrium analysis, the federal funds rate was assumed to represent the marginal cost of funds for all banks, and this marginal cost of funds served to anchor the position of the banking industry's credit-supply curve. But individual institutions, especially smaller ones, in practice might face marginal funding costs that are higher than the federal funds rate and possibly even upward sloping. Thus, although the analysis above suggested that an auction facility or a nonadministered facility would not affect the marginal cost of funds for the industry, such programs might well do so for individual banks. If an institution faces fairly flat marginal revenue curves for its assets (which seems unlikely for smaller institutions), a drop in that institution's marginal cost of funds could well lead to a significant increase in its size.

The preceding analysis can be extended a bit further to consider effects across a range of asset and liability categories. A basic result for banking firms maximizing profits is that the marginal revenue associated with the last dollar invested in each asset category should be equalized and that this value for marginal revenue should be equated with the banking firm's marginal funding cost. Similarly, the marginal cost of the last dollar of each type of liability should be equated across different liabilities.

As shown in diagram 3.C.12, this reasoning suggests that the types of liabilities most likely to be displaced by the introduction of an auction facility or nonadministered facility and any resulting drop in a particular bank's marginal cost of funds would be those with rather flat marginal cost curves (those for which the bank faces a fairly flat supply of funds). Such liabilities likely include eurodollar deposits and other wholesale funds. By contrast, the introduction of an auction facility or a nonadministered facility would be unlikely to lead to much decrease in retail deposits at banks because the marginal cost curve for such deposits most likely would be rather steeply upward sloping (the bank would face a steep supply of funds schedule).

As indicated by diagram 3.C.13, asset classes likely to increase the most in response to the introduction of an auction facility or nonadministered facility and any associated drop in marginal funding costs for a particular bank are those with flat marginal revenue curves (the curve showing the explicit interest charge net of management costs). Asset categories with flat marginal revenue curves are likely to be those that are easy to manage and monitor, such as government and agency securities. By contrast, any drop in marginal funding costs that results from an auction facility or nonadministered facility seems unlikely to spawn much increase in small business or consumer loans because the marginal revenue curves for such loans are likely to be fairly steeply sloped.

Diagram 3.C.1

Effect of Federal Reserve Credit Programs on the Credit Market

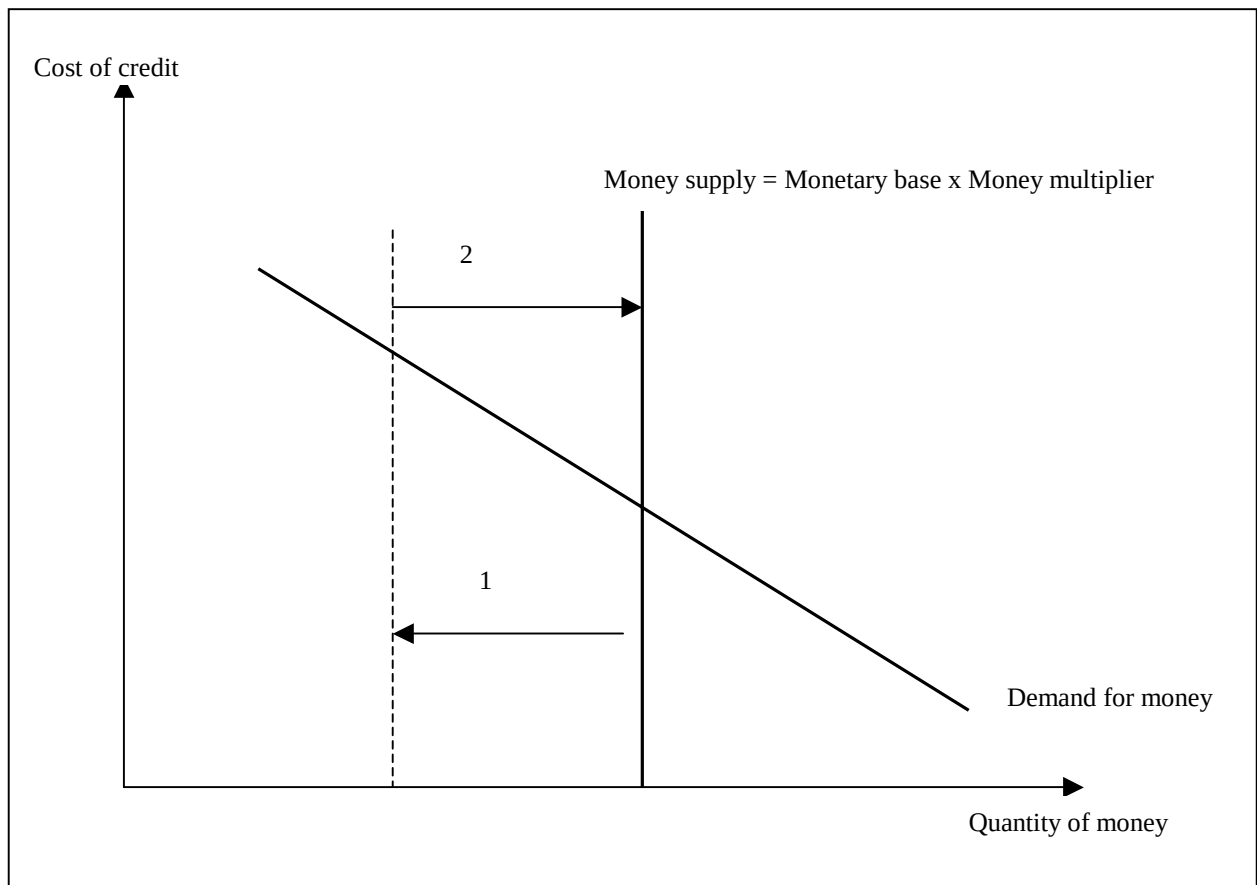
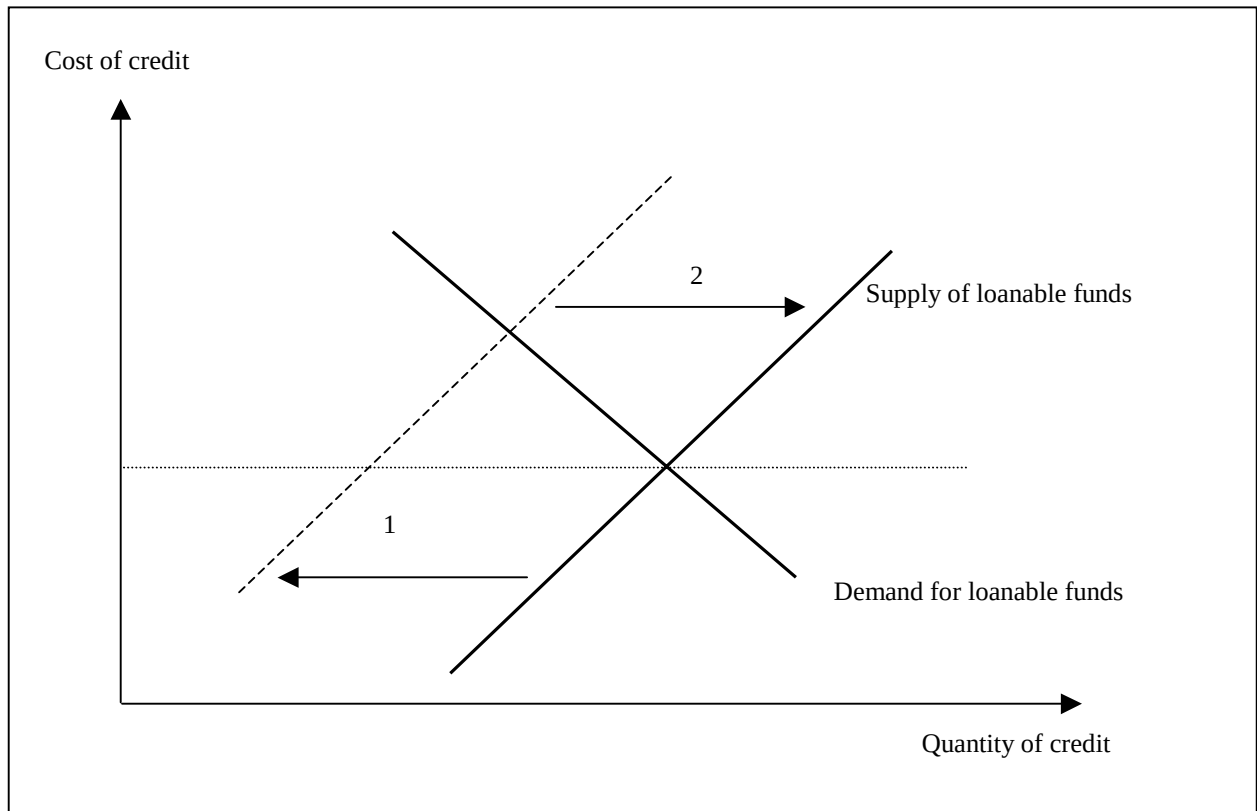


Diagram 3.C.2

Initial Equilibrium under an Auction Credit Facility

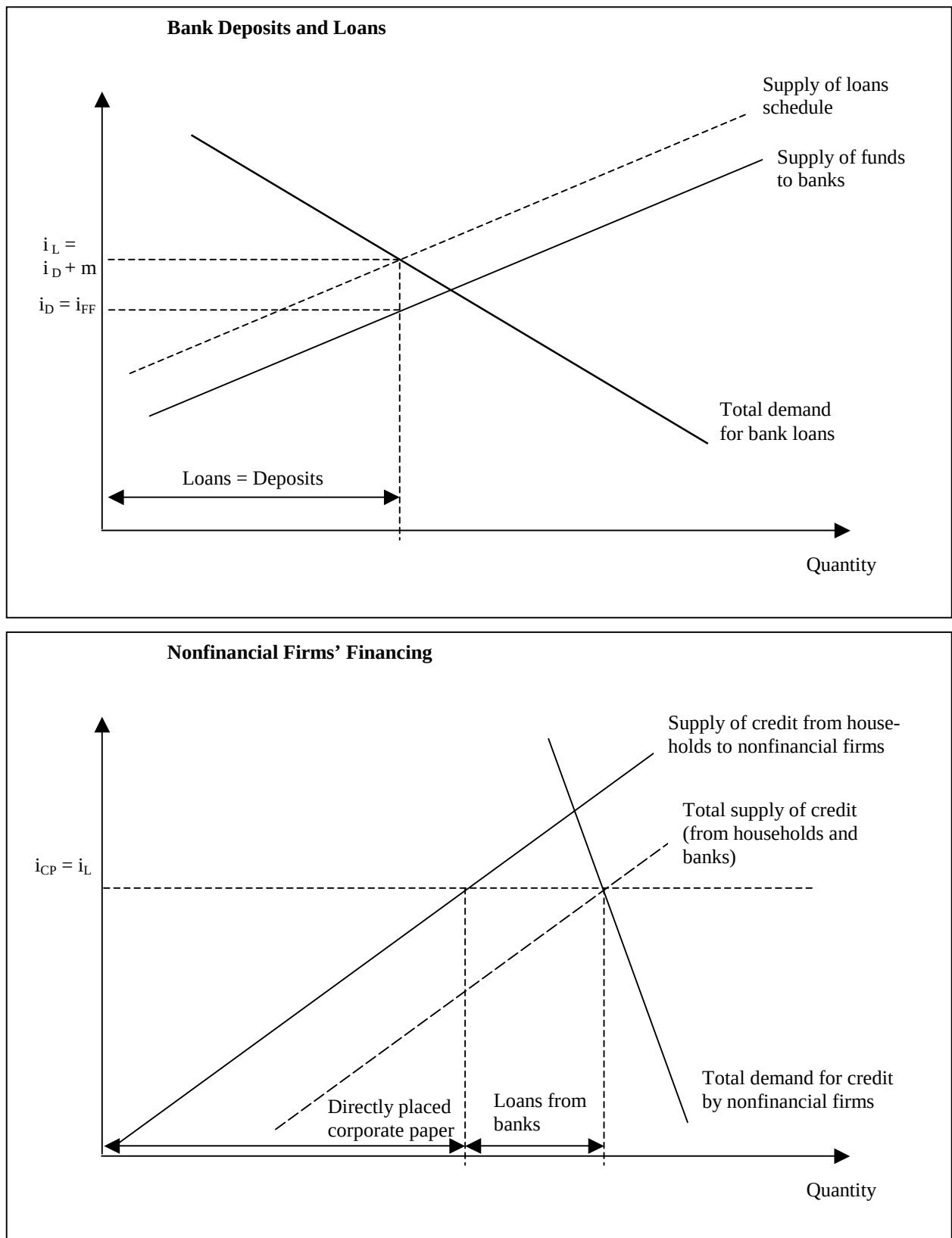


Diagram 3.C.3

Equilibrium under an Auction Credit Facility:

