



WP/09/120

# IMF Working Paper

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## The Federal Reserve System Balance Sheet: What Happened and Why it Matters

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**IMF Working Paper**

Monetary and Capital Markets Department

**The Federal Reserve System Balance Sheet: What Happened and Why it Matters**

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Authorized for distribution by Peter Stella

May 2009

**Abstract**

**This Draft Working Paper should not be reported as representing the views of the IMF.**

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The recent expansion of the balance sheet of the consolidated Federal Reserve Banks (FRB) is analyzed in an historical context. The analysis reveals that the nature of Fed involvement in U.S. financial markets has changed dramatically and its expansion is several orders of magnitude beyond what is usually reported. The associated fiscal risks and potential exit strategies are then considered. Although risks are considerable in certain unlikely scenarios, FRB capital, earnings capacity, and reserves are more than ample to preserve their financial independence. Nevertheless, the occurrence of losses or a significant drop in FRB profit might lead to an eventual curtailment of Fed operational independence. The paper concludes by considering options to enhance FRB risk management and to assign responsibilities for monetary, financial stability and fiscal policies once the current crisis is overcome.

JEL Classification Numbers: E42, E58, E61

Keywords: Central bank capital

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<sup>1</sup> The author would like to thank Jerome Vandenbussche, Zsofia Arvai, Alain Ize, Charles Kramer, Herve Ferhani, Stephen Meyer, Kotaro Ishi, Luis Jacome, Alexandre Chailloux, Christian Mulder, and participants in an MCM seminar for helpful suggestions and Breda Robertson for editorial assistance. The author is responsible for any remaining errors.

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## I. INTRODUCTION

The consolidated balance sheet of the combined U.S. Federal Reserve Banks (FRB or Fed) more than doubled during 2008 to \$2.2 trillion. By some measures the Fed is now the largest bank in the United States. Its response to the financial market crisis has transformed it from a key, though small, U.S. money market participant into the largest actor and fundamental linchpin of that market and, indirectly, of the world financial system.

The transformation of the Fed, from what Benjamin Friedman once called an “army with only a signal corps,”<sup>2</sup> to a truly *central* bank, is even more dramatic than the headline numbers suggest but to demonstrate this some analysis is required. Nor is it self evident what this transformation portends for the Fed and the global financial system.

This paper has three broad objectives. The first is to analyze in historical context the FRB balance sheet transformation with the aim of suggesting alternative metrics for judging both the new scope of the Fed’s role in the financial system and the exposure of its balance sheet to risk. The second is to explore the Fed’s capacity to absorb that risk without jeopardizing its operational independence. The third is to suggest options for managing that risk during the crisis and for more clearly assigning responsibilities for monetary, financial stability and fiscal policies once the opportunity for considering an alternative architecture arise.

## II. THE FEDERAL RESERVE BANK BALANCE SHEET IN HISTORICAL PERSPECTIVE: 1951-2008

This section examines the evolution since 1951 of key FRB balance sheet components with respect to the size of the U.S. economy, its banking and financial systems, and its largest commercial banks. It concludes with a review of changes in FRB balance sheet structure. A natural starting point is 1951, the year the U.S. Treasury-Federal Reserve Accord was reached, ending the Fed commitment to peg interest rates on U.S. Treasury (UST) debt and reestablishing FRB control over the size of its balance sheet and monetary aggregates which had been ceded in 1942.

Analyzing the transformation of the components of the FRB balance sheet—beyond the headline number of total assets—is important for several reasons. An underlying central thesis of this paper is that the events of the last 18 months have witnessed a fundamental transformation of the FRB role in the U.S. financial system. This can only be seen by examining how the *nature* of FRB involvement has changed. Furthermore, it is contended here that these activities can be separated from monetary policy, therefore properly measuring them is essential to designing an exit strategy and reestablishing a clear delimitation of fiscal and monetary policies. Lastly, it is clear the FRB is now managing fiscal risk. It is important to assess adequately the nature of those risks and their implications

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<sup>2</sup> *The Future of Monetary Policy: The Central Bank as an Army With Only a Signal Corps* NBER Working Paper 7420, November 1999.

for monetary policy independence. What has happened is not merely a “doubling or tripling” of what had gone on before.

Before moving on to the examination of the consolidated balance sheet it is important to discuss the financial structure of the Federal Reserve. The Federal Reserve System is composed of 12 regional FRB and the Federal Reserve Board situated in Washington, D.C. Each FRB is a separate legal entity whose capital is fully owned by the member commercial banks in its district. Each FRB publishes its own balance sheet and is required by the Federal Reserve Act (FRA) to pay a six percent annual dividend to its shareholders on their paid-in capital stock after all necessary expenses have been paid or provided for. The Federal Reserve Board sets accounting policy for the FRB, places an assessment on each FRB to fund Board operations and currently requires each FRB to maintain a “surplus” account equivalent to paid-in capital. The Board also requires that FRB profit in excess of what is required to pay dividends and maintain the surplus account be transferred in full to the United States Treasury on a weekly basis under the rubric “Interest on Federal Reserve Notes.” The Treasury owns no Federal Reserve stock.

The Board has its own balance sheet which is not material to the discussion of this paper. (At end 2008, total Board assets amounted to \$217 million compared with total consolidated FRB assets of \$2.2 trillion). In what follows, all of the balance sheet items refer to those of the consolidated FRB unless explicitly stated otherwise. When presenting the consolidated balance sheets certain simplifications have been obtained by netting miscellaneous assets and liabilities; consequently the figures presented may differ slightly from the gross total assets and liabilities of the published balance sheets.

In Table 1 the FRB consolidated balance is arranged in the familiar T-account format.

**Table 1. FRB Consolidated Balance Sheet end-2006**

(In billions of dollars)

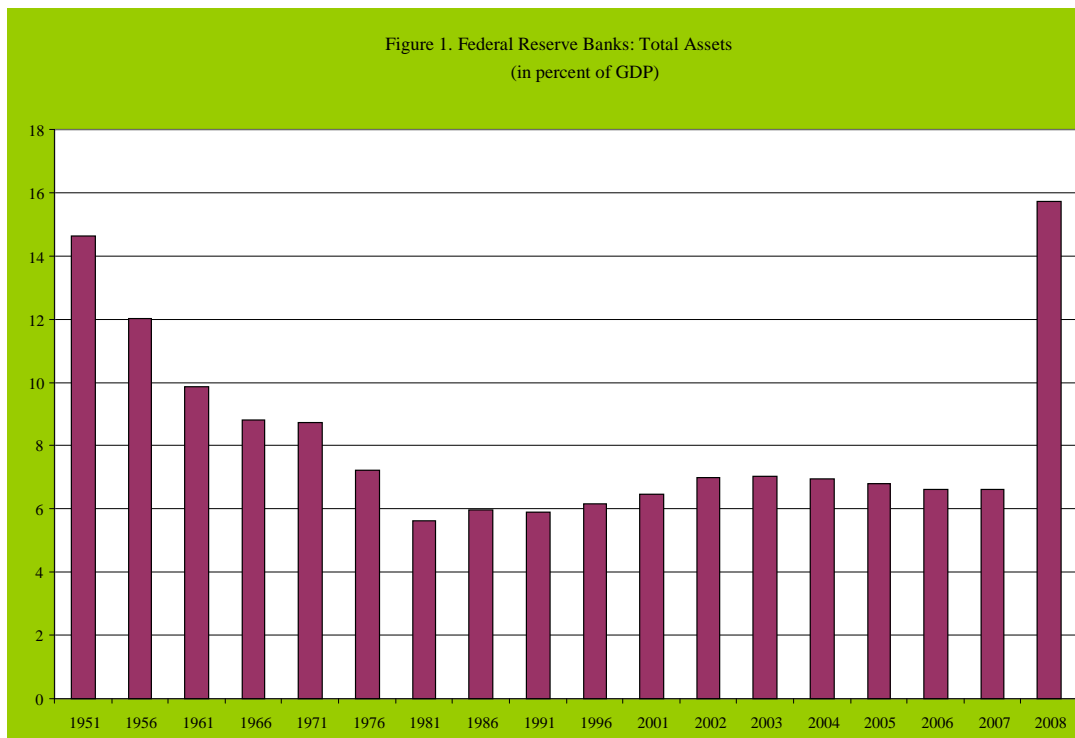
Assets		Liabilities	
Government Securities	784	FR Banknotes	783
Liquidity providing repos	41	Reverse repos w/ foreign entities	30
Foreign Exchange	21	Bank deposits	19
Gold	11	Government deposits	5
Other assets (net)	11	Capital and reserves	31
Total	868	Total	868

Source: FRB Annual Report 2006 and author’s calculations.

The *structure* of the end-2006 balance is representative of that for the Fed for the preceding 50 years, i.e., since the role of gold peaked in the 1940s. The balance sheet is dominated by holdings of government securities on the asset side and banknotes on the liability side, each accounting for 90 percent of the respective sides of the total balance sheet. Foreign assets and

gold, and capital, each account for 3.5 percent of total assets and liabilities respectively. The FRB balance sheet is here playing a minimal role in U.S. credit intermediation.

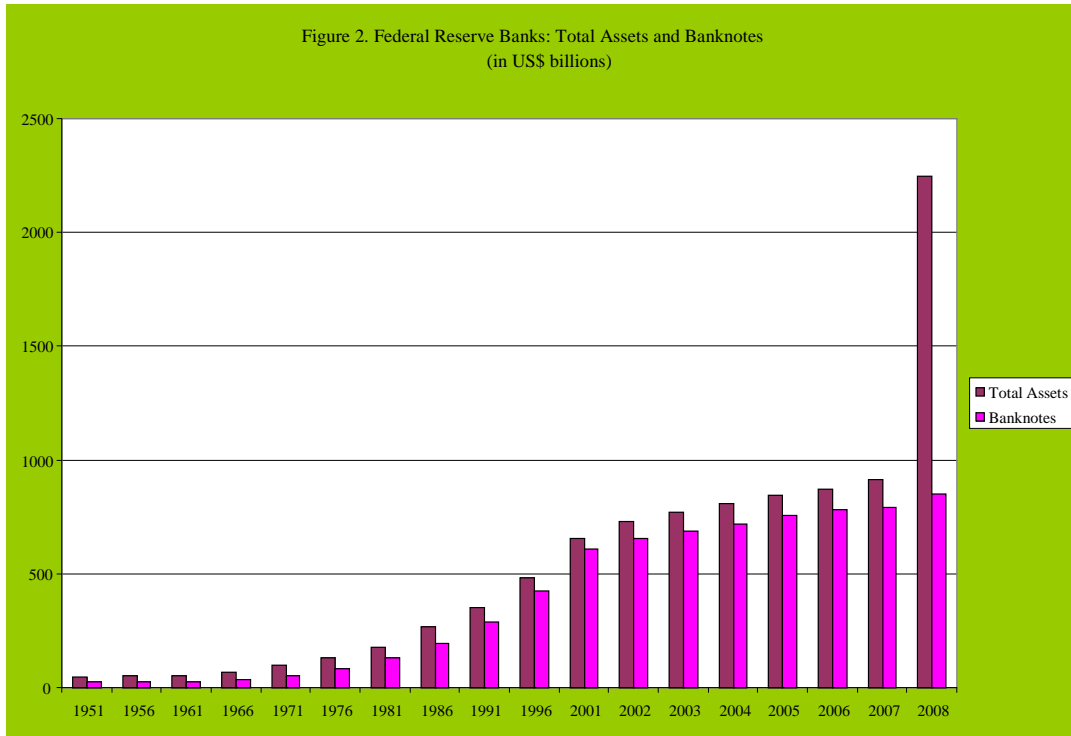
As can be seen in Figure 1, FRB consolidated assets rose sharply in 2008—roughly a doubling in size. This is frequently the metric provided in the press and blogs when discussing the expansion of the balance sheet. It will be argued below that this figure is a dramatic *understatement* of the expansion of the Fed’s role in the financial system. For the purposes of reviewing Figure 1, it should be noted only that there *are* historical precedents for a balance sheet of this size—from 1935 into the 1950s—and that the size of the FRB by this metric had stabilized for approximately 25 years at close to 6 percent of GDP.



Source: Annual Report of the Federal Reserve System (various); Bureau of Economic Analysis, U.S. Department of Commerce; and author’s calculations.

Figure 1 does not well represent the true financial role of the Fed in the U.S. economy for several reasons. The primary reason is that postwar FRB balance sheet dynamics were driven—until 2008—almost entirely by secular growth in U.S. dollar banknotes in circulation. This is evident in Figure 2 where U.S. banknotes in circulation are presented alongside FRB total balance sheet assets.<sup>3</sup>

<sup>3</sup> The fact that approximately half of FR notes are estimated to circulate abroad is actually immaterial to the argument but is certainly supportive of the notion that they do not factor into U.S. monetary policy.



Source: Annual Report of the Federal Reserve System (various).