Households Finance Acquisition of Treasury Bills by Holding Less Corporate Paper

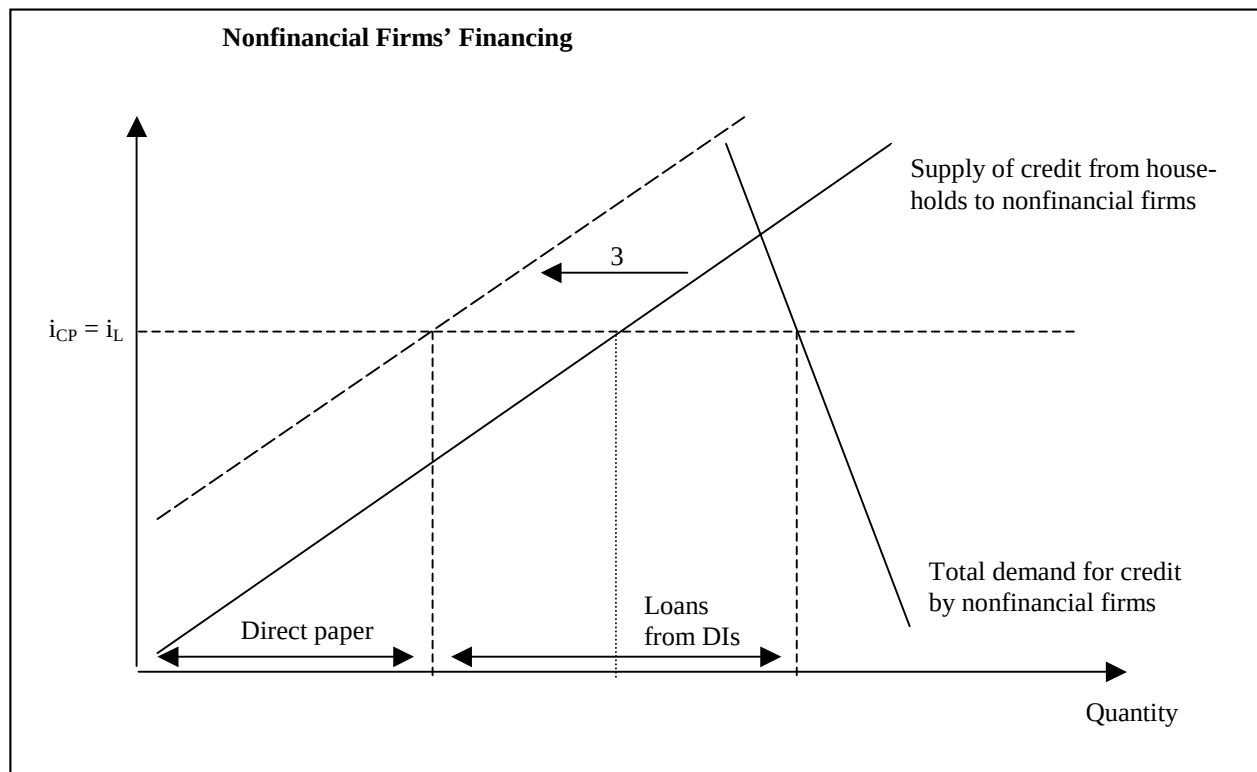
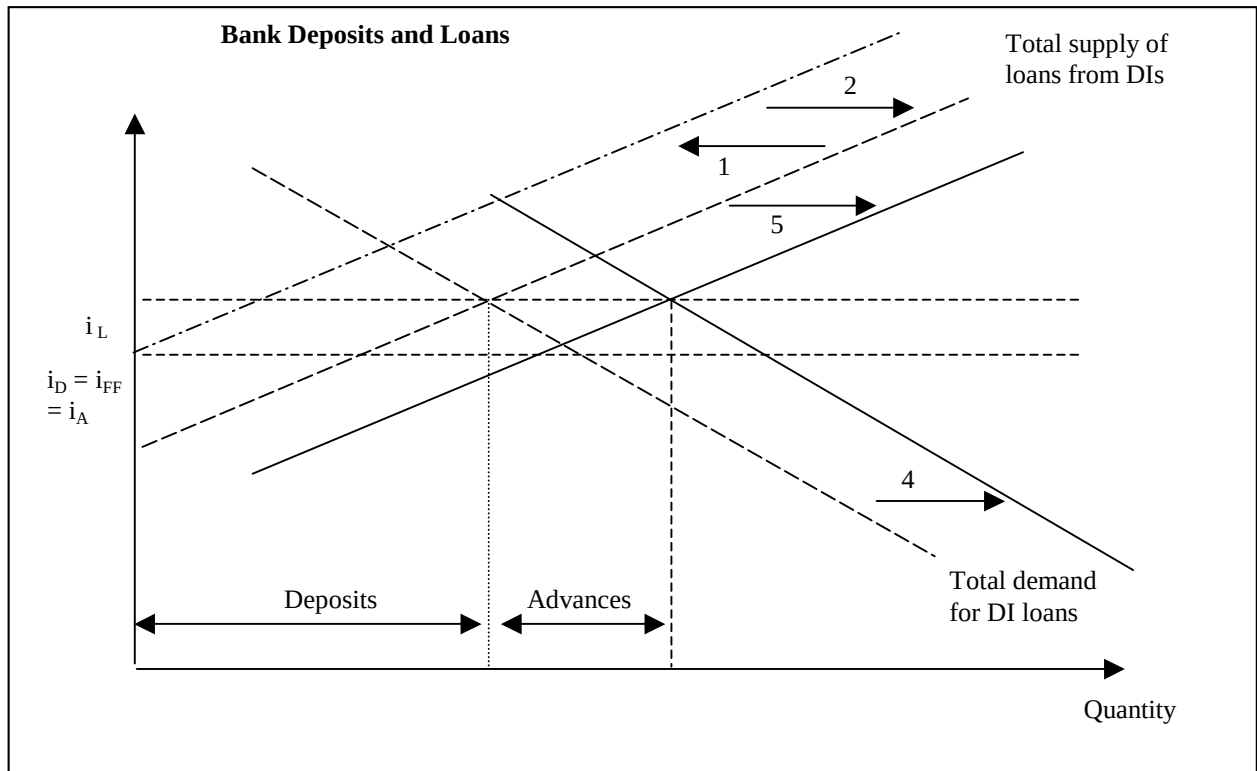


Diagram 3.C.4

Equilibrium under an Auction Credit Facility:

Households Finance Acquisition of Treasury Bills by Borrowing from Banks

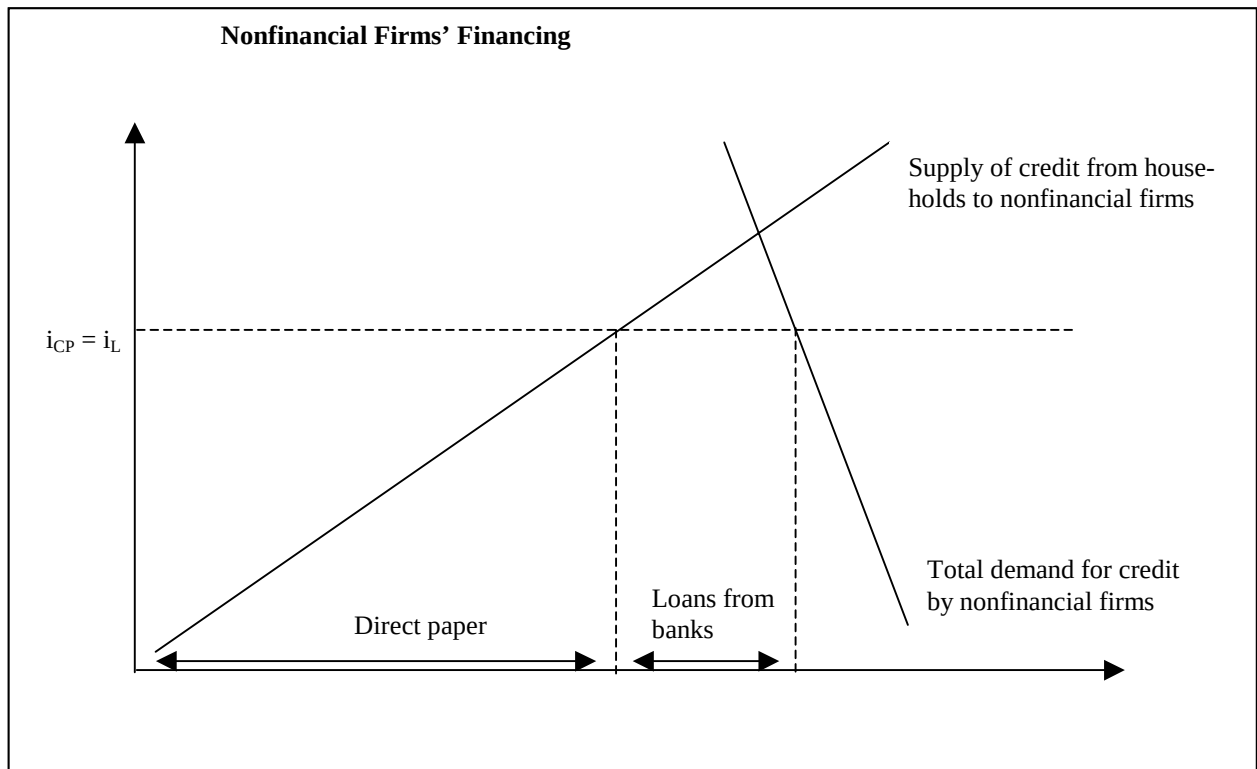
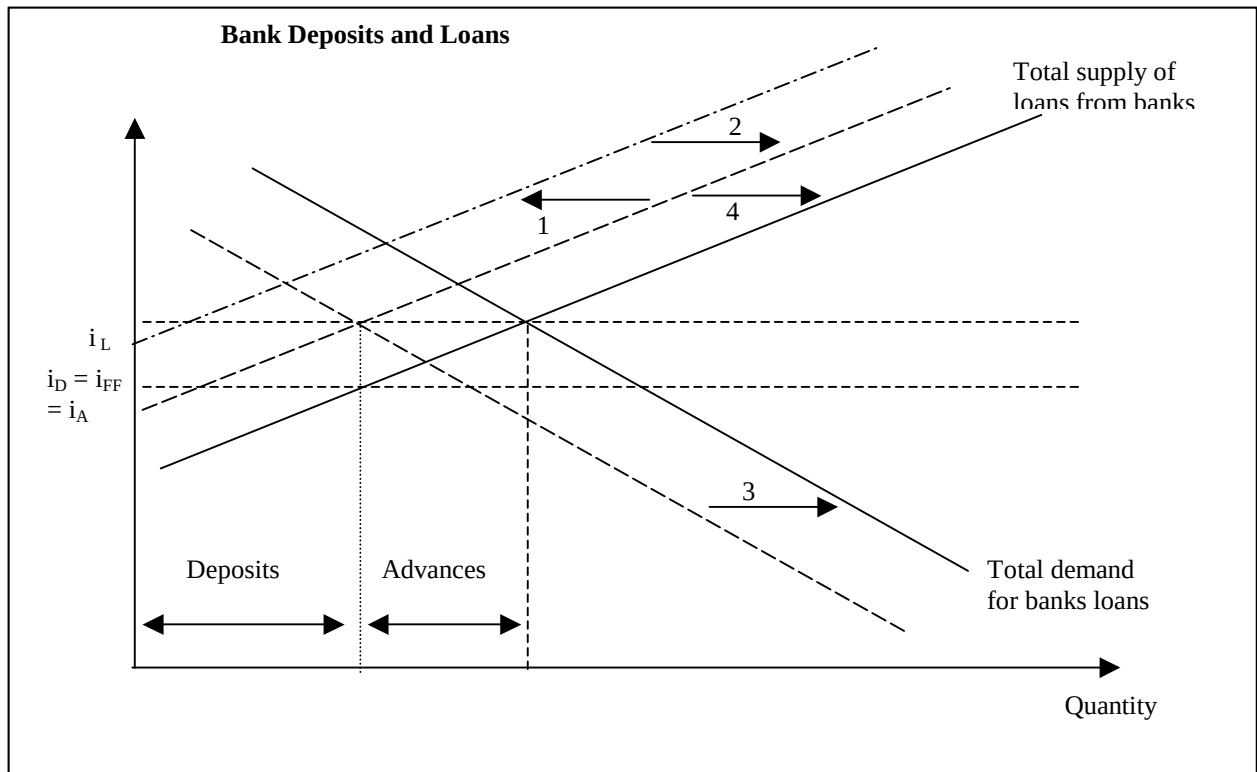


Diagram 3.C.5

Equilibrium under an Auction Credit Facility:
Corporate Paper and Deposits as Imperfect Substitutes

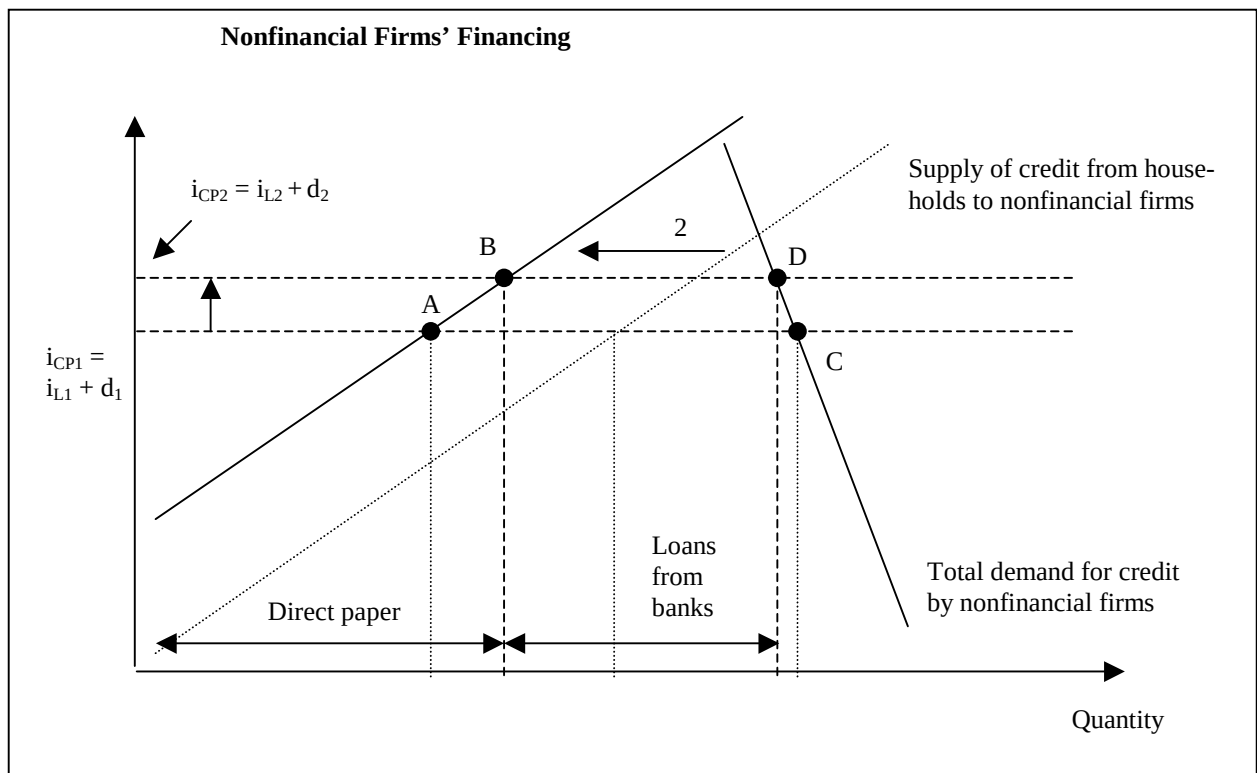
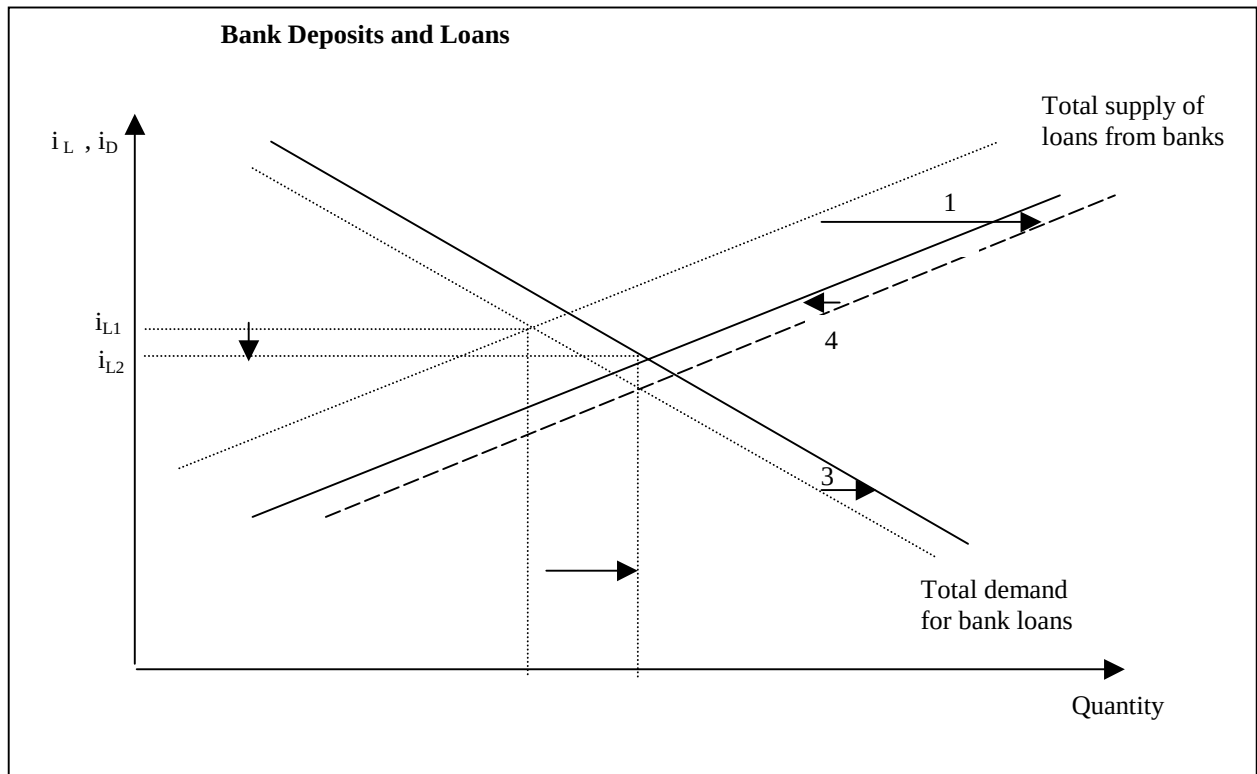