Modern monetary policy implementation focuses on an interest rate operational target.<sup>4</sup> Within that framework, the supply of *banknotes* plays no role, central banks simply provide the amount that is demanded by the public. If doing so causes the relevant short-term interest rate to deviate from the level policymakers judge consistent with achieving their macroeconomic objectives, central banks respond by adjusting the supply of bank deposits with them to bring that interest rate back to its target. Even when they target (or targeted) the monetary base, operations are undertaken in the market for central bank deposits (known in the U.S. as the fed funds market)—not by attempting to influence the supply of banknotes in circulation. The Fed has accommodated the secular demand for currency, accumulating as the counterpart on the asset side of the balance sheet Treasury securities through occasional outright purchases in the secondary market.

The active parts of the FRB balance sheet in the two decades prior to 2007 were “liquidity providing repos” and “bank deposits” (or “reserves”). Monetary policy implementation operated as follows. The Federal Open Market Committee (FOMC), the System’s monetary policy body, determined the level of the monetary policy operational target, i.e. the weighted average brokered interest rate at which banks borrow and lend, overnight and on an unsecured basis, deposits they hold at the FRB (“fed funds rate”). The FOMC directed the management of the System Open Market Account (SOMA) at the FRB of New York to set the supply of reserves so that the market was in equilibrium at the target rate. The FRB NY used repo auctions on a daily basis to impact the supply of reserves based on forecast reserve

<sup>4</sup> See Bindseil (2005) for a discussion of modern practice and its historical antecedents.



demand. Over time, the FRBNY also conducted outright purchases of UST securities to accommodate the secular growth in demand for Federal Reserve Notes. Demand for FR Notes was accommodated passively.

FRB *capital* is also incidental to monetary policy. The level of FRB capital has historically been driven by a policy whereby the FRB match their “surplus” to the amount of capital paid in by their district member commercial banks. Member banks, in turn, are required to purchase (subscribe) FRB stock in an amount proportional to their capital and surplus. Therefore, the level of FRB capital is driven by the growth of its aggregate member banks’ capital. (Consequences of this capital policy are discussed in Section III below.)

On the asset side, it is important to note that in the United States floating exchange rate context, neither gold nor foreign reserves are managed for monetary policy purposes. As noted above, Fed holdings of Treasury securities during the last several decades have been determined by the growth in banknotes. Therefore, the size of the Fed’s active policy-driven balance sheet had been quite small.

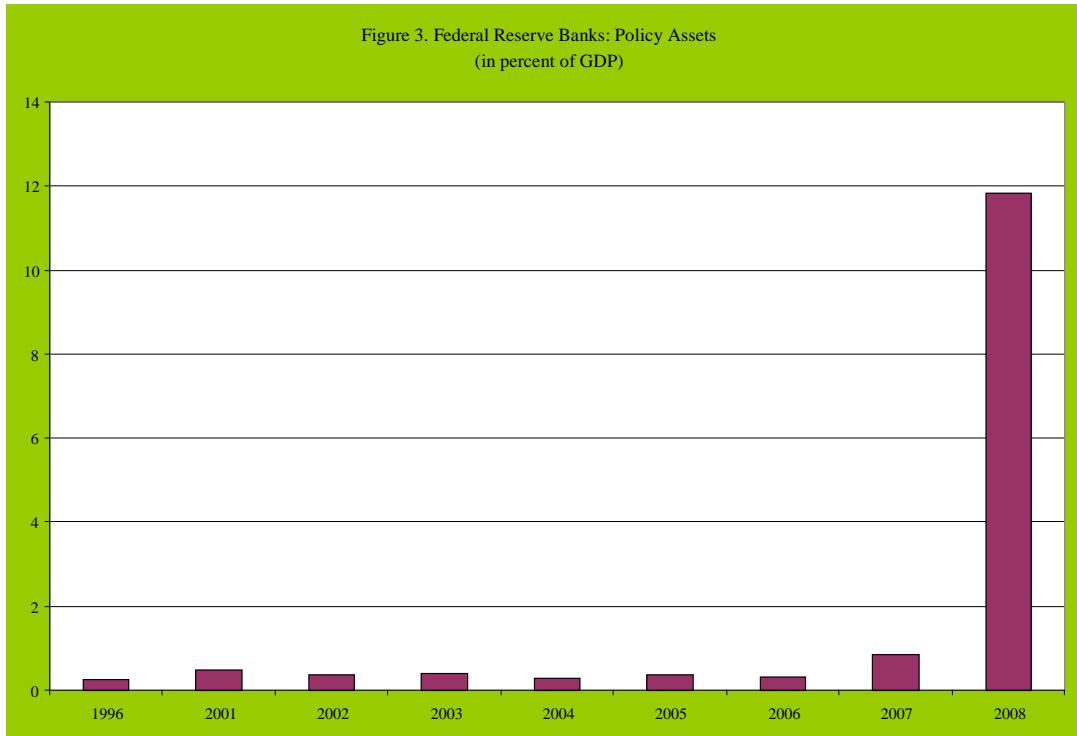
In 2006, the average stock of monetary policy instruments—short-term and long-term repos—was \$25.3 billion. Outright net purchases of securities amounted to \$34.2 billion over the course of the year.<sup>5</sup> (Liquidity providing repos tend to be higher at year-end owing to seasonal demands for banknotes hence the figure of \$41 billion for end-2006 above.)

Consistent with this analytical view of the key policy components of the balance sheet, Figure 3 provides the recent evolution of FRB “policy assets,” which better represents the FRB role in the financial system.<sup>6</sup>

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<sup>5</sup>See FRBNY (2006).

<sup>6</sup>“Policy Assets” are defined as liquidity providing repos plus loans to depository institutions, other loans, central bank liquidity swaps and investments held by consolidated variable interest entities. All but the first two categories were absent from the FRB balance sheet prior to 2007.



Source: Annual Report of the Federal Reserve System (various); Bureau of Economic Analysis, U.S. Department of Commerce; and author's calculations.

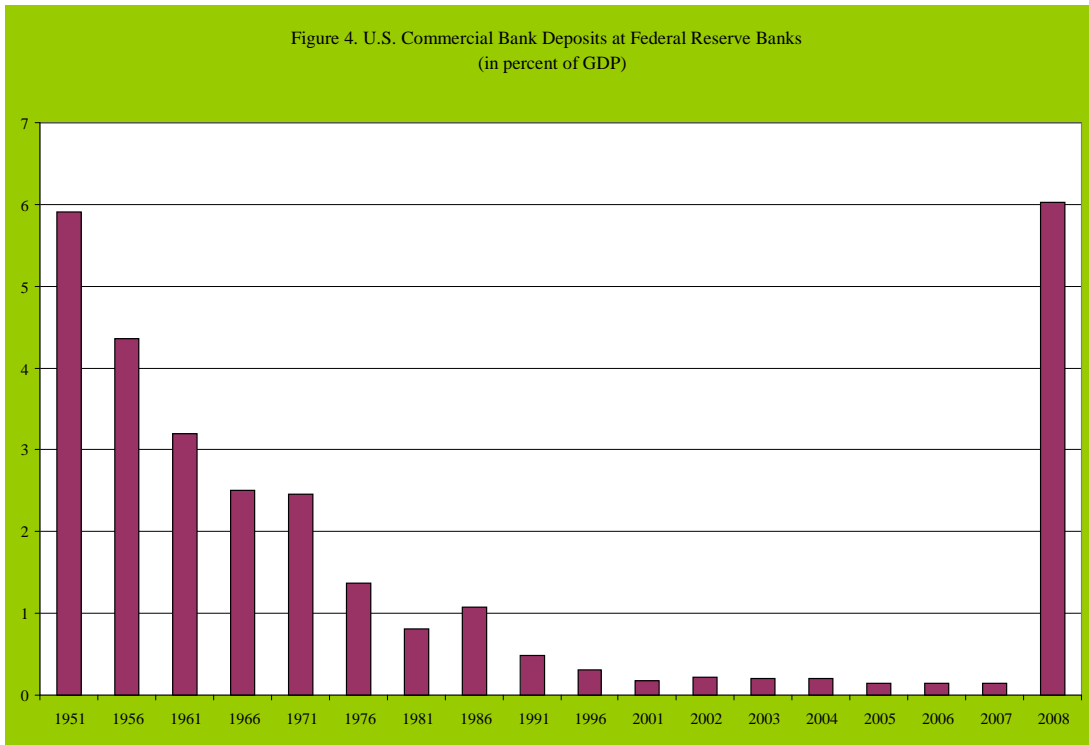
Evident in this Figure, and not in Figure 1, is the extremely small FRB role in intermediating credit in the U.S. economy—until 2008. By this metric, Fed balance sheet growth has been truly stunning. FRB policy assets have expanded by approximately 4,000 percent since 2006.

An alternative measure of the role of the FRB in the financial system is obtained by examining the actively managed liability side of the balance sheet, i.e., the level of financial institution deposits at the Fed. This is shown in Figure 4.

Several forces have driven the evident secular decline in financial institution reserves. A reduction in the direct role of the Fed in intermediating Treasury financing following the Fed-Treasury Accord in 1951;<sup>7</sup> a sharp decline in the level of commercial bank balances at the FRB owing to financial deregulation which included cuts in the reserve requirement and allowing bank cash holdings to satisfy that requirement; an increase in payments system efficiency—enabling banks to operate with much higher deposit to reserve ratios; and a declining relative role of bank intermediation in the U.S. economy.<sup>8</sup> By this metric, FRB liability expansion since 2006 has been approximately 4,500 percent. Excess commercial bank reserves—reserves that are not required to meet the regulatory reserve requirement—rose from \$1.8 billion at end-2007 to \$798.5 billion at end-2008.

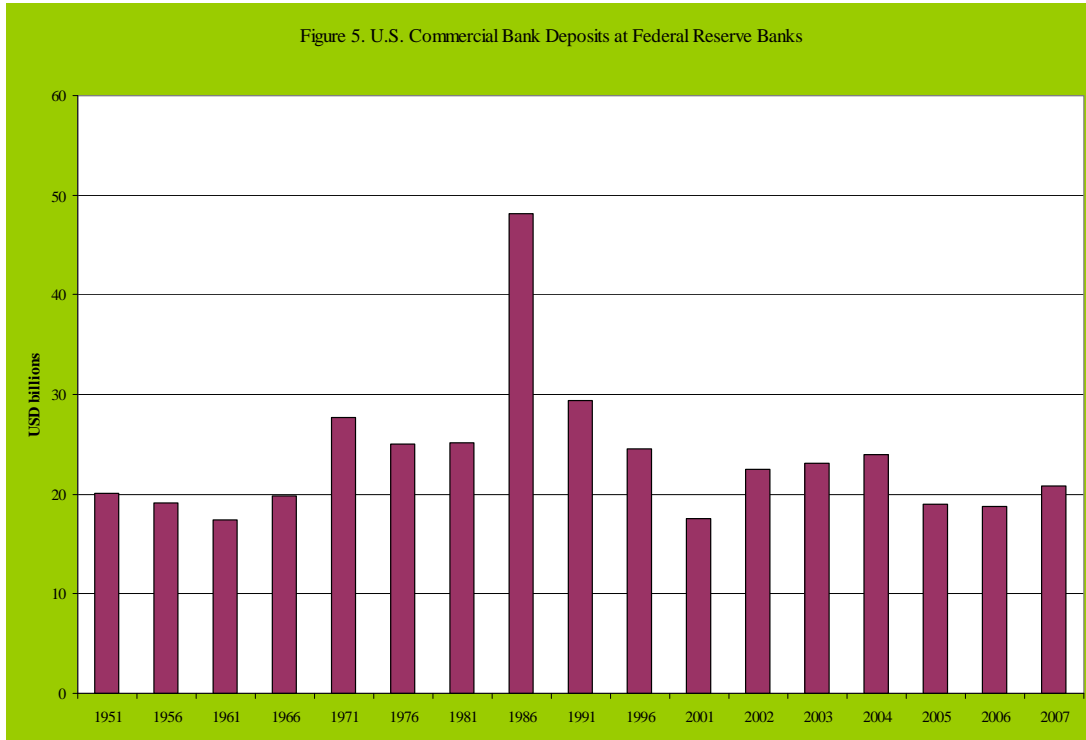
<sup>7</sup> See Goodfriend (1994).

<sup>8</sup> The low and declining level of reserves demonstrates the absence of any motivation to direct credit by the Federal Reserve. In many central banks, during the 1960s and 1970s, high reserve or liquidity requirements were used to fund direct lending to “priority” sectors.



Source: See Figure 1 Source.

We pause here to consider the volume of commercial bank deposits at FRB in nominal U.S. dollar terms. In Figure 5, covering the period 1951 to 2007, one might consider remarkable the fact that financial institution deposits at the FRB remained almost constant in nominal terms while the economy and financial system expanded enormously during those 55 years.



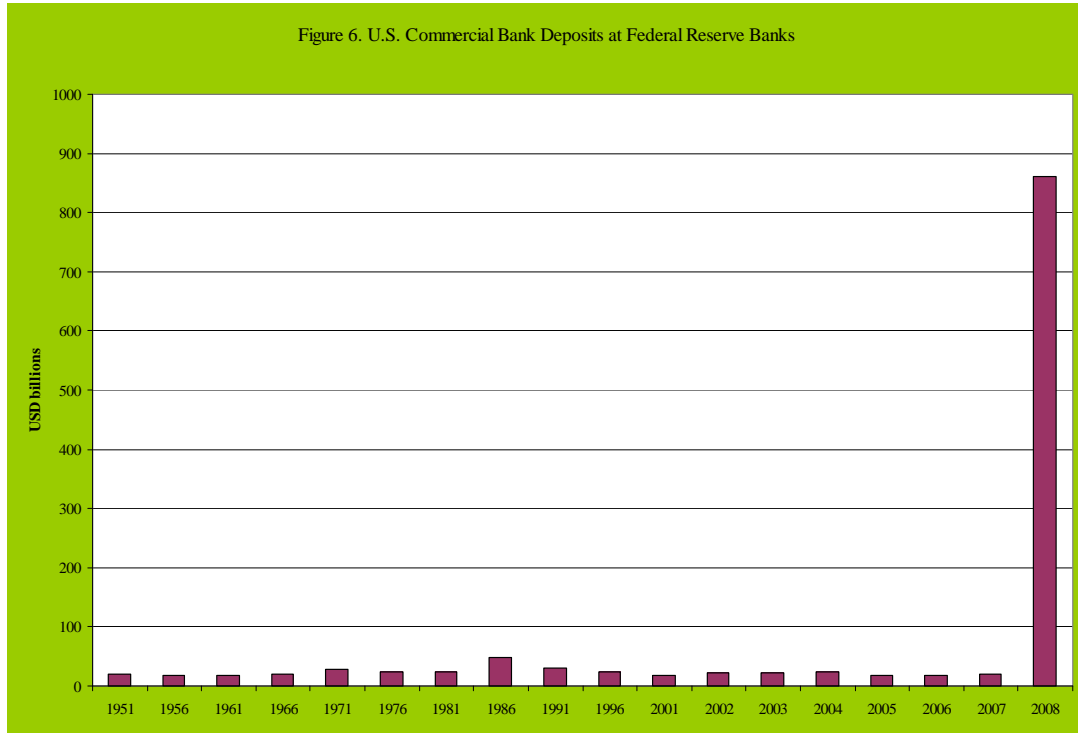
Source: Annual Report of the Federal Reserve System (various).

Even more remarkable is the picture when 2008 is added, represented in Figure 6.<sup>9</sup> Both the increase in bank reserves and policy assets provides a more vivid picture of what has happened with the FRB balance sheet than Figure 1 as well as a better idea of the magnitude of liquidity with which any “exit” strategy would need to contend.

The sharp rise in bank deposits at the FRB is a sign both of the breakdown of the interbank money market and an increased financial system demand for “ultimate liquidity” with greater assurance and longer maturity. This crisis-related phenomenon has characterized not only the U.S. market but virtually all developed financial markets.<sup>10</sup>

<sup>9</sup> Taylor (2009) has a similar figure with more granular data but covering only 2000-2009.

<sup>10</sup> Borio and Nelson (2008); and Chailloux, Gray, Klueh, Shimizu and Stella (2008) discuss how other central banks altered their liquidity management frameworks in response to the initial phases of the crisis.

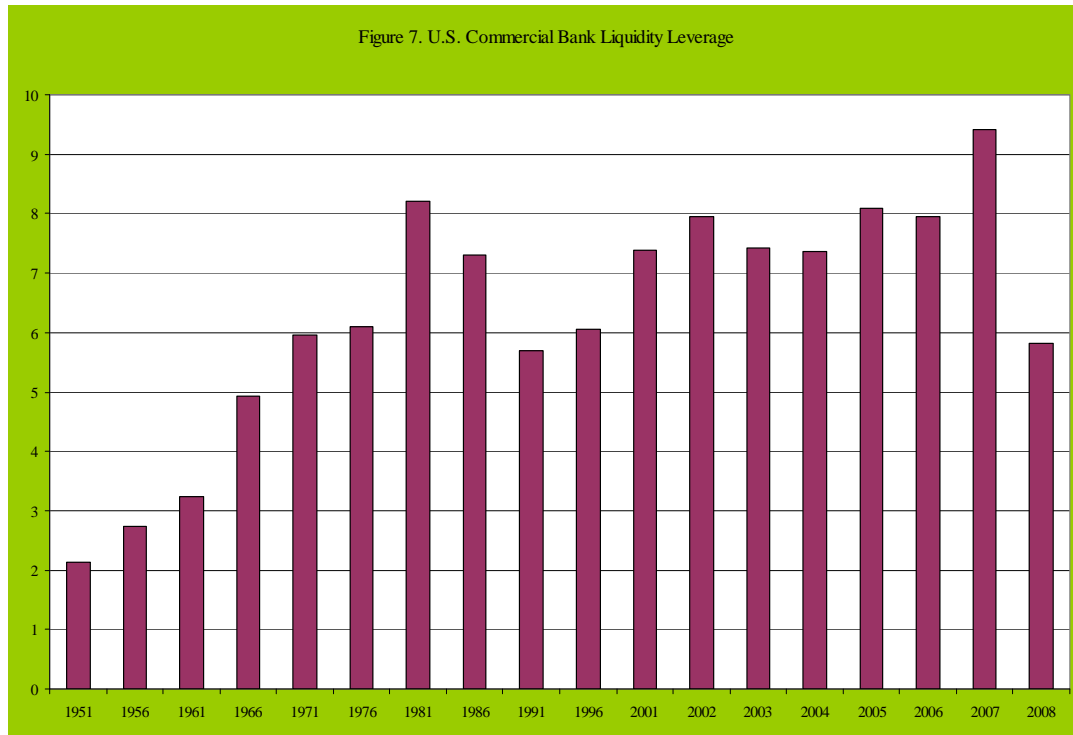


Source: Annual Report of the Federal Reserve System (various).

Figure 6 captures visually the change in the magnitude of FRB financial operations but not their nature. Until late in 2007, the FRBNY actively managed a small liquid portfolio of repos to target the effective fed funds rate. The operational objective was to minimize volatility in the rate in order to provide a pure monetary policy signal. In 2006, the FRBNY had attained a remarkable efficiency in achieving its target—the average deviations of the daily effective fed funds rate from target was only 3 bps, against an average target rate of approximately 500 bps. The FRBNY also utilized carefully designed risk management and operating procedures to ensure both that its lending operations were virtually risk free and to minimize price distortions among asset classes.

The current situation presents a stark contrast. The massive increase in the level of excess reserves in the fourth quarter of 2008 resulted in the effective federal funds rate trading well below the FOMC target rate until mid-December. In light of deteriorating economic conditions, the FOMC explicitly declared in its December 16, 2008 statement that “The focus of the Committee's policy going forward will be to *support the functioning of financial markets* and stimulate the economy through open market operations and *other measures that sustain the size of the Federal Reserve's balance sheet at a high level....* The Federal Reserve will continue to consider ways of *using its balance sheet to further support credit markets* and economic activity.” [emphasis added]. As will be discussed further in section III, the Fed is now using its balance sheet to actively intermediate in distressed credit markets, as well as aiming to alter relative prices among asset classes and along the yield curve, in the process placing its capital at risk to compensate for a withdrawal of private risk capital in money and capital market arbitrage.

As the management of liquidity available to commercial banks is a key policy activity, we here consider U.S. commercial bank liquidity more closely. In Figure 7 the ratio of total U.S. commercial bank assets to “ultimate liquidity”—their holdings of U.S. Treasury and Agency securities and deposits at the FRB—is shown. This subset of asset holdings is considered ultimate liquidity as it may be converted into, or used as collateral to obtain, final means of payment at short notice in all market conditions.<sup>11</sup> In what follows, comparisons of U.S. financial sector assets to this concept will be called “liquidity leverage.”

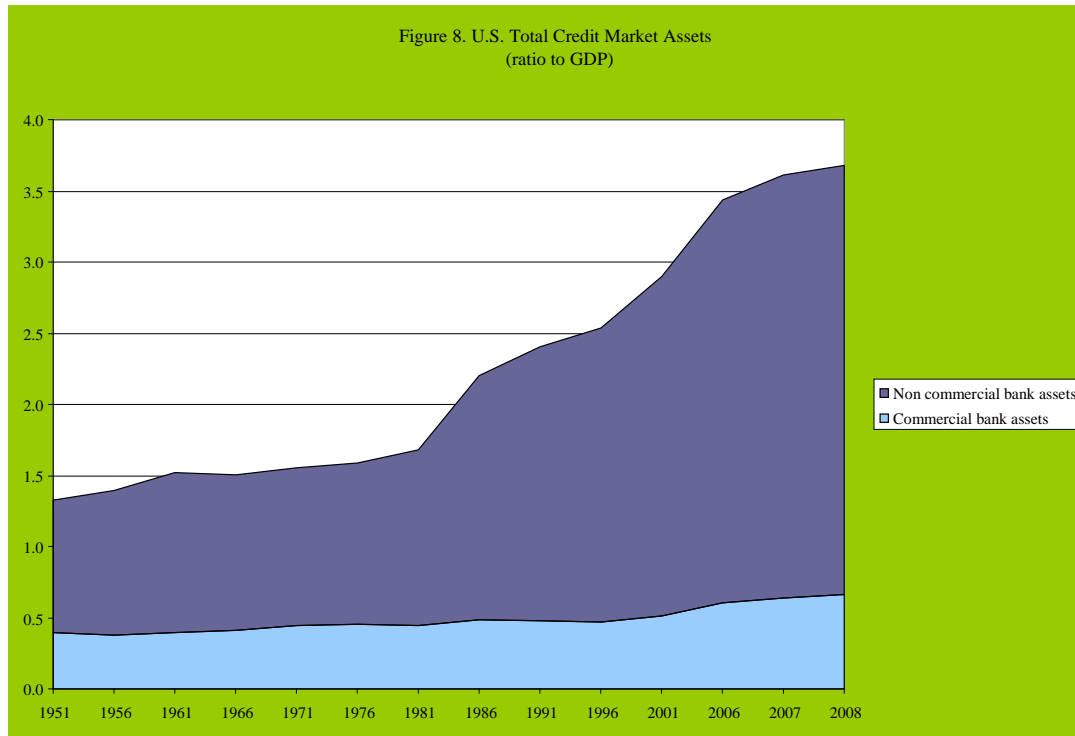


Source: Federal Reserve Board release H.8 (various issues); Federal Reserve Bank of St. Louis FRASER database for pre 1976 data; author's calculations.

U.S. commercial bank liquidity leverage as shown in Figure 7 was relatively high by historical standards, but not extraordinarily so, before the current crisis. But it should be noted that this ratio has over time become an increasingly poor proxy for overall U.S. financial market liquidity leverage. Although commercial banks have retained their role as key providers of payments and settlement services, their on-balance sheet assets account for a declining weight of U.S. financial activity. To the extent that capital markets, investment banks and the “shadow” financial system have grown since the 1950s, the liquidity leverage of the U.S. financial system has grown at rates orders of magnitudes greater than what is illustrated by commercial bank liquidity leverage alone.

<sup>11</sup> U.S. depository institutions also have access to liquidity through the discount window against a broader range of collateral although this was not commonly used until the current crisis.

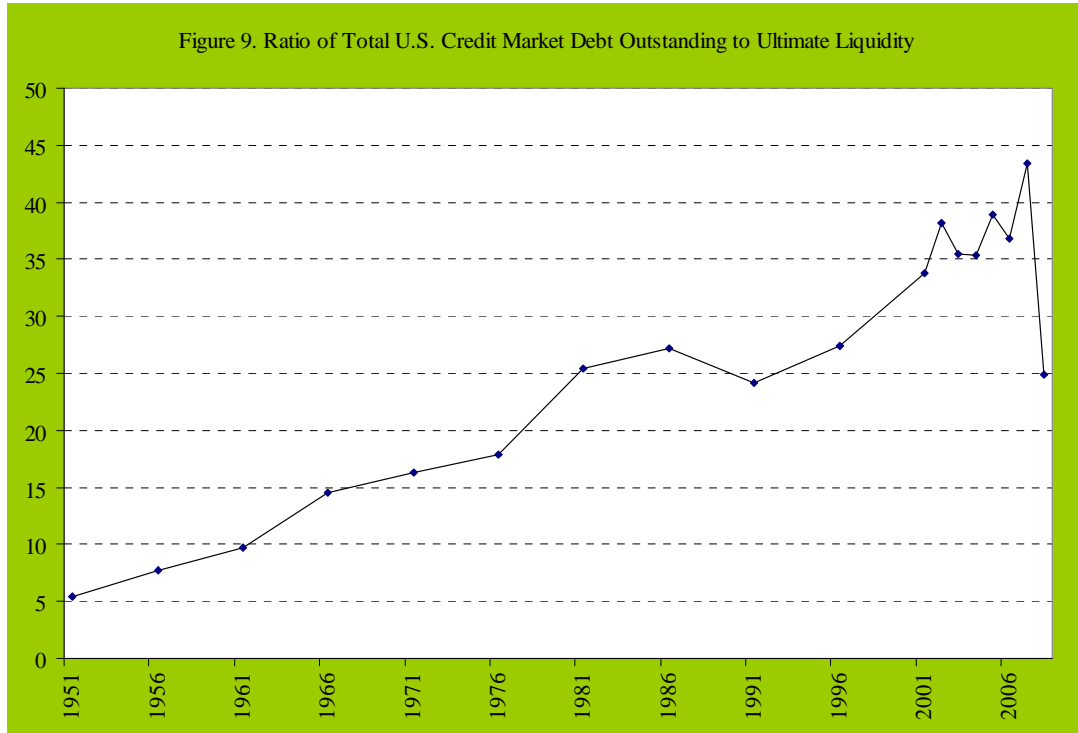
U.S. total credit market assets outstanding have risen much faster than commercial bank assets since 1951, particularly since the early 1980s, contributing to an exponential growth in overall liquidity leverage. As can be seen in Figure 8, during the 30 years from 1951 through 1981, the ratio of total credit market assets to GDP increased from 1.3 to 1.7. In the 25 years from 1981 through 2006, the ratio doubled to 3.4. Almost all of this increase is observed outside the balance sheets of commercial banks. Debt issued by government-sponsored enterprises (GSE), agency and GSE-backed mortgage pools and asset-backed securities (ABS) issuers amounted to just 1 percent of GDP in 1951; 10 percent of GDP in 1981; and 81 percent of GDP in 2006.<sup>12</sup>



Source: U.S. Flow of Funds Account Table L.1, author's calculations.