Diagram 3.C.6

Equilibrium under a Nonadministered Credit Facility

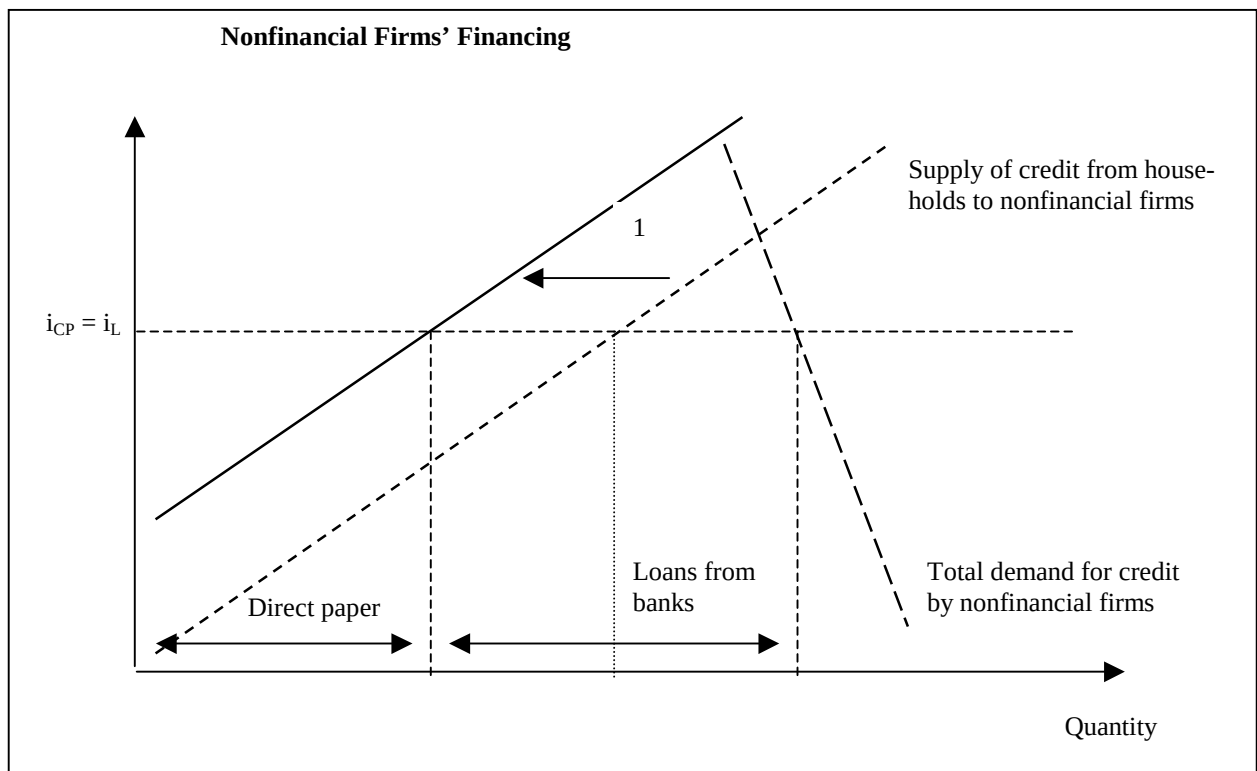
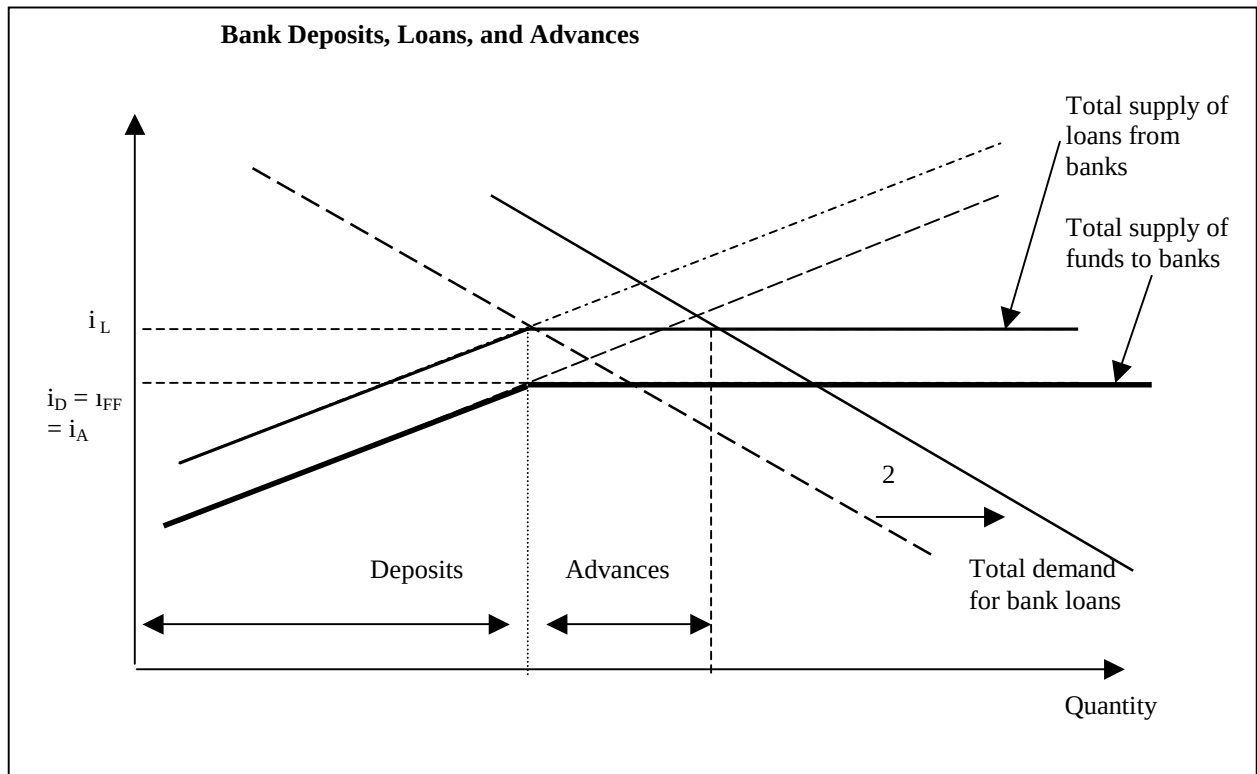


Diagram 3.C.7
Initial Equilibrium

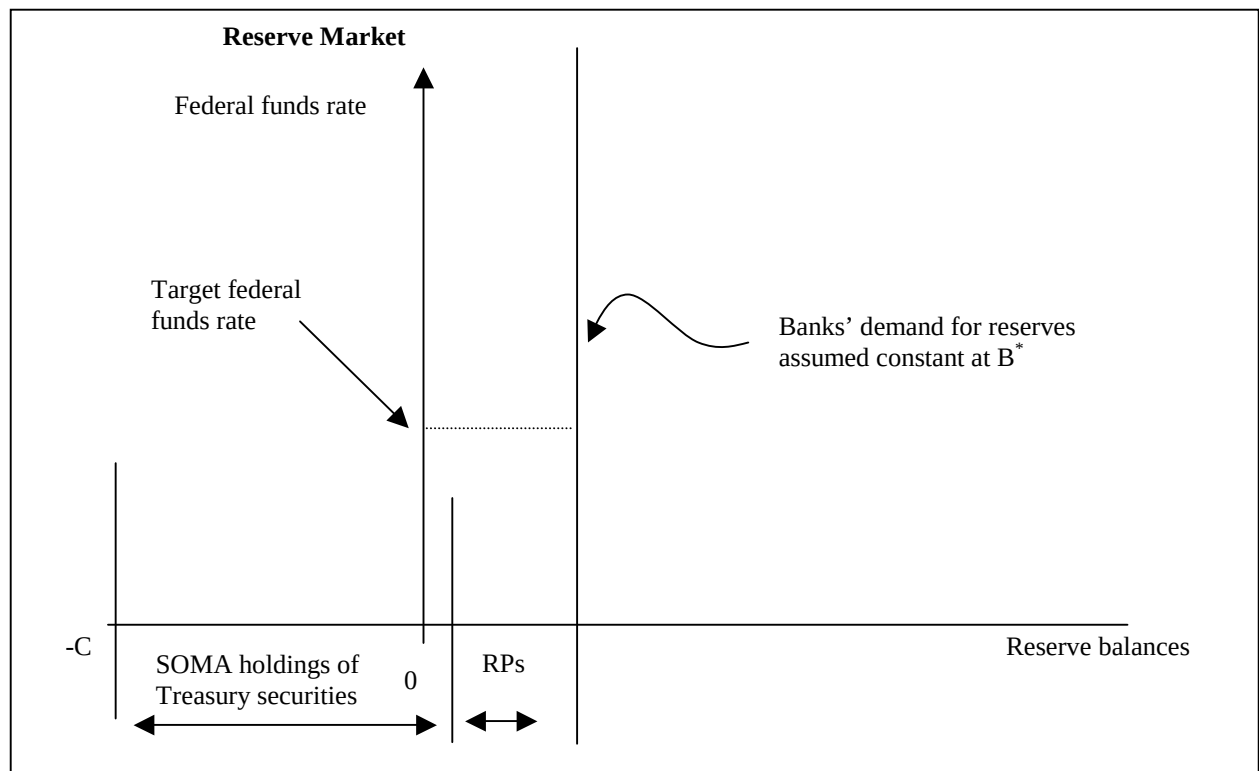
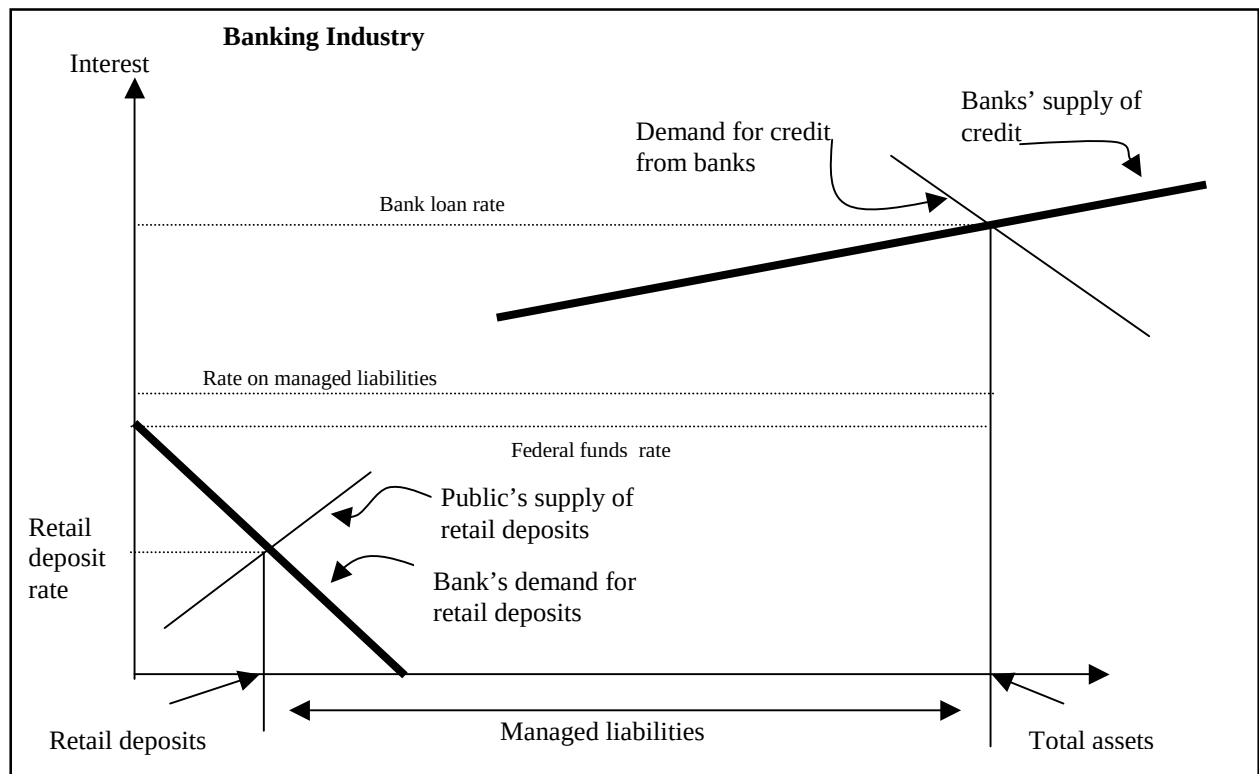