Consequently, U.S. total credit market liquidity leverage (Figure 9) rose much faster than that for commercial banks alone. Overall market liquidity leverage rose from 5 in 1951 to almost 45 in 2007 before the sharp deleveraging process began.

<sup>12</sup> At the end of 2008 the figure was 86 percent of GDP.



Source: Federal Reserve Board release H.8 (various issues); U.S. Flow of Funds Accounts Table L.1

*Overall* market liquidity leverage is a more useful trend indicator and provides a better representation of the deleveraging process underway in the U.S. financial system. The high ratio attained before the crisis also supports the measures central banks worldwide have taken to adjust their liquidity management frameworks in particular to expand both their lists of eligible collateral and eligible counterparties. Figures 7–9 suggest that in the face of disruptions in financial market networks (both intra and international) it was important to provide central bank financing against less liquid collateral; directly to entities not customarily included in the list of direct central bank counterparties; and cross-border so as to interpose the central bank in those network nodes which had ceased functioning.

Owing to the importance of the recent work of Adrian and Shin it is worthwhile to pause here to compare and contrast the concept of leverage discussed here with theirs. Adrian and Shin (2008a) (2008b) insightfully argue and demonstrate that U.S. financial firms tend to increase *equity* leverage when asset prices rise and decrease leverage when asset prices fall. This leads to strong procyclical balance sheet growth and potential financial market instability. In a crisis, to attenuate equity deleveraging pressures, the state might wish to inject equity into financial institutions.

In this paper we are discussing liquidity leverage. In a cyclical upswing or during a period of “great moderation,” institutions may become excessively confident that a wide range of financial assets can be easily converted into final means of payment. They will consequently expand liquidity leverage. In a crisis, to attenuate the consequences of a sharp increase in demand for liquidity, central banks are likely to be called upon to provide increased liquidity, particularly against otherwise illiquid assets. From this perspective, capital and liquidity



injections may be clearly assigned—in theory—to the fiscal and monetary authorities respectively.

We turn now to consider the size of the FRB balance sheet in comparison with large U.S. commercial banks. In performing this comparison, we eliminate banknotes (and a corresponding amount of assets) from the balance sheet. As discussed above, a large part of the FRB balance sheet is the result of issuing banknotes on demand to the public and buying Treasury securities. There is no comparable “commercial banking” activity, indeed commercial banks are prohibited from issuing their own banknotes, therefore FRB “total assets” provides a misleading measure of the FRB role in the financial system.

Tables 2-4 below illustrate the size of consolidated FRB assets—as defined above—in comparison with the 5 largest U.S. commercial banks measured by total consolidated assets at end-2001, end-2006 and end 2008 respectively.

**Table 2. Largest U.S. Commercial Banks end-2001**

Rank	Name	Consolidated Assets (in \$billions)	Cumulative Market Share
1	Bank of America	552	9
2	JP Morgan Chase	538	18
3	Citibank	452	25
4	First Union/Wachovia	233	29
5	Fleet Bank	188	32
<b>Federal Reserve Banks</b>		<b>43</b>	<b>Absolute share 1 %</b>

Source: Federal Reserve Board release *Large Commercial Banks*; and author's calculations. FRB “absolute share” is FRB assets divided by total bank assets.

**Table 3. Largest U.S. Commercial Banks end-2006**

Rank	Name	Consolidated Assets (in \$billions)	Cumulative Market Share
1	Bank of America	1196	13
2	JP Morgan Chase	1176	26
3	Citibank	1019	37
4	Wachovia	518	43
5	Wells Fargo	399	47
<b>Federal Reserve Banks</b>		<b>90</b>	<b>Absolute share 1 %</b>

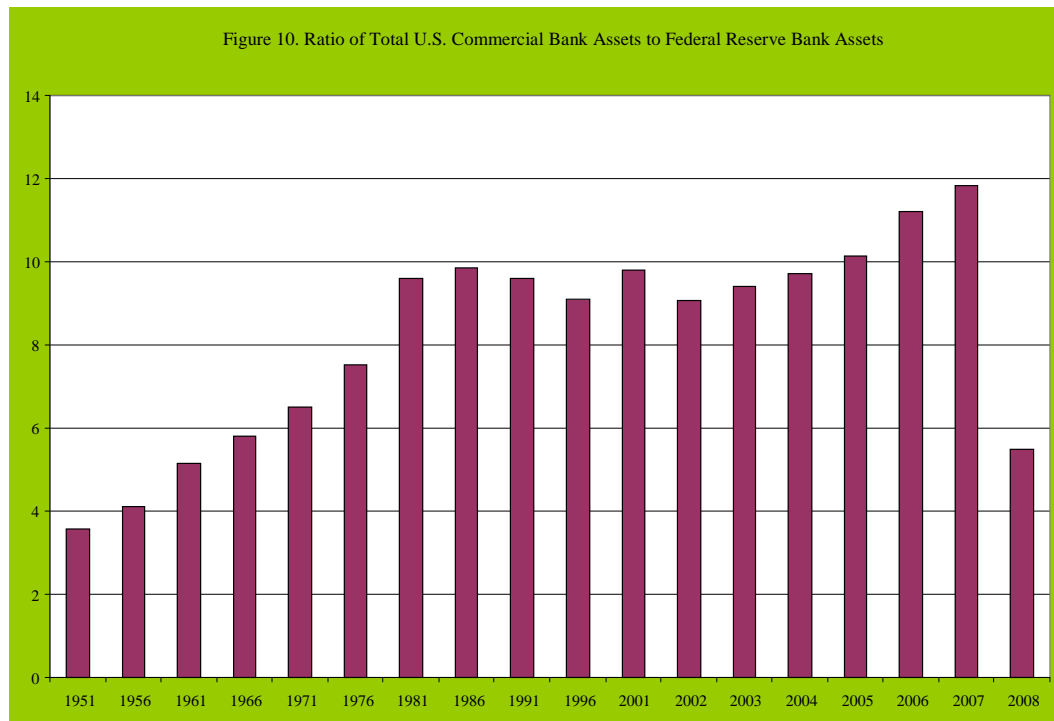
Source: Federal Reserve Board release *Large Commercial Banks*; and author's calculations. FRB “absolute share” is FRB assets divided by total bank assets.

**Table 4. Largest U.S. Commercial Banks end-December 2008**

Rank	Name	Consolidated Assets (in \$billions)	Cumulative Market Share
1	JP Morgan Chase	1746	15
2	Bank of America	1472	28
3	Citibank	1227	39
4	Wachovia (since merged)	635	44
5	Wells Fargo (since merged)	539	49
6	U.S. Bank NA	262	51
<b>Federal Reserve Banks</b>		<b>1393</b>	<b>Absolute Share 12%</b>

Sources: Federal Reserve Board release *Large Commercial Banks*; and author's calculations. 2008 FRB data is from the Annual Report and shows FRB "absolute share" as calculated in Tables 3 and 4.

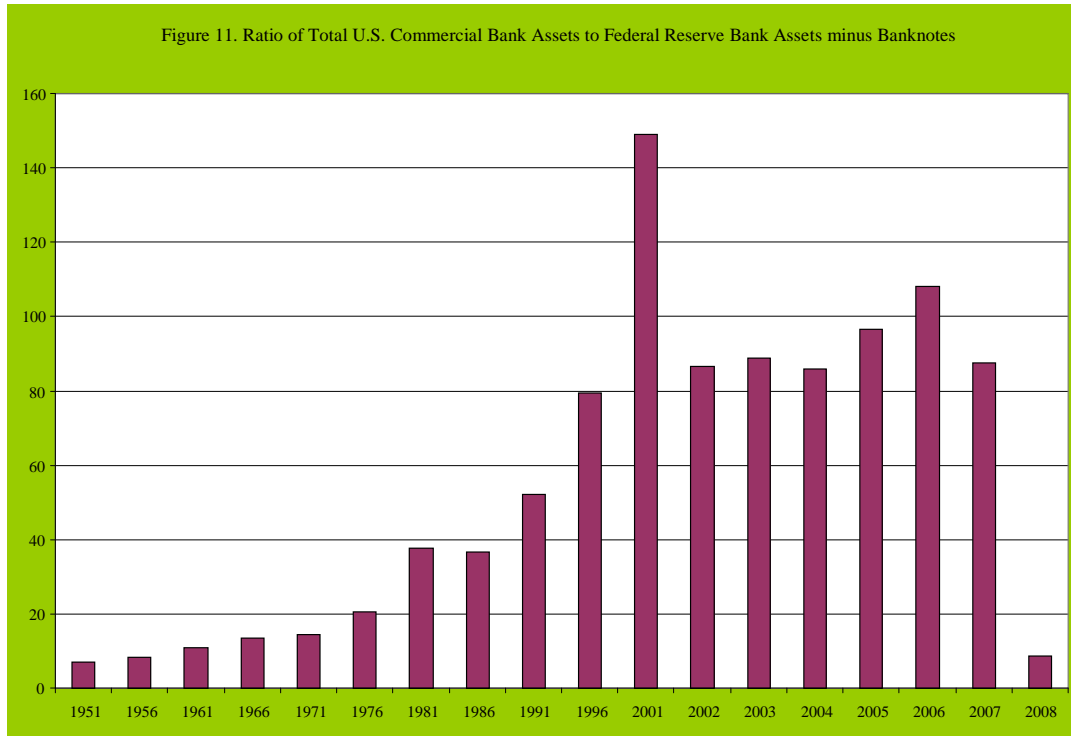
Figures 10 and 11 illustrate in historical perspective the size of the FRB compared to the U.S. commercial banking system. Figure 10 considers total assets. As noted above, the factor driving total FRB assets is banknote growth. Growth in domestic and foreign demand for U.S. banknotes was modestly outpaced over recent decades by growth in banking sector assets with the exception of the period 1981-1996. During this period the Latin American debt crisis both slowed the growth in U.S. commercial bank assets and increased the foreign demand for U.S. banknotes. The dissolution of the Soviet Union also contributed to a rapid growth in foreign demand for U.S. banknotes in the first half of the 1990s.<sup>13</sup>



Source: Federal Reserve Board Annual Reports (various) and Figure 7 source.

<sup>13</sup> The reader may wonder why this balance sheet, earlier "rejected" is now being discussed. How the demand for U.S. banknotes might behave in a global financial/economic crisis is relevant to the discussion in Section III.

Figure 11 compares total commercial bank assets with FRB assets minus banknotes which, as argued above, is a better metric of the comparative size of the Fed in the financial system. Apart from a dip in 1986 owing to the aforementioned Latin American debt crisis, until 2006 the Fed had accounted for an exponentially smaller and smaller role in the market. This figure illustrates the fall and resurgence of the FRB as a “central” bank in the market.



Source: See Figure 10 source and author's calculations.

Not only has the Fed balance sheet expanded in absolute size, and relative to the U.S. financial system, its composition has changed. This can be seen in Tables 5 and 6 and Figure 12.

In Table 5 the 2006 FRB consolidated balance sheet (Table 1) is again presented to ease comparison with the end-2008 balance sheet.<sup>14</sup>

<sup>14</sup> The 2006 and 2008 balance sheets were audited by PricewaterhouseCoopers LLP and Deloitte and Touche LLP, respectively.

**Table 5. Federal Reserve Bank Consolidated Balance Sheet end-2006**  
(In billions of dollars)

Assets		Liabilities	
Government Securities	784	FR Banknotes	783
Liquidity providing repos	41	Reverse repos w/ foreign entities	30
Foreign Exchange	21	Bank deposits	19
Gold	11	Government deposits	5
Other assets (net)	11	Capital and reserves	31
<b>Total</b>	<b>868</b>	<b>Total</b>	<b>868</b>

Source: Federal Reserve Bank Annual Report 2006 and author's calculations.

The end-2008 balance sheet shown in Table 6 illustrates a radical departure from the preceding steady state, with the Fed transformed from a monetary authority with a minimal role in credit intermediation and the operational objective of indirectly influencing the fed funds market to a sizeable and fundamental quasi-investment bank role in financial markets.<sup>15</sup>

**Table 6. Federal Reserve Bank Consolidated Balance Sheet end-2008**  
(in billions of dollars)

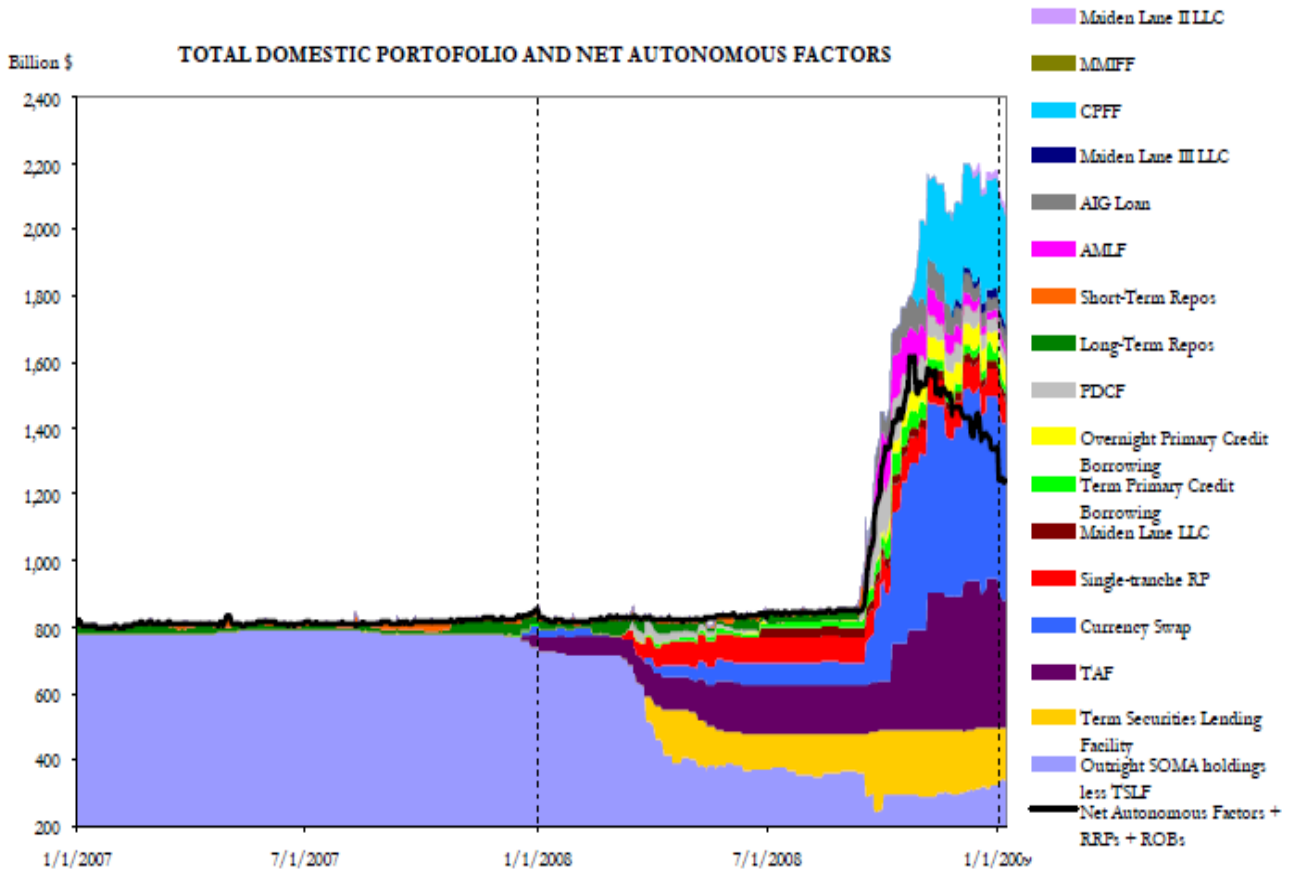
Assets		Liabilities	
Government and GSE Securities	502	FR Banknotes	853
Foreign Exchange Swaps	554	Reverse repos w/foreign entities	88
Term Auction Credit	450	Bank deposits	860
Commercial paper funding facility	335		
Other loans	194		
Liquidity providing repos	80	Government deposits	365
Maiden Lane LLC holdings	77	Other Liabilities (net)	22
Foreign Exchange (other)	27		
Gold	11	Capital and Reserves	42
<b>Total</b>	<b>2230</b>	<b>Total</b>	<b>2230</b>

Source: FRB 2008 Combined Financial Statements and author's calculations.

Figure 12 provides a more disaggregated view of the balance sheet composition evolution.

<sup>15</sup> To a certain extent, this “new” role in commercial credit brings the Fed back to its roots: “...to influence the market a Reserve Bank must always be in the market, and in this sense Reserve Banks will be active banking concerns when once they have found their true position under the new banking conditions.” First Annual Report of the Federal Reserve Board for the period ending December 31, 1914 (p.18).

Figure 12.

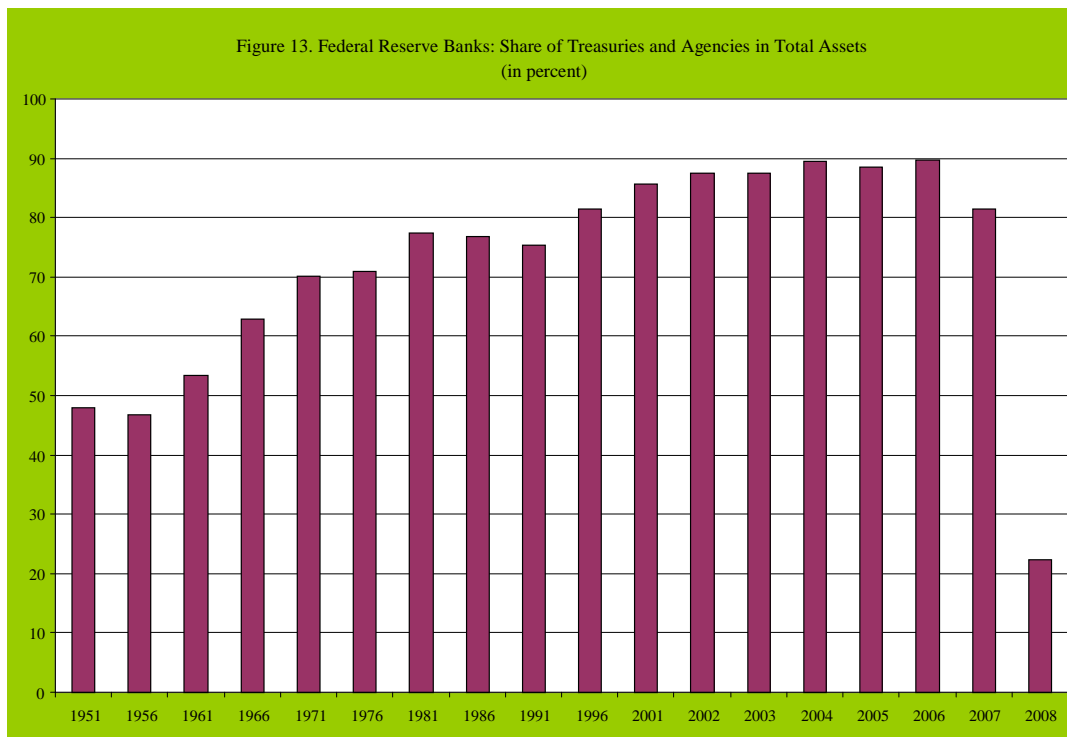


Source: FRBNY (2009).

One of the elements of the compositional change that raised concerns in 2008 was the rapid decline in FRB holdings of U.S. Treasury securities during 2008. These concerns are rooted in the intuition that the Fed's balance sheet quality has thereby weakened owing to a decline in both credit quality and liquidity.<sup>16</sup>

Figure 13 demonstrates that the proportion of assets in Treasuries had indeed fallen dramatically to unprecedented post-war levels.

<sup>16</sup> Here liquidity refers to the ability of the monetary authority to use the instrument in reserve draining operations. In some countries, a legislative act would be required to allow the central bank to sell or pledge gold. In those cases gold could not be considered a liquid asset. Central banks often acquire illiquid assets such as nonperforming loans in conjunction with bank rescue operations.



Source: Federal Reserve Board Annual Reports (various) and author's calculations.

This decline, illustrated in greater detail over the period mid-2007 through February 2009 in Figure 12, followed several phases. Beginning in December 2007, when the Fed began to establish new lending facilities, it actively sought to sterilize the liquidity injections related to those facilities through the sale of its Treasury securities.<sup>17</sup> This was necessary to maintain the Fed target—the fed funds effective rate—at or close to the announced FOMC policy rate. Following the Lehman and AIG interventions, the Fed began to allow the supply of bank reserves to expand rapidly. At the same time, the Treasury announced its Supplementary Financing Program (SFP) which was designed to assist the Fed in managing the balance sheet consequences of those interventions by sterilizing the liquidity created with an increase in Treasury deposits held at the Fed.

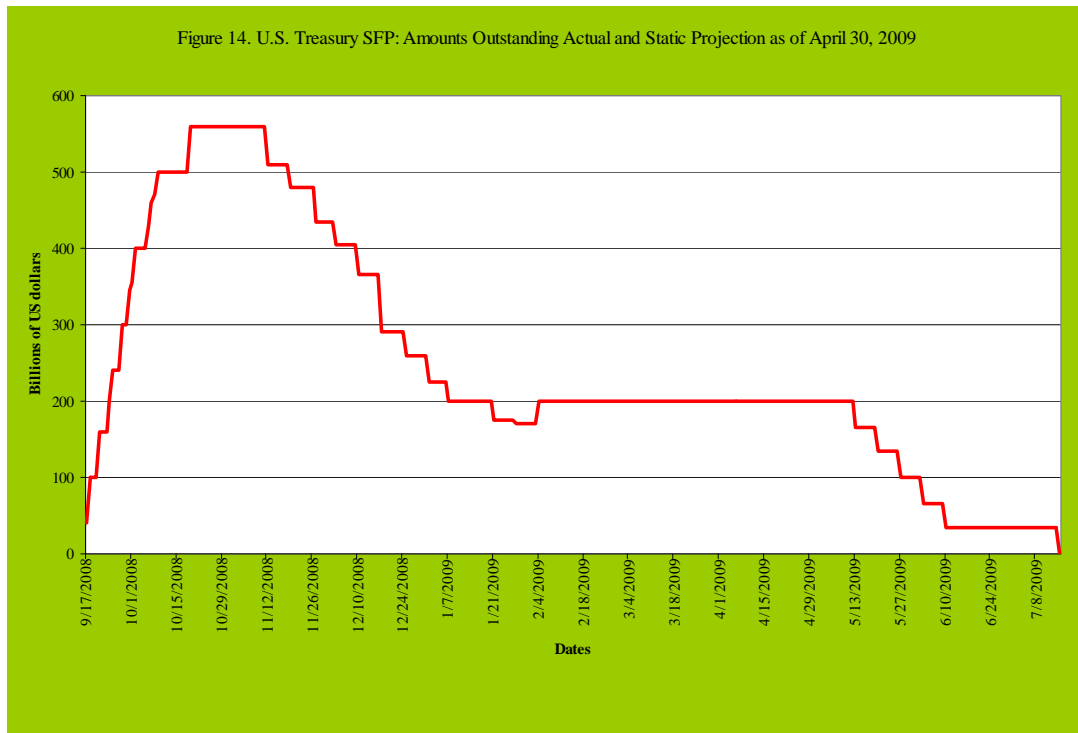
Essentially, rather than leaving the Fed “alone” to sterilize a large part of the expansion of liquidity through sales to the market out of its own portfolio—the Treasury began to issue short-term debt (Cash Management Bills of differing maturities) and to deposit the proceeds at the FRB. The Treasury rapidly increased the net amount outstanding of this debt to \$560 billion in the first six weeks.<sup>18</sup> Nevertheless, the Fed experienced considerable difficulty in maintaining the target fed funds rate in the presence of considerable excess reserves and, more importantly, in the face of significant tiering in the interbank market.

<sup>17</sup> The Fed can also withdraw liquidity by not rolling over its portfolio as it matures. This drains liquidity by requiring the Treasury to transfer to the Fed bank reserves acquired, e.g., by issuing t-bills into the market. The fall in outright holdings of Treasuries in 2007 was the first such fall since 1989 (see FRBNY(2007)).

<sup>18</sup> This compares with a “usual” target of \$5 billion for Treasury’s Fed balance in 2007. See FRBNY (2008).

As the bills began to mature, the Treasury at first fully rolled them over, maintaining net outstandings at \$560 billion. Subsequently, Treasury allowed the amount to gradually decline. The actual and projected time path of the supplementary financial program (SFP) assuming no new issuance, is shown in Figure 14.

The SFP program provided for the sterilization of the liquidity provided by the Fed albeit with an expansion of the balance sheet.<sup>19</sup> Conceptually, given a target sterilization amount, the difference between Fed sterilization through sales from its portfolio and the SFP is that in the former, the Fed would have chosen the precise securities to sell as well as the timing while in the latter the Treasury made those decisions. The Treasury also retained the right to determine how fast to reverse the sterilization, i.e., run down its deposits at the Fed.



Source: U.S. Treasury website and author's calculations presuming no issuance after 5/6/09.