Diagram 3.C.8

Equilibrium under an Auction Credit Facility

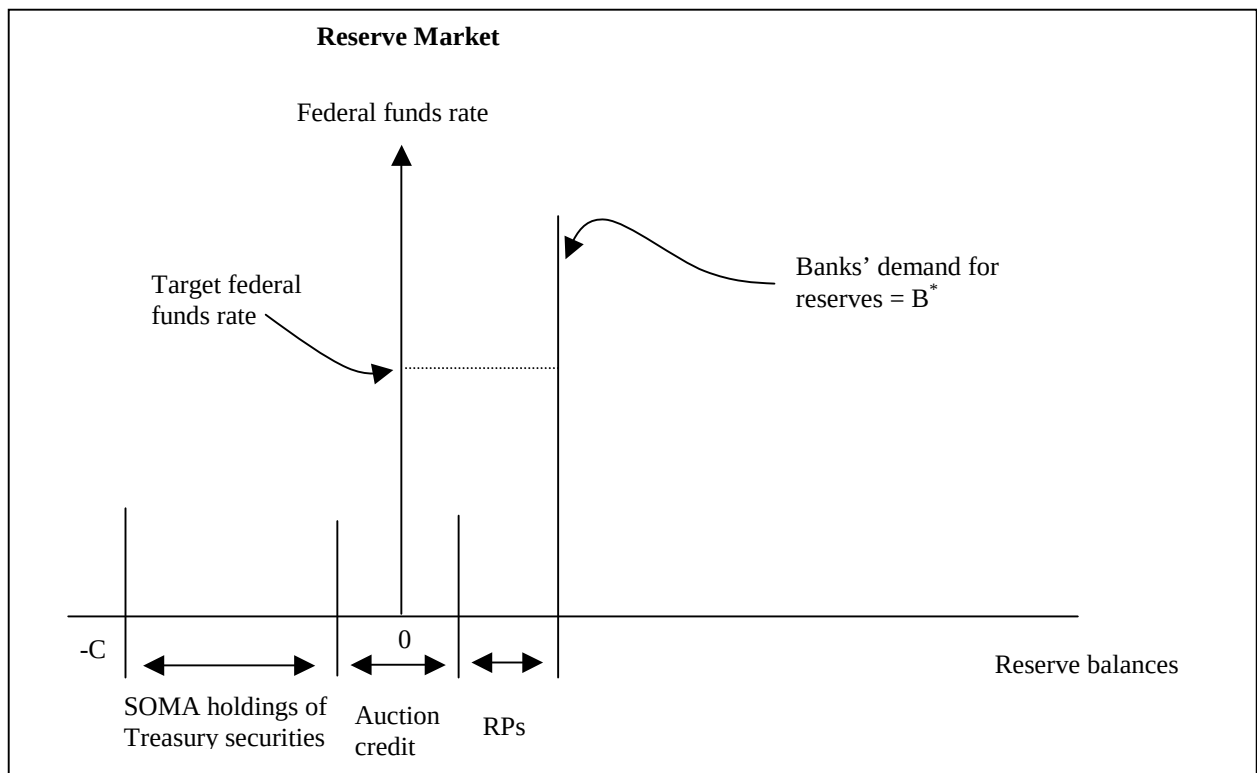
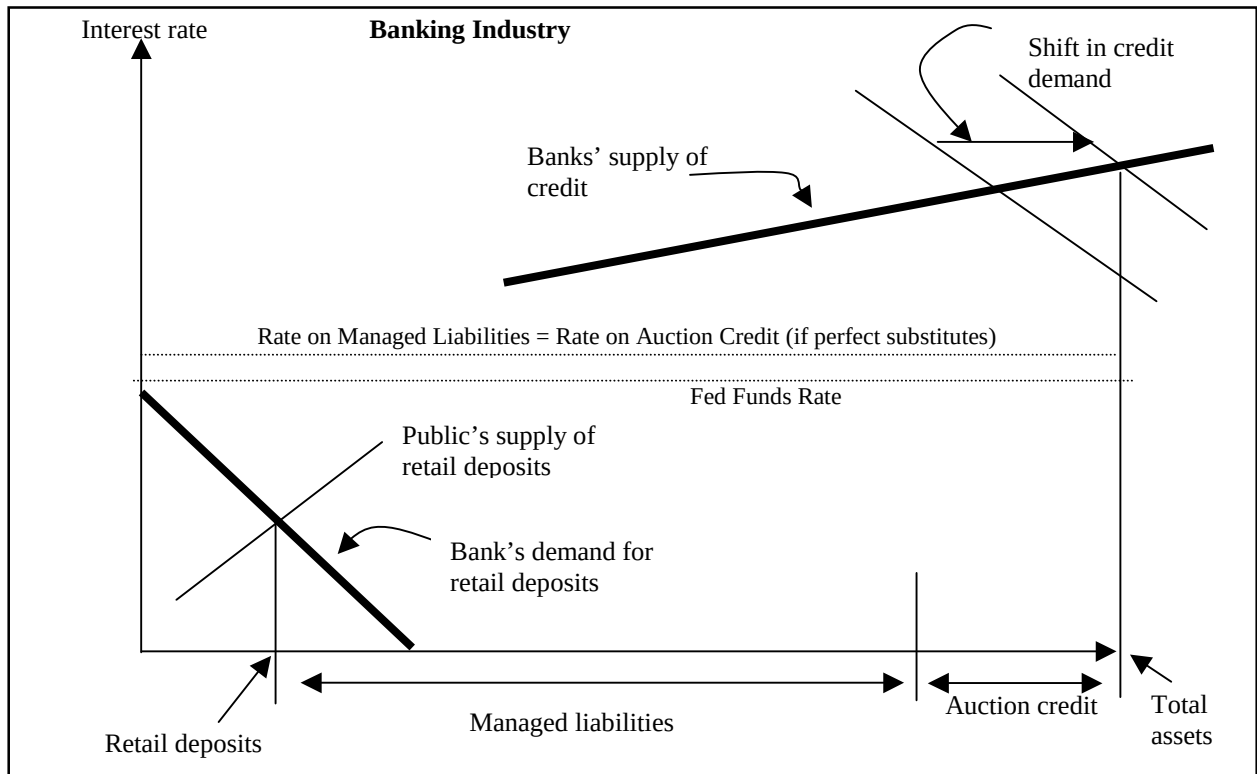


Diagram 3.C.9

Equilibrium under a Nonadministered Credit Facility: The Public Borrows

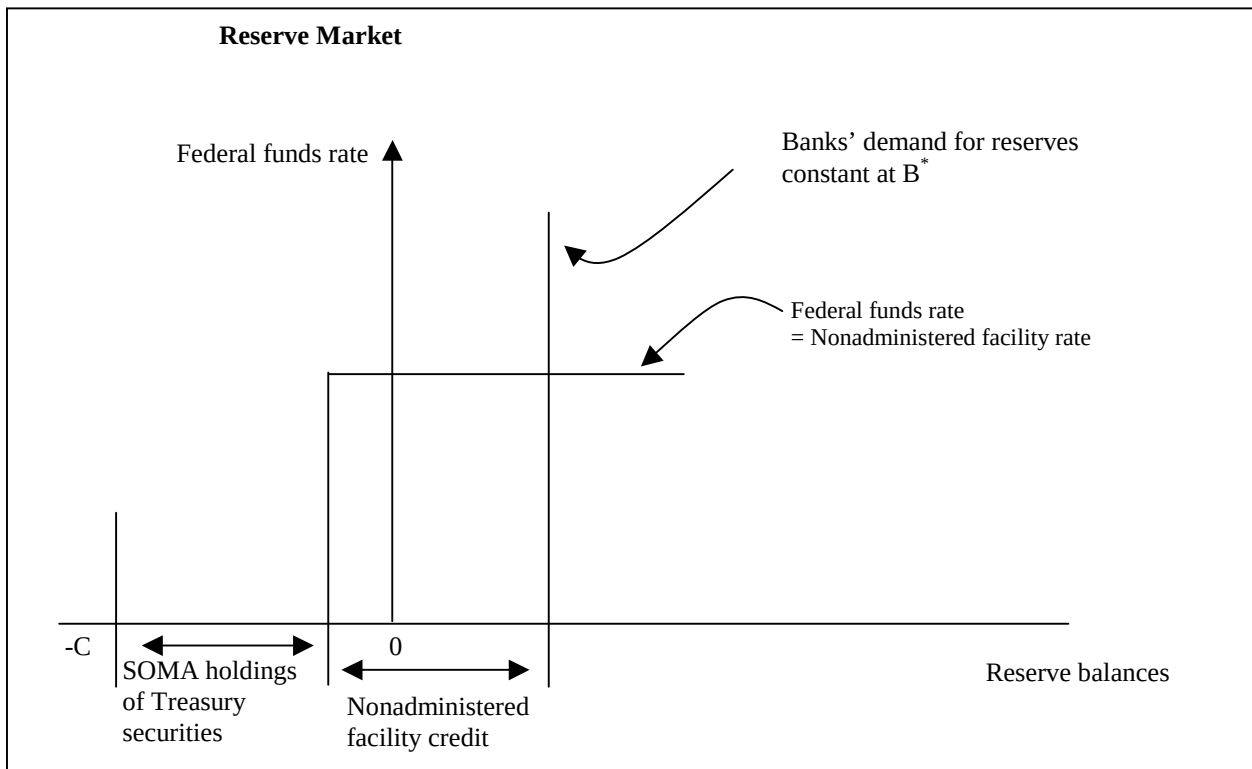
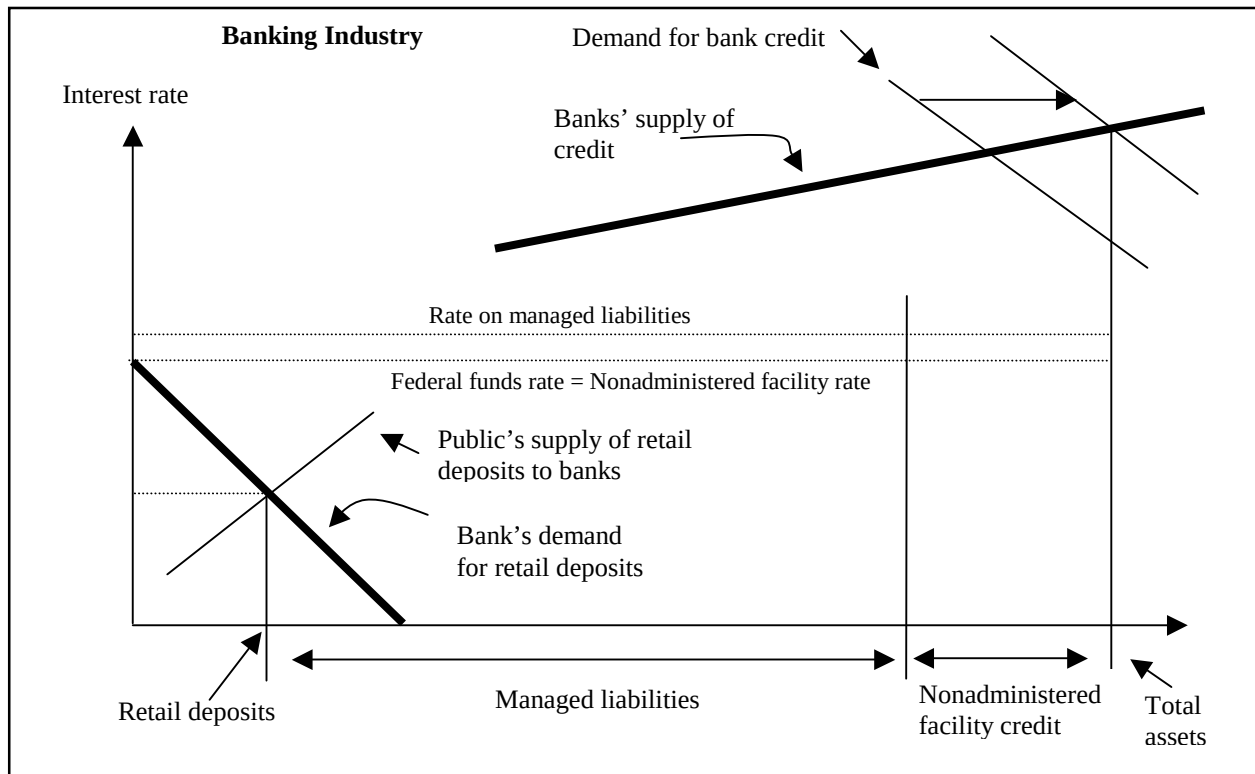


Diagram 3.C.10

Equilibrium under a Nonadministered Credit Facility: The Public Liquidates Deposits

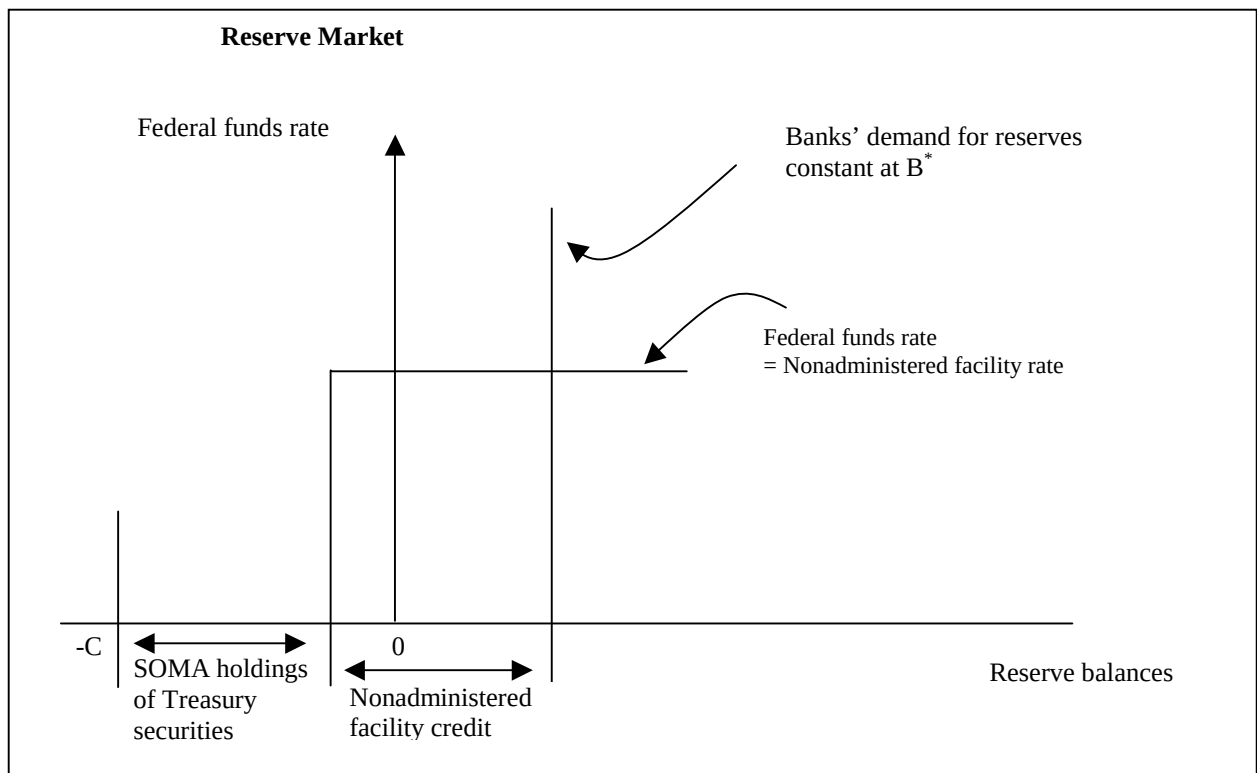
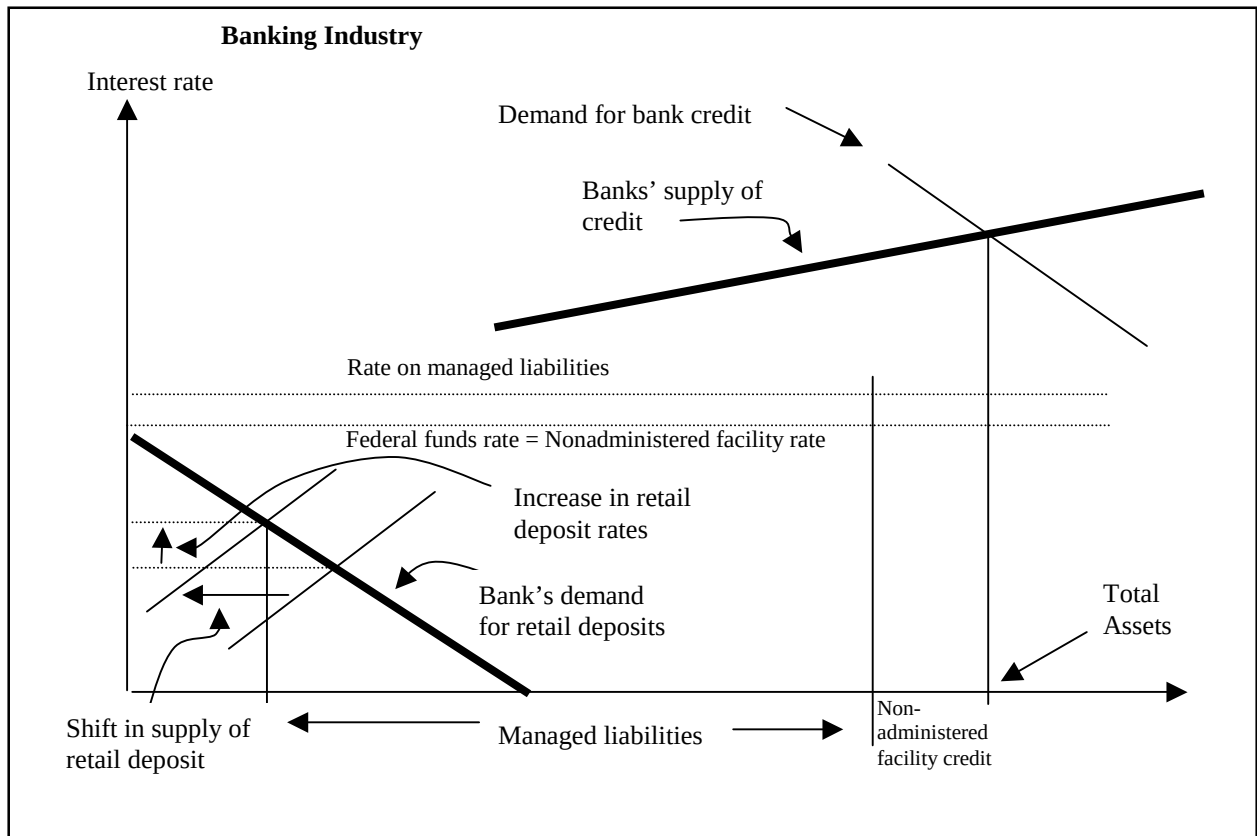