The SFP is remarkable for several reasons. The first is that it is very rare for central banks to obtain liquidity management assistance from sovereign treasuries to this extent and with such alacrity. This points to the special nature of the financial relationship between the Fed and U.S. Treasury discussed more extensively in Stella and Lonnberg (2008). Most central banks cannot rely on such assistance and care must be taken when drawing potential lessons from the U.S. experience with the SFP.<sup>20</sup> It should also be noted that cooperation in September-

<sup>19</sup> FRBNY (2009), in addition to Figure 12, has a clear and more detailed discussion (pages 27–29).

<sup>20</sup> The U.K. Treasury has cooperated closely with the Bank of England during various phases of the crisis. Sims (2003a) points out potential consequences for the European Central Bank in the absence of treasury financial support.

December 2008 was undoubtedly facilitated owing to the fact that it was cost effective. As the Treasury chose to issue short duration paper, significantly shorter than the average residual maturity of Fed holdings, and the yield curve at that time was sharply upward sloping, the SFP sterilized liquidity at a lower net cost than would have been incurred through outright Fed sales.

At end-2008, the average remaining maturity of Fed Treasury holdings was 82.7 months (see FRBNY (2009) while the maturities of the Treasury Cash Management Bills issued under the SFP ranged from 7 to 101 days. The yield curve, for example on December 11, 2008, showed 30 day U.S. Treasury bills at 1 bp with the 7 year UST at 199 bps. As of March 16, 2009, the average weighted cost of SFP financing was 75 bps.

As the Fed makes weekly profit transfers to the Treasury, the nontax revenue foregone through Fed sales of Treasury securities would have exceeded the increased interest expense on Cash Management Bills. Had the financial environment facing the Fed and the Treasury been more similar to that confronting emerging markets—surging interest rates, a rapidly devaluing currency and a loss making central bank—cooperation may have been less smooth.

A second notable feature of the SFP is that it comes close to ceding Treasury quasi-monetary policy power. As an exigency during a transition period toward which the Fed was to obtain the ability to pay interest on reserves and thus sterilize without reducing its Treasury holdings, the SFP was remarkably effective, but were it to remain in place it could blur operational responsibility for monetary policy. The Fed and Treasury have announced that the SFP remains in place to help the Fed manage its balance sheet but also that “...the Treasury and Federal Reserve are seeking legislative action to provide additional tools the Federal Reserve can use to sterilize the effects of its lending or securities purchases on the supply of bank reserves.”<sup>21</sup>

The decline in Fed holdings of Treasuries stabilized at approximately \$480 billion in the first half of September 2008. With passage of the *Emergency Economic Stabilization Act of 2008* (more popularly known as the “Troubled Asset Relief Program” (TARP)) the FRB was permitted to pay interest on reserves beginning in October 2008.<sup>22</sup> Whereas the sale of Treasuries from the Fed portfolio had kept the overall size of the balance sheet constant, the employment of the SFP and the payment of interest on reserves allowed the Fed balance sheet to expand, the difference being that on the liability side the counterpart was either a government or financial institution deposit.

The Fed for some years had been seeking authority to pay interest on reserves both to curb the disincentive to commercial banks to hold reserves with it (a factor driving the data in

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<sup>21</sup> See “The Role of the Federal Reserve in Preserving Financial and Monetary Stability—Joint Statement by the Department of the Treasury and the Federal Reserve (March 23, 2009).

<sup>22</sup> This change was implemented with the reserve maintenance period starting (Thursday) October 9, 2008. See <http://www.newyorkfed.org/banking/circulars/11998.html>. There was also discussion at the time of allowing the Fed to issue its own securities.



Figures 4-6 above) and to better enable it to control the fed funds effective rate target. The ability to pay interest on reserves is likely to play a key role in the Fed strategy to eventually unwind excess bank reserves once the crisis abates.<sup>23</sup>

Another important change in the Fed balance sheet has resulted from the provision of U.S. dollar liquidity to foreign commercial banks via the intermediation of foreign central banks. The global nature of the financial crisis can be gauged from the item “Foreign Exchange Swaps” wherein reside the counter part of the Fed’s U.S. dollar liquidity providing swaps first agreed in December 2007 with the European Central Bank, Swiss National Bank, and Bank of England (BoE). These were subsequently expanded in two waves to the countries listed in Table 7 which shows the amounts outstanding as of end-December 2008.

**Table 7. United States Federal Reserve Swaps with Other Central Banks**  
(in billions of U.S. Dollars)

Institution	Amount of Facility	Outstanding as of December 31, 2008
Bank of Canada *	2	0
Banco de México *	3	0
European Central Bank	Unlimited	291.4
Swiss National Bank	Unlimited	25.2
Bank of Japan	Unlimited	122.7
Bank of Canada	30	0
Bank of England	Unlimited	33.1
Danmarks Nationalbank	15	15
Reserve Bank of Australia	30	22.8
Sveriges Riksbank	30	25
Norges Bank	15	8.2
Reserve Bank of New Zealand	15	0
Bank of Korea	30	10.4
Banco Central do Brasil	30	0
Banco de México	30	0
Monetary Authority of Singapore	30	0
Total	Unlimited	553.7

Source: Treasury and Federal Reserve Foreign Exchange Operations (Oct.–Dec. 2008)

\* All swaps other than these are temporary.

Although some have called this the first crisis of globalized finance, if it is, the qualifier “under floating exchange rates” should probably be added. The following, from the gold standard era circa 1915 could easily have been mistaken for something written today:

“The vast and complex structure of modern banking and credit systems is one of extreme delicacy of balance and adjustments, and it must never be overlooked that it is highly sensitive to all manner of disturbances, as

<sup>23</sup> For a discussion of the operation of the “floor system” see Keister, Martin and McAndrews(2008).

recent events have painfully demonstrated. The banking systems of the larger nations are closely related to one another, and financial distress or collapse at one point quickly transmits shock to all others.”<sup>24</sup>

In addition to the foreign exchange swaps, the term funding auction facility (TAF), the commercial paper financing facility, loans to the special purpose vehicles set up to handle Bear Sterns and AIG as well as other loans (including to AIG) have served to expand assets. On the liability side, as already noted, both bank and government deposits have expanded.

### **III. POSSIBLE CONSEQUENCES OF FRB BALANCE SHEET DEVELOPMENTS**

Both the expansion and change in FRB balance sheet composition have potential consequences for the Fed’s financial strength and operational independence.

#### **A. Fiscal Risk and Potential Fed Losses**

Comparing the end-2006 and end-2008 balance sheets the change in constituent parts is clear. Particularly noticeable is the decline in government securities holdings and the increase in foreign exchange swaps, TAF credit, the commercial paper funding facility, “other loans” and the three Maiden Lane LLC holdings.<sup>25</sup> Particularly with the latter interventions the FRBNY has taken on increased risk. Overall risk is set to increase with the March 18 announced expansion of the Term Asset-Backed Securities Loan Facility (TALF) although the UST is to take the first 10 percent of any TALF losses.<sup>26</sup> The outer envelope for TALF lending is \$1 trillion as of this writing.

A thorough examination of the risks associated with each Fed program innovation would require an examination of each asset class being supported, their price volatility, projections of future real economy dynamics and assumptions about recovery rates on collateral.<sup>27</sup> It would also require knowledge of the FRB asset valuations on which “haircuts” are applied. Consideration of any risk-sharing by the U.S. Treasury would also be necessary. The FRB balance sheet is also very much a “moving target” at the time of this writing with even the outer envelope of balance sheet expansion unknown. In a positive development, the FRB and Treasury have announced that as budgetary resources and time permit, Treasury will “seek to remove” the so-called “Maiden Lane” facilities from the FRB balance sheet. This will reduce the risk to the FRB balance sheet and is consistent with the suggestion in section IV that Treasury use its SFP deposits to purchase those assets.

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<sup>24</sup> First Annual Report of the Federal Reserve Board for the period ending December 31, 1914 (p.19).

<sup>25</sup> The Fed has recently been providing more detail on the composition of its balance sheet. See Bernanke (2009). Maiden Lane I relates to the Bear Stearns operation, while II and III pertain to AIG.

<sup>26</sup> The TALF is designed to support the issuance of asset-backed securities collateralized by auto loans, student loans, credit card loans and loans guaranteed by the U.S. Small Business Administration. See FRB press release November 25, 2008.

<sup>27</sup> The Fed provides a website describing its programs:  
[http://www.federalreserve.gov/monetarypolicy/bst\\_fedfinancials.htm](http://www.federalreserve.gov/monetarypolicy/bst_fedfinancials.htm)

In light of the abovementioned uncertainties the strategy adopted in this paper is to take an aggregate approach toward assessing risk and to provide a preliminary discussion of how the FRB might cope with those risks and any eventual losses. The aggregate approach first divides FRB assets on the end-2008 balance sheet into (credit) risk free and risky assets. A back of the envelope calculation is then made to provide a quantitative illustration of possible losses on those risky assets. The discussion then turns to consider what resources the FRB have to cope with losses and concludes with several FRB capital projections based on the model developed in Restrepo, Salomó, and Valdés (2008). Those simulations are quite sensitive to the time path of interest rates and the liquidity of the FRB asset portfolio. It is important to note at the outset that we attach no subjective probability to the occurrence of these losses. The intent is to consider quite severe hypothetical negative outcomes and assess the FRB ability to cope with them.

There are a number of reasons why applying “Basle-type” capital criteria to central banks is misleading and it is not the intention to do so here. Not only are the various ratios in Basle I not immediately relevant for a central bank—and indeed they were designed for internationally active commercial banks in part to keep a level international playing field—central banks clearly do not engage in economic competition among themselves—the financial structures of central banks are very diverse and extremely difficult to compare meaningfully across countries. Central banks have unique income-earning potential, regulatory powers, often large reserves, and sometimes can count on timely financial assistance from the Treasury with few strings attached. But most fundamentally, *commercial bank* capital thresholds are designed to prevent financial insolvency. This is rarely a literal problem for a *central bank*. What *does* become a problem for the central bank is a financial situation that jeopardizes its operational and financial independence which consequently interferes with its ability to achieve its *policy* objectives. This has been a problem for many central banks worldwide and this is what the analysis herein is attempting to assess.<sup>28</sup>

Given the unique financial structure of the Federal Reserve System it is important to recognize that each individual FRB is a separate legal entity with distinct private shareholders and individual balance sheets. The FRA clearly states that those shareholders are responsible to cover their individual FRB’s liabilities “...for all contracts, debts, and engagements of such bank [FRB] to the extent of the amount of their subscriptions to such stock at the par value thereof in addition to the amount subscribed, whether such subscriptions have been paid-up in whole or in part...”<sup>29</sup> There appears to be no explicit requirement in the FRA for one FRB shareholder to cover the liabilities of shareholders in another FRB nor any legal liability for the Treasury to cover the liabilities of the FRB apart from that bank’s Federal Reserve Notes. Consequently, to consider the risk attached to the *consolidated* balance sheet as well as the capital and earnings available to meet those risks it

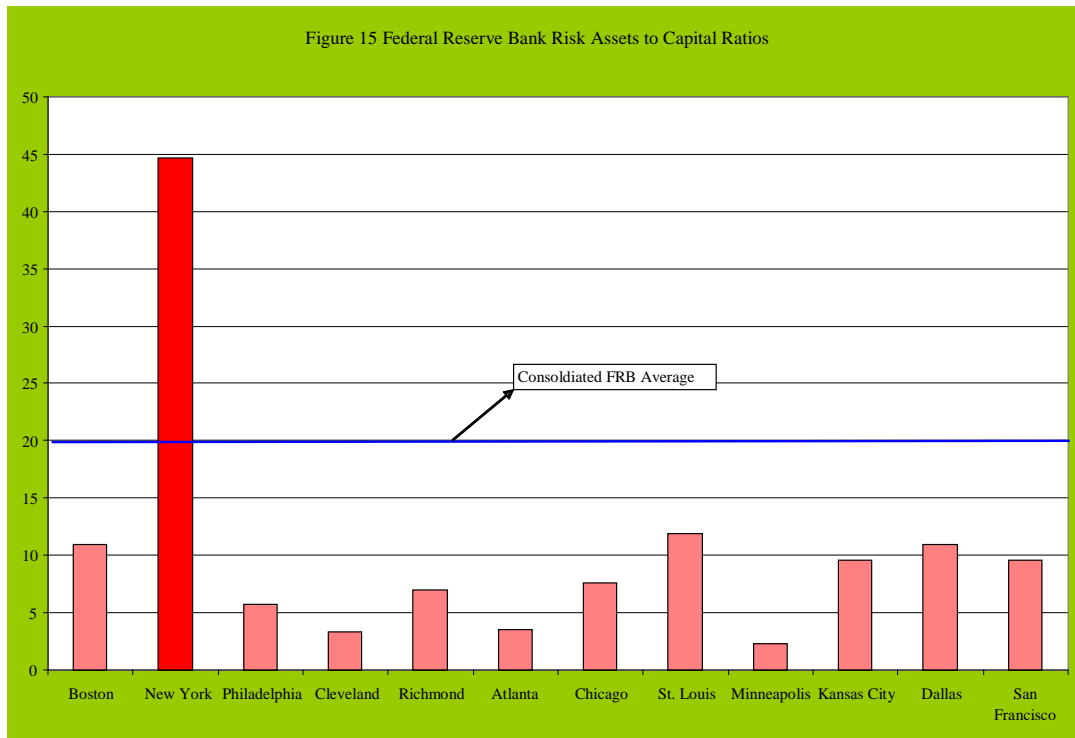
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<sup>28</sup> See Stella (1997), (2005), and (2008) for country examples and further argumentation. Sims (2003b) discusses how central bank balance sheet difficulties can make it impossible to attain an inflation target.

<sup>29</sup> Federal Reserve Act, Section 2.4, “Liabilities of Shareholders of Reserve Banks.”

is necessary to assume that the FRB would act collectively in a mutually supportive way. Although this has not always been the case,<sup>30</sup> it is an acceptable presumption at the present time particularly in light of the “Insurance Agreement of the FRB.”<sup>31</sup> Mutual self insurance among the FRBs is similar to the approach of the European System of Central Banks (ESCB). Although the ECB advised national central banks to make provisions against possible loan losses resulting from exposure to Lehman Brothers’ affiliates, it was stated that the ESCB collectively would share the burden of losses should they be realized.<sup>32</sup>

There are sizeable differences in the various FRB exposures to risk and capital available to meet those risks (see Figure 15).<sup>33</sup> FRB NY accounts for approximately 50 percent total FRB assets and 73 percent of risk assets as herein defined.



Source: FRB release H.4.1 Table 10 (April 29, 2009) and author's calculations.

<sup>30</sup> For example, in 1934, the FRB of Chicago refused to purchase securities held by FRB NY to assist the latter with a shortage of gold holdings. See Meltzer (2003) page 387, footnote 136.

<sup>31</sup> See FRB NY Consolidated Financial Statements (2009) note 11 page 43.

<sup>32</sup> In its 2008 Annual Accounts, the ECB suggested that National Central Banks set aside provisions amounting to 5.7 billion Euro (amounting to 1.5 percent of total ECB assets) owing to possible losses from defaulted loans to Lehman Brothers Bankhaus AG, three subsidiaries of Icelandic banks, and Indover NL, a Dutch bank.

<sup>33</sup> Risk Assets are calculated by subtracting securities held outright, central bank swaps, gold, SDRs, and coin from total assets and adding the interdistrict settlement account.

Turning now to consider assets which can be considered risk free:

- *Claims on the U.S. government and gold* are considered as having zero credit risk. We also consider claims on GSEs, and GSE and Agency mortgage-backed securities (MBS) as having zero credit risk although, depending how their acquisition is financed, they may entail interest rate risk. As of end-December 2008, the FRB had not purchased GSE and Agency MBS and held only \$7 billion in Agency and GSE securities.<sup>34</sup> The FOMC has currently authorized FRBNY to purchase up to \$200 billion in GSE direct obligations; up to \$1.25 trillion in GSE and agency backed MBS and up to \$300 billion in longer-term U.S. Treasuries.
- The same treatment ought to be afforded to *liquidity providing repos* and *foreign exchange swaps* which are mainly claims on OECD central banks collateralized by their respective currencies. Although these agreements were designed to provide U.S. dollar liquidity to foreign private financial institutions, the credit risk arising from the provision of the credit resides with the liquidity providing central bank—not with the Fed. Nor is there any foreign exchange risk to the FRB as the swaps were designed so that the FRB receives the dollars it has lent out—regardless of the contemporaneous exchange rates—plus a premium to cover the cost of credit (borne by the ultimate commercial bank borrower). As this effectively means the only risk to the FRB is a default by another central bank, a highly unlikely event, these assets are considered for the purposes of this paper as being risk free.<sup>35</sup>

Among low risk assets we may consider:

- *Term Auction Credit* facility (established in late 2007) is quite similar to lending at the “discount window.” The TAF is essentially collateralized lending to banks eligible for the FRB primary credit facility. Eligible collateral is the same as that available for use in the primary credit facility. The essential differences between the TAF and the discount window are (i) the pricing mechanism—the TAF lending rate is determined by auction rather than the discount rate; (ii) duration of the credit—28 or 84 days with the option to renew versus overnight lending; (iii) “stigma”—the TAF was designed to lessen the stigma attached to discount window lending by making participation more routine and less individualized.

In a quite dire scenario, one would have to assume some banks would default on their TAF and/or primary credit loans and that less than full value would be obtained from the collateral

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<sup>34</sup> FRBNY Consolidated Financial Statements note 6, page 25.

<sup>35</sup> This is indisputable for the Bank of England, European Central Bank, Reserve Bank of Australia, and Swiss National Bank. One might argue that the payments capacity of the emerging market central banks is less assured. At present, FRB swaps with them represent a small fraction of their entire liquid reserves. It would be difficult to anticipate a default in that situation.

acquired. The FRB would then have recourse to other assets of the debtor including most immediately its deposits with the Federal Reserve System.

The Fed imposes a haircut on TAF and primary credit collateral but the larger uncertainty is on the *valuation* of that collateral under dire market conditions. For example, if an asset worth 90 is mistakenly valued at 100, a 5 percent haircut still leaves the lender underinsured by 5. At a minimum, the collateral could not be sold for full value immediately with the consequence being that the FRB would need to hold a nonperforming asset on the balance sheet for a considerable period of time. Problems of a similar nature have impacted a considerable number of central banks following interventions in past financial crises. Whether the FRB would eventually experience a loss depends on several additional factors such as whether FRB recourse to other bank assets exceeds any shortfall in collateral recovery values and the time frame over which the proceeds from liquidation are realized.<sup>36</sup>

In order to develop a hypothetical risk quantification for these loans it is useful to consider separately the possibility of default and the possible recovery values. For ease of comparison, unless explicitly stated otherwise, the derived expected losses should be considered as occurring within a single calendar year.

The U.S. Savings and Loan crisis provides a potentially useful guideline to consider when considering reasonable risk scenarios. Between 1986 and 1995, 1,043 thrift institutions with combined assets of \$519 billion failed.<sup>37</sup> During the peak of the crisis, 1988-91, 725 institutions failed with combined assets of \$362 billion. Assets of failed thrifts represented a cumulative total of 11.5 percent of average assets of all insured U.S. commercial banks during those three years with the peak being 4.3 percent in 1989. The average size of failed institutions during 1988-91 was fairly modest, \$499 million. As the current crisis may be of greater scope, could evolve more rapidly, and might involve significantly larger individual institutions, we take a somewhat more cautious hypothesized default rate of 20 percent.

Curry and Shibut (2000) calculate the taxpayer loss from resolving the crisis at \$124 billion or 23.9 percent of the \$519 billion in assets on the balance sheets of the institutions at the date of acquisition. Thus the eventual recovery rate was 76.1 percent. An alternative recovery rate proxy may be derived from the more recent experience with the former Bear Sterns assets underlying the Fed's lending to Maiden Lane LLC.<sup>38</sup> Among those assets, the fair value as a percentage of remaining principal of performing loans is estimated at 65.6 percent while that of nonperforming loans is 31.4 percent with an overall average of 63.9 percent.

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<sup>36</sup> As of April 15, 2009 (the latest data available) banks borrowing from the discount window and TAF had pledged collateral net of haircuts valued at \$1.226 trillion against loans of \$503 billion. See the website: [www.federalreserve.gov/monetarypolicy/bst\\_ratesetting/](http://www.federalreserve.gov/monetarypolicy/bst_ratesetting/)

<sup>37</sup> Figures on the Savings and Loan crisis are from Curry and Shibut (2000).

<sup>38</sup> See the audited accounts of Maiden Lane LLC for the period March 14 through December 31, 2008. Note 5.b, page 16 discusses the performance of the commercial and residential loan portfolio. <http://www.newyorkfed.org/aboutthefed/annual/annual08/MaidenLanefinstmt2009.pdf>.

For the purposes of this paper, it will be assumed that both collateral values and recovery rates on residual claims (claims remaining after collateral recovery) are 65 percent. The hypothesized recovery rate on this asset type is therefore 87.8 percent. Assuming a 20 percent default rate yields a hypothesized total loss on the portfolio of 2.5 percent.<sup>39</sup> In the balance sheet projections that follow, this assumption leads to stagnant income from primary credit and TAF loans in 2010. (Although the assumed gross rate of return rises in 2010 to 300 bps from 50 bps, the loss of 250 bps assumed reduces the net return to 50 bps. In 2011, it is assumed that both the gross and net returns are 300 bps.)

- *Commercial Paper Funding Facility (CPFF)* purchases eligible three-month unsecured and asset-backed commercial paper directly from eligible issuers. Issuers must hold the highest available commercial paper rating provided by a national ratings agency. The risk in this asset class is that borrower creditworthiness and liquidity falls sharply during a three month time period and that any collateral and additional recovery is insufficient to cover the principal value of the paper. FRB experience through end-December 2008 has been positive. CPFF LLC net income over the period October 14, 2008 through December 31, 2008 was slightly more than \$1 billion. This initial performance is not too surprising if one accepts that U.S. investment grade corporate sector balance sheets came into the recession quite healthy. The risk is that the deteriorating real economy leads to a deterioration more rapid than predicted by historical estimates of ratings transition matrices<sup>40</sup>. Experience during the past 18 months has raised many questions as to the reliability of agency ratings as well as the stability of transition matrices. In the interest of prudence, we consider a default probability of 10 percent and a recovery value of 85 percent of assets.

Among higher risk assets we consider:

- *Other loans*, equal to \$194 billion in Table 6, comprises primary credit of \$94 billion already classified with the TAF above; \$37 billion in credit to primary dealers (PDCF); \$24 billion in the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF); and \$39 billion loaned to AIG. The PDCF was announced in March 2008 and became operational in September 2008. It is designed to provide financing to participants in the securitized credit markets. Tri-party repo eligible collateral is taken by the Fed which is in general of good quality. However, it should be noted that both Bear Sterns and Lehman Brothers were, at the time of their acquisition/bankruptcy, primary dealers. We consequently add the PDCF to the

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<sup>39</sup> A 20 percent default rate means here that loans equivalent to 20 percent of the total Fed portfolio go into default, i.e., the borrower(s) fails to pay on time and in full according to the original terms.

<sup>40</sup> A ratings transition matrix provides the historical frequency that ratings change from one category to another. For example, the frequency that a AA rating transitions to a AAA or A rating at the next rating review. Historically, transitions from investment grade to default (C or D) within 3 months are very rare.

category TAF/Primary with the same risk classification<sup>41</sup>. The AMLF was set up to provide funds to U.S. financial institutions to purchase high-quality ABCP from money market mutual funds to allow the latter to retain confidence in the liquidity of those instruments in the light of their own heightened liability redemption concerns. Although the duration of financing under this program exceeds that of the CPFF, we believe it is of a sufficiently similar nature to classify it in the same way (AMLF financing is nonrecourse).<sup>42</sup> The \$39 billion loan to AIG would appear to have a high risk given the firm's ongoing difficulties and the restructuring of previous U.S. government-arranged financial agreements. With respect to AIG we consider a 75 percent default probability and 50 percent loss given default as prudent.

- *Maiden Lane LLCs* are special purpose vehicles formed by the FRB of New York to manage its interventions in the JP Morgan acquisition of Bear Sterns (ML I) and in AIG (ML II and ML III). Details of the operations of the ML and their balance sheets may be found in the FRBNY consolidated financial statements. At the time of their establishment, JPMorgan and AIG contributed equity amounting to \$1.15 billion, \$1 billion and \$5 billion in ML I, II, and III respectively. At end-2008, the fair value of the equity stakes in ML I and II were zero and \$2.8 billion in ML III. The FRBNY net exposure to the MLs is therefore \$74.3 billion, equivalent to the fair market value of assets of \$77.1 billion minus AIG's claim of \$2.8 billion in ML III. For the purposes of this paper we assume an aggregate 75 percent default rate and an 80 percent loss given default on ML exposures.
- *Identified Specific Contingent liabilities* include FRBNY commitments to provide contingent credit to Citigroup (\$244.8 billion) and AIG (\$23.2 billion); and FRB of Richmond contingent funding support to Bank of America (\$100 billion).<sup>43</sup> The support to Citibank and Bank of America would take the form of financing an identified pool of assets once losses on that pool exceed a threshold amount. In the case of Citibank, losses of \$56.2 billion would need to be recognized on a \$301 billion asset pool before FRBNY financing would be provided against the pool. In the case of Bank of America, losses of \$18 billion would need to be recognized on an \$118 billion asset pool. In the case of AIG, the \$23.2 billion represents the then undrawn upon portion of the secured line of credit provided by the FRBNY as part of the UST/FRB financial assistance package (restructured on November 10, 2008). To fully quantify the risks involved under this rubric would require making conjectures on (i) the likelihood of the contingency thresholds being attained; (ii) how much of the contingent claim would be drawn down; (iii) the probability of default on those loans; (iv) likely recovery values. Rather than engage in this speculation, which would inevitably involve assumptions about individual institutions, we prefer not to

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<sup>41</sup> Owing to relatively low PDCF exposure and rounding margin, this does not change the hypothesized loss.

<sup>42</sup> Owing to relatively low AMLF exposure and rounding margin, this does not change the hypothesized loss.