Diagram 3.C.11

Differential Increase in Bank Size when Loan Rates Rise Relative to Funding Costs

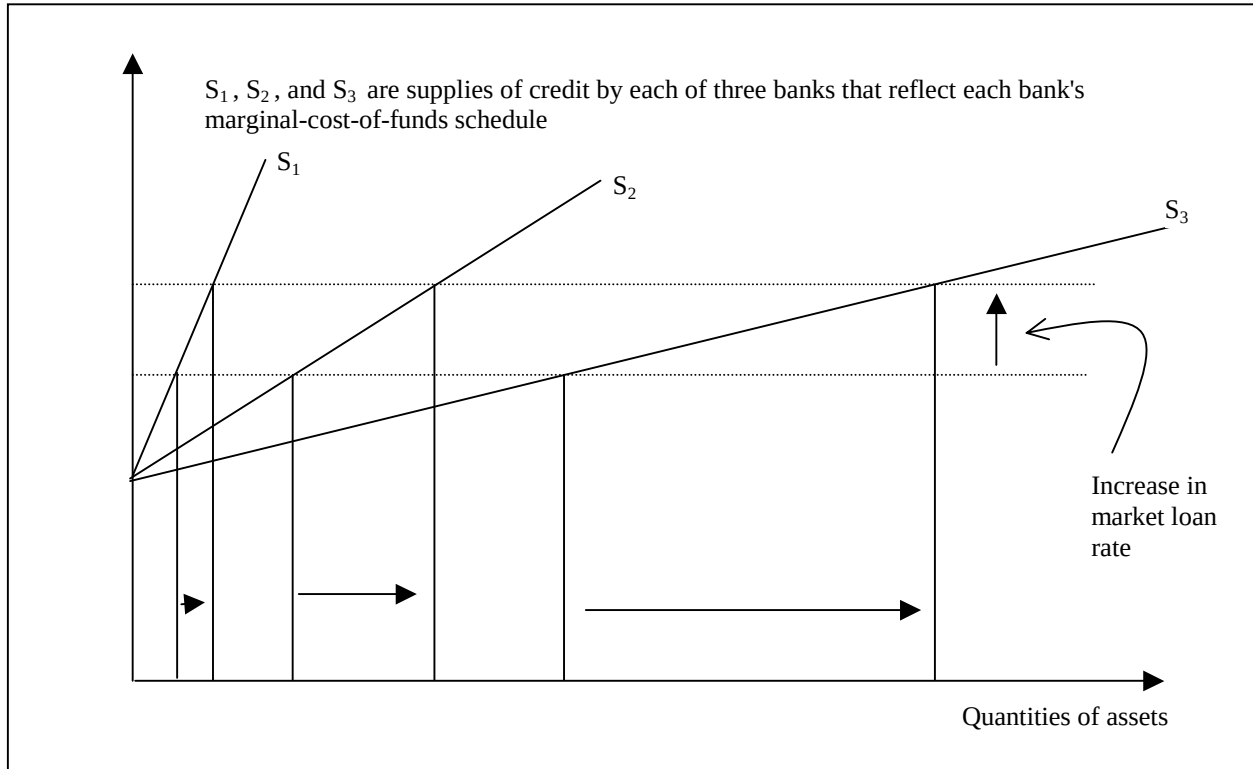


Diagram 3.C.12

Differential Effects across Types of Bank Liabilities

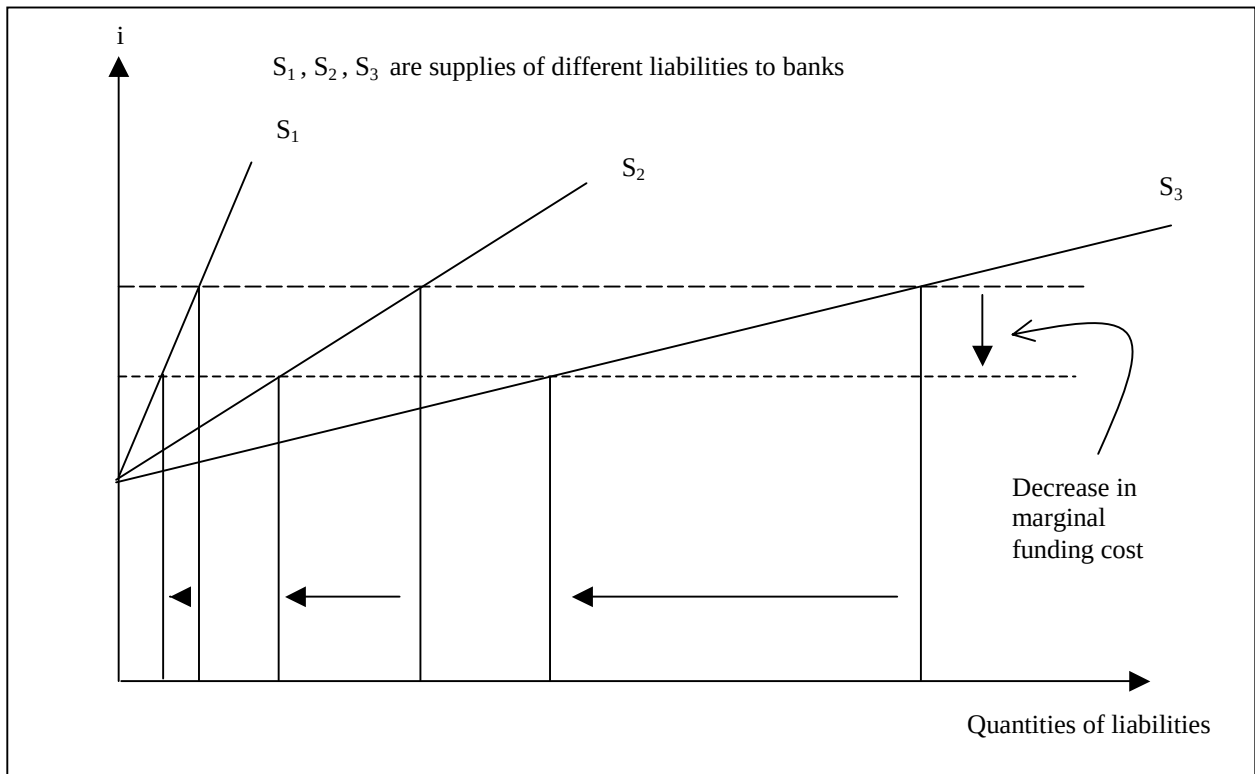
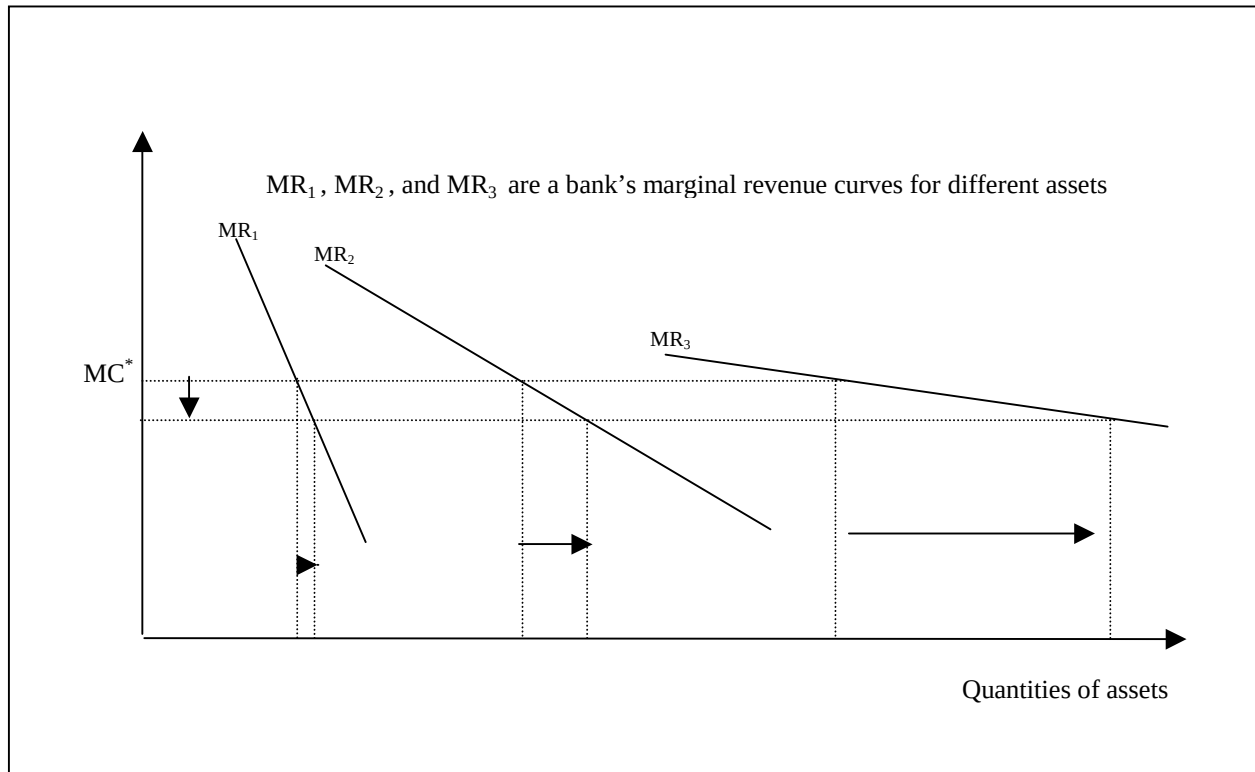


Diagram 3.C.13

Effects of a Decline in Marginal Funding Cost on Quantities across Asset Categories



Appendix 3.D

Practical and Operational Issues Associated with Expanded Use of Discount Window Credit

This appendix explores the practical and operational issues that would arise in expanding discount window lending as a source of Federal Reserve credit. Generic operational issues pertinent to both an auction credit facility and a nonadministered credit facility, such as eligibility requirements and credit limits, accounting issues, and aggregate lending capacity, are discussed first. Then some operational considerations more specifically associated with the auction facility or the nonadministered facility are discussed in turn. Many of the topics relevant to this appendix are discussed fully in the main text of this chapter and are discussed only briefly here. Topics not covered in the main text are discussed here in more detail.

BASIC OPERATIONAL ISSUES ASSOCIATED WITH EXPANDED DISCOUNT WINDOW LENDING PROGRAMS

Any program that would dramatically expand levels of discount window lending would raise a variety of operational issues. Many of these issues revolve around the fact that the quality of the Federal Reserve's balance sheet would decline if an auction credit facility or a nonadministered credit facility were adopted, simply because the Federal Reserve would be replacing high-quality Treasury securities with non-Treasury assets (in this case Federal Reserve advances). For example, both an auction facility and a nonadministered facility would entail increased credit risk for the Federal Reserve and could increase moral hazard. Such problems could probably be mitigated by establishing criteria for participation, including eligibility requirements, credit limits based on an institution's financial condition, and collateral requirements. To a great extent, resolving these operational issues involves tradeoffs between the objectives of minimizing risks to the Federal Reserve and designing a program that generates a significant aggregate volume of discount window credit outstanding to replace the Federal Reserve's holdings of Treasury securities. Although credit risk to the Federal Reserve would increase from an expanded discount window lending program, the interest rate risk of the Federal Reserve's portfolio could fall, because both auction facility and nonadministered facility advances would have shorter maturities than many of the Treasury securities currently held in the System Open Market Account (SOMA) portfolio. An expanded discount window lending program would also raise accounting and legal issues related to Federal Reserve Bank balance sheets.

Managing Federal Reserve Credit Risk

As discussed in the main text, any program that significantly expands discount window lending would involve more credit risk to the Federal Reserve, if only because the dollar amount of discount window credit extended by the Federal Reserve would be so much larger than it is under existing discount window programs. Compared with U.S. Treasury securities, advances to discount window borrowers have lower credit quality.

In private credit markets, lenders recognize that they have imperfect information about borrowers' financial situations and commonly adopt a variety of measures to manage their credit risk and avoid attracting only risky borrowers. It seems likely that similar prudential measures applied to an expanded discount window lending program could be effective in mitigating the Federal Reserve's credit risk and would also help address concerns about moral hazard. Such measures include stringent eligibility requirements, credit limits that are based on the borrower's financial

condition, collateral requirements and the appropriate valuation of collateral, regular monitoring of the borrower's financial condition, and clear "exit strategies."

Eligibility Requirements

With any lending arrangement, an initial consideration is borrower qualification. The Federal Reserve Act allows Federal Reserve credit extensions only to those depository institutions that are subject to reserve requirements, except under extraordinary circumstances. The act also requires that all loans be collateralized to the Reserve Bank's satisfaction. Considering the study's objectives in introducing a new discount window program—to significantly expand Federal Reserve loans on the Federal Reserve's balance sheet—it seems clear that counterparties in the program should present minimal credit risk to Reserve Banks.

A borrower's financial strength is reflected in supervisory ratings and related information as well as in financial and market information. Combining these features, eligibility to borrow from an auction facility or a nonadministered facility could be restricted to well-capitalized depository institutions that have an investment-grade rating and a current CAMELS ratings of 1 or 2.¹ In some respects, such a limitation would be parallel to the existing regulatory restraints on depository institutions' access to wholesale funding sources such as the brokered deposit market. Extending eligibility to institutions rated CAMELS 3 would increase the risk to Reserve Banks and does not appear necessary to achieve a substantial increase in loans on the Federal Reserve's balance sheet. That is, both an auction facility and a nonadministered facility would have the potential to generate a substantial amount of Federal Reserve credit even when institutions rated CAMELS 3 are not eligible.

Of course, the maximum capacity for auction facility or nonadministered facility lending to eligible depository institutions could vary over time with the overall condition of the banking industry, and it would vary more if the program were limited to institutions having a CAMELS rating of 1 or 2. But aggregate lending capacity would still be quite substantial in the future, even if the fraction of institutions that were well capitalized fell to the levels prevailing during the banking downturn of the early 1990s. For example, the percentage of commercial banks rated 1 or 2 was only about 70 percent in 1991, compared with more than 80 percent now, and the percentage of total bank assets held by these banks was between 65 percent and 70 percent in several quarters during and just after the 1990–91 recession, compared with more than 80 percent now.

With parallel requirements, foreign banking organizations could also be eligible for the program. One approach might be to subject them to the same capital and investment-grade requirements for eligibility and use the SOSA ratings for foreign banking organizations as a substitute for CAMELS ratings. This approach could be controversial, however, and a decision about how best to permit foreign banking organizations access to potentially large amounts of funding from the Federal Reserve would call for further analysis. In general, however, it would appear best to apply all administrative criteria for foreign organizations at the consolidated bank level. For

1. This group would include both depository institutions that have been rated investment grade by public rating agencies and depository institutions considered to be equivalent to those rated investment grade. CAMELS is the acronym for a consolidated rating of six supervisory criteria: capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk. As of the third quarter 2000, more than 7,000 commercial banks had a CAMELS rating of 1 or 2, representing more than 80 percent of total bank assets; however, only about 2,500 banks had pledged collateral and therefore were able to borrow from the discount window.

example, the aggregate credit limit for all branches of a foreign institution operating in the United States should be based on the financial condition of the parent.

Credit Limits

To further limit risk to the Federal Reserve Banks, credit to an individual depository institution could be constrained to the lesser of the lendable value of its pledged collateral or a credit limit based on its financial strength. Use of a credit limit would be consistent with the Board's payment system risk (PSR) policy. Under current PSR policy, limits (called net debit caps) on the amount of intraday Federal Reserve credit (daylight overdrafts) available to individual institutions are based on an institution's capital, current financial condition, internal control strength, regulatory rating, and stated request for a given level of potential credit. The institution must specify a limit, or cap, from a range of options. Relatively low caps require minimal documentation but must be supported by the institution's primary regulator. Higher caps require a thorough and well-documented self-assessment based on the criteria set forth above, support by the primary regulator, and review by Reserve Bank staff. Intra-day credit limits are stated as multiples of an institution's risk-based capital levels; for depository institutions with high caps, the two-week average credit limit (net debit cap) under the current PSR program is 1.5 times capital.² A more conservative credit limit could be established for use with an expanded discount window lending program. Other approaches to structuring a credit limit under an auction facility or a nonadministered facility might be to limit the proportion of an institution's liabilities that could be derived from the Federal Reserve credit facility or to tie a limit to a percentage of the institution's total assets. The above PSR limit (net debit cap) is used in some examples presented below to illustrate a credit limit policy.

Collateral Requirements and Haircuts (Margins)

Requiring collateral against discount window advances would provide another layer of protection against credit risk because the assets pledged as collateral by borrowers would serve as security for the credit extended. This topic is discussed fully in the main text.

Illustration of Credit Limits and Federal Reserve Lending Capacity

Given the eligibility requirements discussed above and an assumption about credit limits, the capacity for the Federal Reserve to extend credit under an auction facility or a nonadministered facility can be illustrated. The lendable value of pledged collateral at the end of June 2000 was about \$450 billion (table 3.D.1). This amount represents, however, only a small share of the total loans and securities held by depository institutions (hereafter, banks, a term intended to encompass commercial banks, thrift institutions, and credit unions). The quantity and mix of loans and securities available for pledging provides a deep pool of *potential* collateral now totaling more than \$5 trillion (table 3.D.2). The Federal Reserve's experience with the century date change indicates that the supply of discount window collateral is elastic and implies that sufficient collateral would be available and pledged as needed if a new lending program were successfully implemented (although some of this collateral would be pledged as a precaution against the possible use of adjustment credit). For example, collateral pledged in advance of the century date change peaked at more than \$700 billion.

2. Specifically, a bank's two-week average net debit cap refers to the maximum dollar amount of uncollateralized daylight overdrafts that it may incur in its Federal Reserve account on average over a two-week reserve maintenance period. The net debit cap is equal to the bank's capital times a cap multiple, which in this case is 1.5 for banks that choose high caps. See "Guide to the Federal Reserve's Payment System Risk Policy" (<http://www.federalreserve.gov/paymentsystems/psr/default.htm>).

3.D.1. Discount Window Collateral Pledged by Depository Institutions and Their Simulated Credit Limits, by Asset Size of Institution, June 30, 2000

Billions of dollars

Asset-size group	Collateral pledged ¹	Credit limit ²
Largest 50	283	386
Largest 100	353	443
Other	99	107
Total	452	550

NOTE. Of 7,792 institutions with reserve accounts at Federal Reserve Banks on June 30, 2000, a total of 2,578 had collateral pledged for discount window loans.

1. Lendable value.

2. The simulated credit limit is tied to each institution's capital by using the net debit cap of 1.5 times capital (discussed in the text of this appendix). The amount shown is calculated by summing the net debit caps of each institution that has pledged collateral, has elected caps, and has a CAMELS rating of 1 or 2. As of June 30, 2000, less than 2 percent of the institutions that had collateral pledged for discount window loans had a CAMELS rating worse than 2; for definition of CAMELS, see text note 1 of this appendix.

Using the net debit cap discussed above to represent credit limits for banks, the aggregate credit limit for all banks would represent about 10 percent of banks' loans and securities (table D.1). So while credit limits for individual institutions would mitigate risk to the Federal Reserve, they would still allow a substantial amount of advances from an auction facility or nonadministered facility to be placed on the Federal Reserve's balance sheet to replace holdings of Treasury securities.

Not all banks currently pledge collateral for discount window purposes. Even so, the amount of credit that could be extended under a new discount window lending program is quite large because all of the largest 100 banks have pledged collateral. For example, the lendable value of collateral pledged by the largest 50 banks as of June 30, 2000, was \$283 billion, and the aggregate credit limit for the largest 50 that had a CAMELS rating of 1 or 2 was \$386 billion (table D.1). Broadening the group to the largest 100 banks increases pledged collateral to \$353 billion and increases the simulated aggregate credit limit (for those with a CAMELS rating of 1 or 2) to \$443 billion. If pledged collateral remained at these levels in the aggregate after the introduction of an auction facility or nonadministered facility, the collateral level would be the binding aggregate limit for expanded discount window lending under the new lending program (although some of the collateral pledged would also be needed to support adjustment credit borrowing).

Therefore, if the Federal Reserve wanted to replace as much as \$250 billion of the Treasury securities on its balance sheet (nearly half of its holdings in late 2000) with new discount window advances under an auction facility or nonadministered facility, it could do so if just the largest 50 banks participate (even though, of course, the program would be open to all eligible borrowers). This number of participants is close to the number of primary dealers that the Domestic Trading Desk has dealt with in the past as counterparties in open market operations, before the consolidations and withdrawals of many dealers during the past ten years. And the Federal Reserve could accomplish replacement of this level of assets without having banks pledge any additional collateral beyond the amounts already pledged for discount window purposes.

3.D.2. Distribution of Total Assets of Depository Institutions and of Their Collateral Pledged for Discount Window Loans, by Type of Asset, June 30, 2000

Type of asset	Total assets		Collateral pledged ¹	
	Amount (billions of dollars)	Percent	Amount (billions of dollars)	Percent
Securities				
Debt				
U.S. Treasury securities	131	2	4	1
Agency securities ²	276	4	13	3
States and localities	91	1	6	1
Pass-throughs	288	4	16	4
CMOs, REMICs, and strips ³	168	2	6	1
Other domestic	88	1	31	7
Foreign	55	1	1	0
Equity	42	1	1	0
Total	1,139	16	78	17
Loans				
Commercial, industrial, and agricultural	1,141	16	202	45
Mortgages				
One- to four-family homes ⁴	1,286	18	58	13
Home equity loans and lines	161	2	0	0
Commercial real estate	759	10	51	11
Consumer	800	11	62	14
Total	4,147	57	373	83
Other	2,011	28	0	0
Total	7,297	100	452	100

NOTE. Components may not sum to totals because of rounding.

1. Lendable value.

2. Excludes mortgage-backed securities.

3. Collateralized mortgage obligations, real estate mortgage investment conduits, and debt separated into principal-only and interest-only securities.

4. First and second trusts.

Collateral Composition

Under either an auction facility or a nonadministered facility, the assets acquired by the Federal Reserve when making advances would be claims on depository institutions. The claims would be secured by collateral pledged by the borrowers. A variety of asset types are now pledged as collateral for discount window purposes. As of June 30, 2000, commercial, industrial, and agricultural loans constituted the largest share of pledged collateral. Its share of pledged collateral was also substantially larger than its share of depository institutions' total assets. But the shares of pledged collateral of several other categories of assets—including one- to four-family mortgages, commercial real estate, consumer loans, and total debt securities—each exceeded 10 percent and were distributed more closely to their shares of total assets (table D.2). Although borrowers often pledge only one or two types of assets for discount window loans, the Federal Reserve typically has not ended up with only a narrow set of such assets.

Because the scale of discount window lending could be far greater under either an auction facility or a nonadministered facility, the Federal Reserve would want to pay close attention to whether it

receives a diversified set of collateral against advances by the alternative facilities. If it does not receive a diversified set of collateral, the Federal Reserve could choose to impose concentration limits so that it does not end up holding a large amount of collateral consisting of just one or two types of bank loans and also does not end up holding a large share of the bank debt of a single firm. The Federal Reserve could also establish in advance a requirement that collateral pledged by banks must be diversified across asset types, or it could establish some aggregate limit on the amount of collateral that would be accepted from one issuer.

Collateral Management

An expanded discount window lending program would increase collateral-management activities and in turn would increase costs to the Federal Reserve and to banks. Securities (now most commonly in book-entry form) are very cost effective to manage as collateral; loans are more costly to manage because they are nonmarketable.

At present, nearly 80 percent of the collateral pledged for discount window purposes is held under borrower-in-custody (BIC) arrangements. The initial setup for BIC arrangements—in particular, the modification of systems to accommodate asset labeling and reporting to the Reserve Bank—generally represents the borrower's largest cost in the pledging of collateral. For the Reserve Banks, BIC administration costs are related to initial setup of a BIC (including taking appropriate steps to protect the Reserve Bank's security interest, such as filing financing statements) and to monitoring by means of both on-site and off-site reviews. As a BIC portfolio expands, incremental increases in monitoring costs are a function of the complexity or characteristics of the assets pledged. If the term of discount window loans were to increase, as envisioned under an auction facility, the reporting and on- and off-site monitoring processes might also require modification.

Currently, the majority of the largest 100 banks hold collateral pledged to the Federal Reserve in BIC arrangements. These institutions would be expected to maintain their current collateral levels and possibly increase their pledging levels to take fuller advantage of a new lending program. An increase of pledged collateral within existing BIC arrangements might marginally increase the costs to both the borrower and the Federal Reserve, depending on the need to revamp control procedures.

Only about 5 percent of small banks now have BIC arrangements in place, however, and implementation of an auction facility or nonadministered facility program might precipitate an increase in the number of smaller banks that pledge collateral. Increases in collateral pledged by these institutions would most likely be in new BIC arrangements to avoid the transport and administrative costs related to physically moving assets such as commercial loans to a Reserve Bank. An increase in collateral-management costs to the Federal Reserve (and to banks) resulting from increases in the number and size of BICs would be related to the types and mix of assets pledged and the cost of any changes in on-site reviews or other control measures. As noted earlier, however, if obtaining advances under the auction facility or nonadministered facility involves increasing returns to scale for banks, then the number of participants in an auction facility or nonadministered facility could settle down to a few large banks that redistribute the funds to other banks through the federal funds market.

The Federal Reserve's additional collateral-management costs from an auction facility or nonadministered facility would depend on the scale of the lending program that it wanted to achieve. The Federal Reserve already has about \$350 billion of pledged collateral from just the largest 100 banks. If the Federal Reserve wanted an auction facility or nonadministered facility to replace less than that amount of Treasury securities on its balance sheet, the Federal Reserve's

existing costs of collateral management might increase somewhat; whether it did so would depend on the types and mix of assets pledged as collateral as well as on whether the banks involved had previously established borrowing agreements and pledged collateral. If, on the other hand, the Federal Reserve sought to expand the auction facility or nonadministered facility to more than \$500 billion, additional collateral would have to be pledged by banks, and collateral-management costs would increase even more, particularly if a large number of banks set up new BIC arrangements to participate in the new program.

If the Federal Reserve were to face significantly higher collateral-management costs, it could consider charging fees to banks to cover these costs. In doing so, the Federal Reserve would have to be careful not to introduce distortions in the incentives banks have to pledge different types of collateral.

Loan Maturity

The maturity of credit extended under an auction facility and a nonadministered facility is another consideration in exposing the Federal Reserve to risk. Here the issues for the two programs are quite different. The auction facility would extend credit for somewhat longer terms of up to three or four months, while the nonadministered facility would extend overnight credit. Longer-term credit poses more risks than does overnight credit, not only in terms of credit risk but also in terms of interest rate risk and liquidity risk. These additional risks from auction facility advances should be incorporated into the valuation of collateral to determine appropriate haircuts for collateral pledged against auction facility advances. The longer the term of the advance, the larger the haircut should tend to be.

For the Federal Reserve, some tradeoff would exist between the risk of extending longer-term (auction facility) advances and the costs of using auctions to replace a certain dollar amount of Treasury securities. Longer-maturity loans would reduce the frequency and magnitude of auctions required to attain any given amount of loans outstanding on the Federal Reserve's balance sheet. For example, a weekly auction of \$10 billion of three-month credit—a little larger than the size of current weekly auctions for Treasury bills—would result in a steady-state (or "permanent") loan portfolio of \$130 billion dollars. Achieving the same \$130 billion steady-state loan size using overnight advances would require daily auctions of \$130 billion, an amount that does not seem feasible.

Condition Monitoring

To control its risk, the Federal Reserve currently monitors all banks that hold accounts at the Federal Reserve as well as others that are eligible to borrow or open accounts. The introduction of a new lending program having the proposed eligibility criteria would establish a conservative financial threshold that might require changes in monitoring processes and could increase costs in this area. Condition monitoring is discussed fully in the main text of this chapter.

Exit Strategies

Regardless of the Federal Reserve's best efforts to minimize credit risks, loans under an auction facility or a nonadministered facility would inevitably be extended to some banks whose financial condition later deteriorates. It seems appropriate for the Federal Reserve to specify in advance how it intends to manage such situations. Those issues are also discussed fully in the main text.

Bank Risk-Taking and Risks to the FDIC

The Federal Reserve should be concerned not only about the risk to its own portfolio but also about the effects of its actions on the riskiness of depository institutions and thus the risks to the

Federal Deposit Insurance Corporation (FDIC). The main text of this chapter discusses several aspects of this issue, including effects on banks' incentives to assume credit risk and liquidity risk.

Accounting Issues for Reserve Bank Balance Sheets

The volume of borrowing under either an auction facility or a nonadministered facility across Federal Reserve Districts would not necessarily bear a close relationship to the "structural" size of individual Reserve Bank balance sheets. For example, large institutions in a particular District could have quite large amounts of credit outstanding, possibly far exceeding the total currency issued by that District's Reserve Bank. Such imbalances could be addressed in several ways. For instance, to fund credit demands on its auction or nonadministered facilities that exceeded its total currency liabilities, a Reserve Bank could be allowed, in effect, to "borrow" from other Reserve Banks. Alternatively, discount window loans across the System could be pooled, and shares in that pool could be allocated to individual Reserve Banks—a structure that would be analogous to that of the SOMA. These alternatives, or other possible approaches, would raise accounting, operational, or legal issues that would need to be studied before an auction facility or nonadministered facility could be implemented.

OPERATIONAL ASPECTS SPECIFIC TO THE AUCTION CREDIT FACILITY

Establishing an auction credit facility would require the Federal Reserve to address several operational issues, including ensuring market participants are given adequate information at the outset of the program to ensure a smooth transition; developing a system for conducting regular nationwide auctions; and enhancing current automated systems to handle an increased workload.

Transition Issues

To help ensure that markets adjust quickly to an auction credit program and that they yield adequate participation at the auctions, the Federal Reserve might wish to provide additional information to the market concerning reserve forecasts. The objective would be to reduce uncertainties about the Federal Reserve's intentions that could otherwise inhibit bidding at the auctions. For example, publishing the Desk's forecasts of reserve factors in the current maintenance period could be helpful to market participants. They might see, for example, that the Federal Reserve was forecasting sizable reserve needs that would be met largely through auction credit. This information would help ensure that market participants were aware of the auctions and better positioned to make informed decisions.

Auction Mechanics

The auction itself could be organized so that bids could be taken at individual Reserve Banks and then forwarded to a central site to determine awards, or, alternatively, all bids could be submitted directly to a central site. The Treasury auction offers a working model for such a process. In the past, bids for Treasury securities were taken by all Reserve Banks and forwarded to a single site. Today, in a process that has been largely consolidated, bids are sent directly to the Treasury, and an automated system determines the auction results. Having one centralized site for collecting and processing bids and awarding the credit is likely to be the most cost effective procedure. Automated interfaces would allow the process to be essentially transparent to all parties.

Auctions could be conducted at regular intervals (weekly, monthly, and so on) for advances having a single maturity or for advances having different maturities, depending on the degree of flexibility the Federal Reserve wanted to have in extending credit and the scale of the lending program implemented.

Two types of auction are possible: a *uniform price auction* and a *discriminating price auction*. In a uniform price auction, each participant submits a bid (or possibly multiple bids) specifying a quantity and interest rate. All winning bids would be filled, and the winning bidders would pay the highest winning rate that was bid (the stopout rate). In a discriminating price auction, the bid process is the same, but credit would be awarded at the interest rate established by each of the bids, starting from the lowest interest rate, until the total amount to be supplied was exhausted. The auction process could be structured to accept either fixed or variable-rate bids and would not require a minimum bid.

As is done in the Treasury's auctions, awards to any one bidder could be limited to a percentage of the total credit auctioned. Noncompetitive bids for smaller tenders could be accepted if the Federal Reserve wanted to ensure that smaller banks would use the auction facility. At some point in the auction and credit-award process, bidders would be required to verify that they meet the eligibility criteria and that each bank is bidding within its credit limit.

An automated application similar to the Treasury Automated Auction Processing System (TAAPS), linked to the Common Loans Automated System (CLAS), would accommodate the described auction process for distributing Federal Reserve credit. Alternatively, determination that bidders were eligible and within their credit limits could be done *ex post*, with sanctions imposed on any institution violating these requirements.³

An important operational issue discussed in the main text of the chapter is whether separate auctions should be held for advances secured by different classes of collateral. One could imagine, for example, one set of auctions for loans secured by safe and liquid assets such as Treasury and agency securities and a separate set for loans secured by other types of collateral. Whether some broader objective would be served by conducting segregated auctions is unclear, but no benefit seems to be gained by creating, in effect, a separate market in the form of special tranches of auction facility credit secured by Treasury and agency collateral. By holding such auctions, the Federal Reserve would, in effect, be immobilizing a certain quantity of marketable debt that might otherwise be employed by market participants for trading and hedging purposes. Moreover, the Desk's existing repurchase arrangements would seem to be the superior vehicle to extend credit against Treasury and agency securities, and the repurchase market is already well organized and very deep.

Loan Transactions and Automation

To get some perspective on the difficulty of handling a large auction facility lending program, consider the frequency and size of the auctions needed to "permanently" replace \$100 billion of Treasury securities on the Federal Reserve's balance sheet. If all auction facility advances had three-month maturities, the Federal Reserve could auction roughly \$8 billion of advances each week and after thirteen weeks would have \$100 billion of advances outstanding. This amount would remain outstanding as long as the Federal Reserve continued these weekly auctions in the same amount. If auctions of three-month advances were held more frequently, such as daily, then the amount auctioned could fall to about \$1.4 billion per day. Weekly auctions of about \$8 billion do not appear large compared to existing auctions of marketable Treasury and agency

3. One concern might be that a borrower's condition could decline while a loan under the new program is outstanding. Some arrangement might be necessary to accommodate this situation, as is discussed in the main text of this chapter. Allowing the borrower to hold the loan to maturity—that is, not accelerating repayment—would provide the borrower some time to arrange alternative funding. Adjustment credit or extended credit could also be available for transitional purposes.

securities. And daily auctions of \$1.4 billion are not inordinately large compared with the size of daily open market operations.

The less frequent the auction, the larger the auction amount would have to be to achieve the \$100 billion of advances outstanding. And the shorter the maturity of the advances, the larger the amount auctioned would have to be. For instance, if advances had maturities of two months instead of three months, then weekly auctions would have to be about \$12 billion (instead of \$8 billion) on an ongoing basis to generate a steady-state portfolio of \$100 billion of auction facility advances.

Although the number of loan transactions at each auction is speculative, let us suppose that as many as fifty banks participate in the weekly auctions. This number could be on the high side if there are economies of scale in acquiring Federal Reserve advances in such auctions. Fifty loan transactions for fifty-two weeks would amount to 2,600 loan transactions in one year.

What do these numbers imply for the alternative discount window operations in comparison with existing operations? The auction process described in the above example would result in more borrowers at any one time than under the existing discount window programs. In 1999, a total of 1,003 loans were made under the three current programs and the Special Liquidity Facility. In operational terms, the new lending program would require processing support for the auction itself, additional credit and repayment accounting transactions, and adjustments among Reserve Banks to appropriately distribute these assets on the Reserve Bank's balance sheets. Efforts to manage collateral and monitor the financial health of borrowers may also need to increase. The capacity of the CLAS system today, however, is 32,500 loans per year, so it appears that unless the number of credit extensions under a new lending program were quite large in any one year, CLAS capacity would be sufficient.

The auction process lends itself well to automation. The Federal Reserve could develop an automated system modeled after the TAAPS program. Such a system could interface directly with CLAS so that staff involvement in the actual processing of the credits would be minimal. The TAAPS system has been in place for some years, and enhancements and some re-engineering of functionality have added to the total investment in the application, but its development costs to date do not reflect what the cost would be to develop a new Federal Reserve credit auction system. Estimates based on other System applications suggest, however, that the total development cost would likely be several million dollars.

CLAS would receive information on successful bids from the auction system and create accounting entries for the credit and repayment at maturity, as it does for the current lending programs. As a control, CLAS could report exceptions, such as collateral deficiencies, as it does today. Edits could be based on credit limits and supervisory information available from the CLAS link to the National Examination Database application in the National Information Center. Limits on processing in CLAS are a function of transaction input, which is currently done manually because under existing discount window programs, each credit extension is individually negotiated and processed. An automated auction application that interfaces with CLAS would eliminate this constraint. Enhancements to CLAS to allow for this interface and for edits to confirm credit limits and collateral would also be needed. A very rough estimate of the cost of these modifications is 20 percent of the original \$2.8 million development costs for CLAS, or about \$560,000.

OPERATIONAL ISSUES SPECIFIC TO THE NONADMINISTERED FACILITY

For the most part, key operational issues associated with the nonadministered facility are similar to those for the auction facility. Automated systems would need to be developed to handle an increased workload and loan processing.

Automation

For the nonadministered facility, loan maturities would be overnight. That would mean that if the nonadministered facility lending program were as large as \$100 billion, then \$100 billion of loan transactions would have to be processed each day. Maintaining this dollar volume under a nonadministered facility would likely involve a far larger number of transactions than would the longer-term auction facility advances and would essentially require automation. Manual processing of such a large volume would be extremely labor intensive. To speed processing, a nonadministered facility would need to be established as a more or less "automatic" credit line in which end-of-day account overdrafts are simply converted to loans (up to the level of collateral pledged) for eligible institutions.

Implications for Reserve Management

The nonadministered facility proposal appears to have some interesting implications for banks' reserve-management practices. In some standard models of reserve management, for example, banks determine their pattern of reserve holdings on each day of the maintenance period by balancing two costs. On the one hand, banks running short on reserves early in the maintenance period face a greater risk of incurring an overnight overdraft (or the need to borrow at the discount window) and a penalty for a reserve deficiency. On the other hand, banks running long on reserves early in the period face the risk that they could be "locked in" to cumulative excess reserve positions for the period because they are unable to work off their accumulated excess without incurring overdraft penalties. In balancing the risks of running long or short on reserves during a maintenance period, banks have tended to run a little short early in the period and to meet a sizable proportion of their period average reserve need on the last few days of the maintenance period.

Under a nonadministered facility, such a balancing of risks would largely disappear. An institution could virtually guarantee that it would incur no overdraft penalties, reserve requirement deficiencies, or large cumulative excess reserve positions. It could maintain an account balance close to zero on all nonsettlement days (or just large enough to mitigate its risk of daylight overdrafts) and then hold enough on the final day of the period to just meet its average reserve requirement. Other than holding balances during the day for clearing purposes, a bank could achieve this position by simply running well short on reserves on all nonsettlement days and borrowing just enough from the nonadministered facility to bring its account balance up to zero. On the last day of the period, the bank would simply borrow enough from the nonadministered facility to meet its entire reserve requirement.

That is how banks should behave in theory. Many types of friction could, of course, cause banks to stray from such an extreme pattern of reserve holdings over the maintenance period. Still, if many institutions began to adopt this strategy, the Federal Reserve might want to reconsider its current reserve maintenance rules. In particular, it might want to eliminate the current provisions allowing for the averaging of reserves held across all days of a maintenance period in favor a system that required institutions to meet their reserve requirement on a daily basis. Obviously, such a change would result in a more stable daily level of aggregate reserve demand.

Payment System Risk

The nonadministered facility would also have significant interactions with payment system risk policies and procedures.

An important goal of current payment system risk policies has been to encourage institutions to closely monitor their account position throughout the day and to avoid overnight overdrafts. Measures adopted to accomplish the latter goal include stiff penalties for overnight overdrafts followed up by administrative actions if overdrafts become frequent. In addition, Reserve Banks now routinely contact institutions that are overdrawn late in the day to notify them of their position (if they were not aware of it) and to inquire about their plans for covering their account position by the end of the day.

It would appear that, under the nonadministered facility, the incentives for account management would be adversely affected. As long as an institution had sufficient collateral pledged, it would have no reason to worry about an overdrawn position toward the end of the day—it would simply borrow at the nonadministered facility to cover any overdraft. At the margin, this possibility might result in some moral hazard incentives in connection with operational risks. That is, the nonadministered facility might, in effect, act as insurance for an institution that encounters an operating problem that leaves it overdrawn at the end of the day. Without any real costs resulting from such operating problems (beyond those related to customer relations), banks might well be less vigilant in monitoring their transactions and less inclined to invest the time and money necessary to ensure that their funding situation and back-office functions operate efficiently. Avoiding such "operational" moral hazard with a nonadministered facility seems difficult. Closer monitoring of an institution's account during the day might help mitigate such problems.

Appendix 3.E

Assessment of Discount Window Alternatives in Terms of the Study's Overall Principles

This appendix considers the extent to which the two discount window alternatives are consistent with the principles of central banking presented in chapter 1. This appendix also addresses discount window alternatives in terms of the criteria for collateral presented in that chapter's appendix 1.D.

Chapter 1 sets out four general principles that the Federal Reserve should observe in managing its portfolio:

1. Exercise effective control over the stock of high-powered money and the size of its balance sheet. This control is often called instrument independence
2. Structure its portfolio and undertake its activities so as to minimize their effect on relative asset values and credit allocation within the private sector
3. Manage its portfolio to be adequately compensated for risks and to maintain sufficient liquidity to conduct potentially large actions on short notice
4. Place a high priority on transparency and accountability.

DISCOUNT WINDOW ALTERNATIVES IN TERMS OF THE CENTRAL BANKING PRINCIPLES

Chapter 1 states that the first principle is of fundamental importance and that the central bank has more latitude in adhering to the remaining three principles.

Principle 1: Instrument Independence

Under the current procedure for implementing monetary policy, the Federal Reserve essentially allows the size of its balance sheet to be determined by the demand for Federal Reserve credit that is consistent with the federal funds rate targeted by the Federal Open Market Committee (FOMC). The demand for Federal Reserve credit is met primarily by conducting open market operations in Treasury securities. The Federal Reserve can offset unexpected changes in factors affecting the supply of funds to the financial system by conducting offsetting transactions in Treasury securities or repurchase agreements.

One of the working assumptions of the overall study is that the FOMC would continue to set an intended level of the federal funds rate, in which case both an auction credit facility and a nonadministered credit facility would allow the size of the Federal Reserve's balance sheet to be determined by the demand for Federal Reserve credit. In a broad sense, then, the auction facility and nonadministered facility would be little different from current open market operations in their control over the size of the Federal Reserve's balance sheet.

Nevertheless, the two alternatives would work in different ways. Unless auctions of longer-term advances were held daily, an auction facility by itself would not allow the daily adjustments to the Federal Reserve's balance sheet that are now allowed by open market operations or that would

be allowed by a nonadministered facility. But the discussion of the auction facility envisioned that it would only supplement ongoing open market operations so that such operations would continue to provide the needed daily adjustments in the Federal Reserve's balance sheet.

The Auction Credit Facility

Within the context of an interest rate targeting strategy, the auction facility alternative would allow the Federal Reserve to adjust the size of its balance sheet to help hit a federal funds rate target because (1) depository institutions would bid for fixed amounts of Federal Reserve advances being offered in the auctions and (2) borrowers would not be permitted to prepay the advances. The Federal Reserve could ensure that it has control over these balance sheet adjustments because it could vary the amount of advances being auctioned.

As discussed in the main text of this chapter, the Federal Reserve could vary the size of its auctions to account for secular, cyclical, and seasonal factors in the context of achieving the target federal funds rate. If the Federal Reserve had to extend a large amount of emergency credit, the maturing auction facility loans could help offset that emergency lending and thereby help maintain the target federal funds rate. In addition, emergency lending could be offset by reducing the size of subsequent auctions.

The speed and effectiveness with which adjustment could occur would depend on the frequency of the auctions and the terms to maturity of the advances auctioned. If the emergency lending occurred between the dates of the auctions, the federal funds rate might fall below the FOMC's target until the next auction, when a smaller amount could be offered to offset the emergency credit extended. For the Federal Reserve to control its balance sheet in such a case would require that some part of auction facility advances be overnight loans, that some auctions be conducted daily, or that the Federal Reserve retain a sufficient portfolio of System Open Market Account (SOMA) assets (whether Treasury or non-Treasury securities) that it could sell to offset an increase in emergency lending. It was the last option—that auctions would supplement open market operations, not supplant them—that was incorporated in the auction facility discussion in the main text of this chapter. Consequently, if the Federal Reserve extended a substantial amount of emergency loans, adjustments to its balance sheet would not be made solely through the auction facility.

In sum, auctions of advances appear to be broadly consistent with the principle of maintaining the central bank's instrument independence within the context of using an interest rate targeting strategy.

The Nonadministered Credit Facility

Under the nonadministered credit facility, depository institutions would obtain overnight advances at the target federal funds rate. The amount of advances from the nonadministered facility that would be on the Federal Reserve's balance sheet would be demand-determined and based on the FOMC's target for the federal funds rate.¹ The FOMC would control the amount borrowed from the nonadministered facility through its control over the federal funds rate target.

1. Under each discount window alternative, the FOMC would set the intended federal funds rate. But the nonadministered facility would supply whatever quantity of advances would be demanded at that interest rate target, whereas the auction facility would offer a fixed quantity of advances projected to be consistent with that interest rate target. In that sense, the auction facility, more than the nonadministered facility, would be similar to current open market operations, in which the Desk sets a quantity of nonborrowed reserves projected to be consistent with the intended federal funds rate.

As discussed in the main text of this chapter, the nonadministered facility could provide Federal Reserve credit that would support secular, cyclical, and seasonal growth of the demand for currency. Reductions in the Federal Reserve's nonadministered facility advances would occur when depository institutions (hereafter, banks, a term intended to encompass commercial banks, thrift institutions, and credit unions) decide not to renew them. Since nonadministered facility advances would be overnight loans, banks could easily reassess their funding needs as market conditions change. In the event that the Federal Reserve had to extend some amount of emergency loans, borrowing from the nonadministered facility would decline as the funds from the emergency loans were redistributed through the financial system. Provided nonadministered facility credit becomes large as a share of total Federal Reserve credit, even very large extensions of emergency lending would be offset simply by banks' not renewing their existing nonadministered facility loans.

Under the nonadministered facility, the Federal Reserve would still exercise control over the size of its balance sheet, although it would do so through a different means than in the case of the auction facility. Consequently, the nonadministered facility also appears to be consistent with the principle of maintaining the central bank's instrument independence, at least within the context of the Federal Reserve's use of an interest rate targeting strategy.

Principle 2: Minimizing Credit Allocation and the Effects on Relative Prices

Under either of the two discount window alternatives, the Federal Reserve would extend credit to banks, and they would redistribute that credit in their normal operations as financial intermediaries. If one of the discount window alternatives is adopted, and Federal Reserve advances became a large part of the Federal Reserve's balance sheet, the importance of banks might increase relative to that of primary dealers and other financial institutions. As discussed in the main text of this chapter and in appendix 3.C, the bank sector might increase in size relative to the nonbank sector of the financial system. This eventuality might be viewed as having resulted from the Federal Reserve's allocating credit to the bank sector. Banks, however, not the Federal Reserve, would make the ultimate decisions about allocating credit to the rest of the economy. Furthermore, banks have always played an important role in the transmission of monetary policy. Chapter 1 notes that many foreign central banks have chosen to conduct their central bank activities through regulated institutions.

In addition to its effect on the bank sector, the introduction of the auction facility or nonadministered facility could alter the relative prices of some financial assets (see the main text of this chapter and appendix 3.C). These effects are hard to quantify (or even to sign in some cases). Providing Federal Reserve credit through advances to banks would tend to spread any relative price effects across a broad range of sectors served by the banking industry. Thus, use of either of the two discount window alternatives appears consistent with the approach suggested in chapter 1, which says that the risk of affecting relative prices across private assets could be reduced by a strategy of substantial diversification. In the case of discount window alternatives, the diversification would be across depository institutions' holdings of securities and loans.

An additional concern might be whether the use of haircuts for groups of collateral having different degrees of liquidity could distort the way banks allocate credit. The auctioned and nonadministered advances, which would be made under section 10B of the Federal Reserve Act, would be secured by pools of collateral. As discussed in the main text of this chapter, collateral is sufficiently plentiful that banks would not give great weight to haircuts when making their credit-allocation decisions or when posting collateral, particularly because of credit limits, that is, limits on the amount each bank could borrow from the auction facility or nonadministered facility. For

these reasons, the Federal Reserve's collateral policy would seem unlikely to affect a bank's decision on the margin to make additional loans

In sum, the two discount window alternatives neither directly subsidize nor directly allocate credit to any one nonfinancial sector.

As discussed at length in the main text of this chapter, the introduction of the auction facility or nonadministered facility might generate other effects in financial markets. For instance, either facility could have an effect on lending by the Federal Home Loan Banks (FHLBs) because FHLB loans are likely to be collateralized with the same assets as are discount window advances. FHLB loans could decline in those maturity ranges used by the auction and nonadministered facilities. The facilities might also increase bank risk-taking and moral hazard, and the nonadministered facility may affect the functioning of the federal funds market.

Principle 3: Liquidity, Credit Risk, Interest Rate Risk, Internal Controls, and Settlement Risks

Liquidity

Chapter 1 discusses the liquidity of the Federal Reserve's assets in terms of the Desk being able to add or drain reserves in large amounts on short notice and without large changes in the market values of those assets. That document also says that the principal liquidity concerns for the Federal Reserve's portfolio stem from short-term needs to alter its size and composition and not from longer-term changes in its size. Chapter 1 notes that since 1976 the daily changes in the size of the portfolio have typically been about 1.5 percent but that on rare occasions it has changed as much as 15 percent. In terms of Federal Reserve assets as of late 2000, a 1.5 percent change amounts to about \$8 billion and a 15 percent change amounts to about \$80 billion. The questions, then, are (1) Would the auction facility or nonadministered facility allow short-term changes of the Federal Reserve's assets in that range? and (2) Could such changes occur without large changes in the assets' market values? These questions are addressed in detail in the main text of this chapter. Both facilities seem likely to permit adjustments within the range of the typical daily changes in the System's portfolio. A nonadministered facility would probably be more effective than an auction facility at making very large adjustments, particularly if the intervals between auctions were long.

Credit Risk

Chapter 1 argues that, to help maintain the liquidity of the Federal Reserve's assets, credit risks should be kept low. As discussed in the main text of this chapter and in appendix 3.D, credit risk to the Federal Reserve would increase under either an auction facility or a nonadministered facility, because under the current discount window lending programs, a large share of the Federal Reserve's portfolio is in Treasury securities. The much larger scale of lending under either new facility would, by itself, increase the magnitude of credit risk.

Under either facility, credit risk would depend on the credit quality of the borrowers, which in turn would depend on the eligibility criteria for borrowing as well as on the level of the credit limits and on the collateral required to secure the advances. Eligibility to borrow would be limited to strong institutions, that is, those that are well capitalized with investment grade ratings and CAMELS ratings of 1 or 2 (with comparable requirements for foreign banking organizations). The higher the standard applied for eligibility, the lower the credit risk of the Federal Reserve. The Federal Reserve would potentially have credit exposure to a far larger number of banks than it currently has under open market operations, which involve a relatively small number of primary dealers, although ultimately the number of banks that participate in the

auction facility or nonadministered facility will depend on whether participation involves economies of scale.

In addition, the estimated market value of the collateral used to back the auction facility or nonadministered facility advances would be given a haircut, which also would help to control credit risk to the Federal Reserve as long as the haircuts appropriately reflect credit risk. As noted in the main text of this chapter, the collateral that banks would find operationally efficient to deliver to the Fed would likely be the least liquid, a condition that also could increase credit risk to the Federal Reserve. In addition, the greater legal complexity of secured lending arrangements compared with the repurchase agreements used in open market operations may introduce some additional risk for the Federal Reserve in the event of a default or the insolvency of a counterparty.

In addition to being lessened by strict eligibility criteria, credit limits, and collateral requirements, the Federal Reserve's credit risk under the discount window alternatives would be mitigated by several other factors: The Federal Reserve would have good information on the health of banks; it has the regulatory authority to take actions involving banks, and it could act if a bank's position deteriorates. Nevertheless, the Federal Reserve's credit risk under the discount window alternatives would still rise from today's level.

Interest Rate Risk

Chapter 1 says that the Federal Reserve should manage its assets so that their market value changes little when interest rates change. Although the Federal Reserve reports the value of its Treasury securities holdings at par, the holdings are subject to interest rate risk. An expansion of advances on the Federal Reserve's balance sheet under the auction facility or nonadministered facility would also involve some interest rate risk. Any unanticipated change in market interest rates would affect the value of the Federal Reserve's loans and the market value of the collateral used to secure the advances. If haircuts are applied appropriately and are reevaluated regularly, such interest rate risk should be mitigated because the methodology for determining haircuts on collateral takes into account interest rate risk.

Interest rate risk under the discount window alternatives also depends on whether the advances are overnight or longer term. Advances from a nonadministered facility would have little interest rate risk since they would be overnight loans. But auction facility advances are envisioned to be longer term, so that changes in market interest rates will pose additional interest rate risk to the Federal Reserve to the extent that these advances are made at fixed rates.² But since the term of those advances could generally be no longer than four months (see appendix 3.A, note 3), the extent of interest rate risk would be quite small and even less than for much of the current SOMA portfolio, which contains a large amount of Treasury securities with terms longer than three or four months. The interest rate risk associated with Federal Reserve holdings of auction facility loans would likely be similar to the interest rate risk of SOMA holdings of longer-term repurchase agreements.

Internal Controls and Settlement Risks

Chapter 1 says that management of the Federal Reserve's assets should maintain high standards of internal controls, minimal settlement risk, high legal certainty, and settlement with finality. One

2. An alternative would be to make auction facility advances at a floating rate instead of a fixed rate. Auctions of floating-rate advances may not be much more difficult to conduct than auctions of fixed rate advances because banks already bid for funds at floating rates in some markets.

advantage that both discount window alternatives would have is that the Federal Reserve already has well-developed systems for discount window lending that address these issues. The auction facility or nonadministered facility would use the same systems for making advances, although modifications may have to be made to automate the processing of loans.

Principle 4: Transparency and Accountability of the Federal Reserve

As discussed in the main text, both the auction facility and nonadministered facility would generally be consistent with the principle of transparency and accountability.

DISCOUNT WINDOW ALTERNATIVES IN RELATION TO THE CRITERIA FOR DISCOUNT WINDOW COLLATERAL IN CHAPTER 1

Chapter 1, appendix 1.D, addresses the primary risks associated with discount window collateral: credit, market, liquidity, operational, and legal risks. That appendix also discusses collateral procedures (such as haircuts and perfecting interest in the collateral pledged), custody arrangements, administration staffing needs, competition for collateral, and systemic risk and public accountability.

Appendix 1.D is consistent with the view that, as security for a loan, collateral helps align the practices of the borrowing bank with the Federal Reserve's goal of minimizing its risk without serving as the primary source of repayment of Federal Reserve advances. Rather, according to appendix 1.D, repayment is made through proceeds from normal cash flow. Indeed monitoring the financial condition of potential and actual borrowers should be just as important as assessing the assets pledged, according to that appendix, although the careful assessment of collateral would still play a critical role in minimizing the risk exposure of the Reserve Banks.

Current System practices are consistent with the collateral criteria outlined in the main text of chapter 1 and in appendix 1.D. As discussed in the main text of the present chapter and appendix 3.D, the auction facility and the nonadministered facility would use the System's existing framework for valuing and managing collateral and therefore would be generally consistent with the collateral criteria outlined in appendix 1.D. The key difference between the auction facility or nonadministered facility and the existing discount window programs would be the larger scale of lending by the alternative facilities, a condition that could lead the Federal Reserve to reexamine some of its approaches to collateral within its existing framework.

The potentially large size of auction facility or nonadministered facility lending poses challenges in handling such operational matters as custody arrangements and administrative staffing. As discussed in appendix 3.D, the existing amount of pledged collateral (more than \$400 billion) would allow the Federal Reserve to significantly increase its advances to banks without necessarily incurring substantial additional costs of valuing and managing collateral. But such an increase would still pose operational challenges to Federal Reserve resources unless the process of extending auction facility or nonadministered facility advances were more automated. Furthermore, the Federal Reserve would have to employ additional resources (both computer and human) if the scale of lending under either the auction facility or nonadministered facility expanded further and required large amounts of additional collateral to be pledged.

Because the alternative facilities entail a far larger scale of lending, the overall magnitude of the credit risk posed to the Federal Reserve would be increased relative to the very small amount of lending done under existing discount window facilities. Certainly if the Federal Reserve is to have billions of dollars of advances outstanding to individual depository institutions, then its concerns about credit risk would be greater than they are today. Therefore, under an expanded

discount window facility, the Federal Reserve would want to reassess its methodology for determining haircuts, reevaluate these haircuts more frequently than the current intervals of twelve to eighteen months, and monitor the value of the collateral pledged by a borrowing bank and the bank's health more closely.