<sup>43</sup> See FRB Combined Financial Statements, Note 3, page 10-11 and Note 11, page 40. As of April 20, 2009 the accounting treating of the Bank of America support had not yet been determined.



allocate losses against these claims separately but instead to implicitly include them by taking a very prudent approach to the TALF program (below).

- Term Asset-Backed Securities Loan Facility (TALF)* lending had not occurred as of end-December 2008 but the FRB Board has made several announcements that have been directed at making the program more attractive including extending the possible duration to 5 years and expanding eligible collateral. The Board has stated that it may authorize up to \$1 trillion in lending during 2009. The UST has stated its intention to utilize TARP funds to insure the FRB against the first 10 percent of any losses incurred through the TALF. The FRB would lend on a nonrecourse basis to holders of eligible AAA-rated ABS with the intention to foster securitized issuance of student, auto, credit card, and Small Business Association guaranteed loans. Contemplating the potential risks with TALF involves considerable conjecture. Experience during 2008 with the valuation of ABS suggests a high degree of prudence is warranted. Certainly, the provision of UST insurance provides protection to the FRB but also supports the view that risk is material. With this in mind, and considering that no allowance is being made for identified or unidentified contingent liabilities (see preceding bullet point), we consider it prudent to hypothesize a 30 percent default rate and a 35 percent loss given default after UST indemnification. Although this might be considered on the high side of the loss distribution for the TALF as a standalone facility, we utilize this rubric to implicitly account for possible losses associated with unidentified contingencies.
- A summary of the assumptions and the hypothesized risk profile are provided in Tables 8 and 9 below.

**Table 8. Summary of Static Risk Assumptions**  
(in percent)

Asset	Default	LGD
TAF/Primary	20	12
CPFF/AMLF	10	15
AIG Loan	75	50
TALF	30	35

Source: Author's assumptions.

When applied to the end-2008 balance sheet and the assumed future TALF exposure, these assumptions yield hypothesized losses equivalent to 9 percent of risk assets.

**Table 9. Summary of FRB Loss Scenario Envelope**  
(US dollar billion)

Asset	Exposure	“Loss”
TAF/Primary	577	14
CPFF/AMLF	358	5
AIG Loan	39	15
Maiden Lane	74	44
<hr/>		
TALF (proj)	1000	105
Total	2048	183

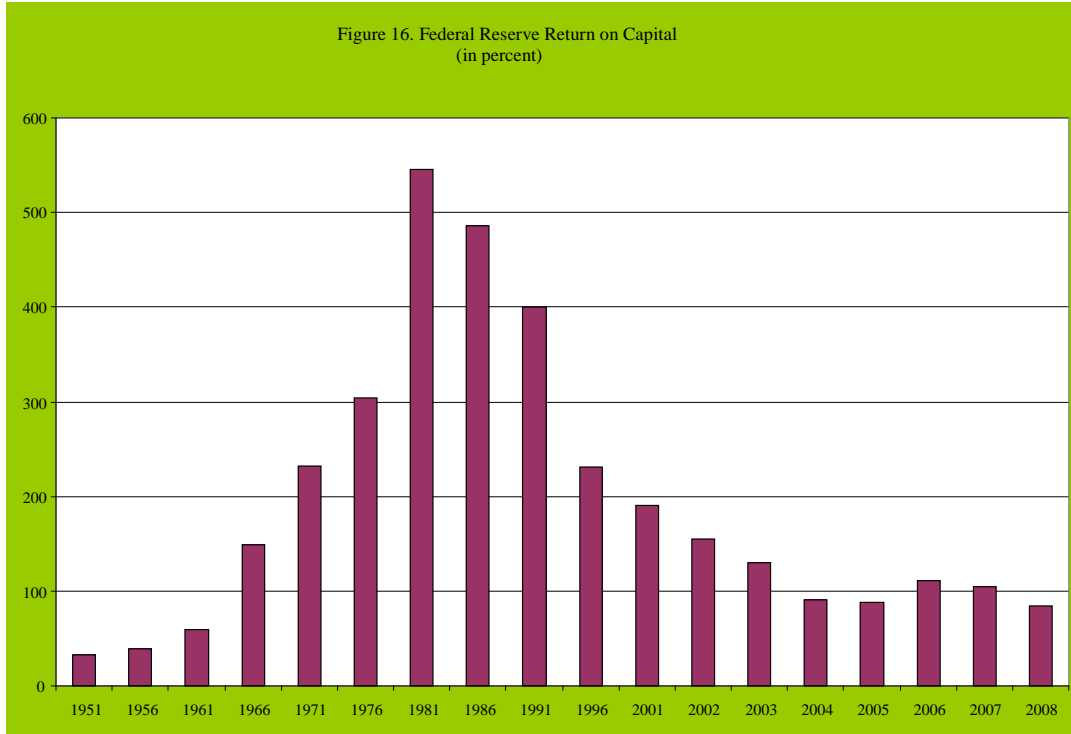
Source: Author’s assumptions.

### **B. Federal Reserve Bank Ability to Absorb Losses**

In a given year, the FRBs and any commercial bank have the same two primary sources to absorb losses from any one of their business lines—earnings and capital.

*Earnings.* The FRBs are highly profitable. The Federal Reserve has made a profit every year since 1916 including throughout the Great Depression. Average annual profit during the last 5 years (2004–2008) was \$30.7 billion. Clearly, FRB income generation capacity far exceeds that of any commercial bank owing to the spread between its main conventional financing source, banknotes, and its holdings of Treasury assets. This link is so well established that FRB transfers to Treasury have been called “interest on FR notes” since 1947.<sup>44</sup> Figure 16 provides the FRB “return on capital” for selected years dating back to 1951. This compares with an average return on U.S. commercial bank equity of 13.7 percent during the period 1998-2007. Therefore, while it would take the average U.S. commercial bank approximately 7 years to double capital by fully retaining earnings, the FRB could conceivably do so in one.

<sup>44</sup> The original title was “franchise tax,” abolished by Congress in 1933. See Meltzer (2003) page 599.



Source: Federal Reserve System Annual Reports (various years) and author's calculations.

The recent change in FRB balance sheet composition and lower market interest rates reduced FRB interest income from UST, Agency and GSE securities by \$13 billion in 2008. However, interest income derived from increased lending to financial institutions; the central bank liquidity swaps; and securities held by the Maiden Lane and CPFF special purpose vehicles more than made up for this decline. Total interest income rose from \$41 billion in 2007 to \$43 billion in 2008. As most of the balance sheet expansion was financed with low yield or zero interest obligations, interest expense rose by only \$1.7 billion.<sup>45</sup> Overall, net income prior to distribution rose from \$38.4 billion in 2007 to \$38.7 billion in 2008 despite losses of \$9.6 billion on the portfolio holdings of the Maiden Lane SPVs.<sup>46</sup>

*Capital.* With consolidated capital at \$42 billion, adding one year of average past annual earnings yields a year-ahead buffer of \$73 billion. As FRB makes weekly transfers to the U.S. Treasury, in order to build a buffer of this size the FRB would need to retain earnings for a longer time than is currently its practice. (Most central banks make treasury transfers annually, after the publication of the yearly audited financial statements).

<sup>45</sup> The FRB expanded their liabilities at very low marginal cost in 2008. Compared with 2007, banknotes rose by \$61 billion; government deposits—which bear no interest—by \$349 billion; and bank deposits—currently paying interest at 25 basis points, by \$839 billion.

<sup>46</sup> The net loss to the Fed from the Maiden Lane SPVs in 2008 amounted to \$3.4 billion as the 3 SPVs registered \$1.9 billion in net interest income while \$4.4 billion in losses were absorbed by JPMorgan and AIG.

The FRB has an unusual equity structure prescribed in U.S. Code (see Appendix 2). FR member commercial banks are required to subscribe to FRB stock in an amount equal to 6 percent of their own capital and surplus. The paid-in portion (one half) of this subscription forms FRB balance sheet “capital.” FR Board policy requires FRB to maintain a reserve “surplus” equal to paid-in capital. In Figures 17–22 below, “capital” is the sum of capital and surplus.

In legal terms FRB equity is a direct function of the level of capital in the U.S. banking system. It is *not* directly related to potential FRB losses nor adjusted in line with perceived changes in risk. Indeed, the structure of FRB stock subscription and redemption implies that during a period of financial crisis, when commercial bank capital levels are falling, FRB capital would also fall—even though this may be a time of increasing FRB risk.

Presumably FRB capital policy was framed in the FRA to maintain FRB equity funding proportional to the size of the U.S. banking system and the FRB an appropriate “weight” in the financial market owing to its obligations to act in that market. With the atrophy of that Fed role, FRB equity has become somewhat like the human appendix, an organ whose function is no longer understood. It is thus not surprising that in its review of the role of FRB surplus, the United States General Accounting Office declared “We found no widely accepted, analytically based criteria to show whether a central bank needs capital as a cushion against losses or how the level of such an account should be determined.”<sup>47</sup>

In summary, FRB capital represents a buffer against losses although the size of the buffer at this time is subject to fluctuations in the capital levels of FR member banks.

*Banknote issuance.* The FR has a third reliable source from which to finance losses—banknote issuance (the counterpart to the present discounted value of future seignorage). FRB purchase notes from the Bureau of Engraving and Printing at the cost of production and issue them in the market at face value. The difference between the cost of production, plus the costs of maintaining the banknote supply in good physical condition, which implies replacement at well defined “soiled” benchmarks, represents seignorage. In a floating rate fiat money system one might consider seignorage as the immediate difference between the banknotes issued and their lifecycle cost, i.e., immediately as revenue, or as the revenue obtained over time from the assets acquired with those banknotes. Conventional accounting adopts the latter treatment. Here banknote issuance is considered “financing” so this ambiguity is avoided. In the balance sheet projections considered below, banknote demand is assumed to grow at the same rate as nominal GDP and, owing to their small magnitude in comparison to total income, costs associated with issuing and maintaining currency are ignored.<sup>48</sup>

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<sup>47</sup> *Federal Reserve System: The Surplus Account* (2002).

<sup>48</sup> In 1997, cost of currency amounted to 1.5 percent of consolidated FRB current income. In some countries this can be a material cost for the central bank. Some sub-Saharan central banks experience negative seignorage owing to the high cost of procuring banknotes relative to their nominal denominations in local currency as well as high costs to maintain quality currency in adverse climactic conditions.

*Other Reserves.* In addition to the assets shown on the balance sheet the FRB has additional sources of strength with which it could cope with losses. The first would involve a revaluation of gold. Although changing nothing in reality, a revaluation of the FRB gold certificates would provide a “paper” profit of approximately \$236 billion. If one were concerned with the psychological impact of negative capital, it would be relatively simple to erase it with a revaluation of gold.

A second “reserve” is the difference between the fair market and balance sheet valuation of the UST and Agency securities held in the SOMA. At end-December 2008 this difference amounted to \$62.4 billion. In other words, the Fed had \$62.4 billion in unrecognized gains on its securities portfolio or, alternatively, were the Fed to have instantaneously sold its entire portfolio into the market at end-December 2008 market prices (clearly an economic impossibility), it would theoretically have absorbed \$566.4 billion in monetary base compared with the \$502.2 billion balance sheet valuation of the SOMA portfolio at that time. This thought experiment illustrates the ephemeral nature of this “reserve”. Were the Fed actually to sell a large portion of its portfolio outright, interest rates would likely rise, leading to a fall in value of the remaining portfolio. Similarly, in a situation of rising inflationary expectations and rising long-term interest rates, this cushion to absorb liquidity could rapidly evaporate. Conversely, in a situation such as 2008, a deteriorating world economy and sharply declining risk appetite led to a flight to U.S. Treasuries which raised their prices.

Table 10 summarizes the discussion thus far.

**Table 10. Federal Reserve System Capacity to Absorb Losses**

Nature of the Reserve	Value in U.S. \$ billion	Notes
Current capital and reserves	42.2	End-December 2008
Annual profit	30.7	Average 2004-2008
Banknote issuance	27.8	Average 2004-2008
<b>Subtotal</b>	<b>100.7</b>	
Revaluation of gold	235.6	Gold at 943.25 per ounce*
Mark-to-Market SOMA (Treasury/Agencies)	64.2	End-December 2008

Source: Federal Reserve Board Annual Reports (various); author’s calculations. London mid-morning fixing price March 4, 2009.

*Earnings capacity over time.* So far, the discussion has centered on resources available within a one year time frame to cover losses assumed to occur over that time. It is important to recognize however, that the Fed also has a strong ability to generate future income. That is, although current resources might be inadequate to cover losses in a given year, FRB future income generation potential or “franchise” value, would permit it to cover a significant capital shortfall over time without the need to change its policy path. To obtain a hypothetical balance sheet measure of this future income potential, one may consider the present discounted value of an infinite stream of profits amounting to the current 5 year average profit of \$30.7 billion per year, discounted by, say, 3 percent. This yields an “asset” valued at

over \$1 trillion. This hypothetical addition to balance sheet capital may be thought of intuitively as the annuity value of the FRB's seignorage monopoly.

Coping with a scenario involving one-time losses on the order of \$200 billion on a portion of the FRB asset portfolio would entail a decline in FRB capital of approximately \$170 billion assuming the other earnings in Table 10 and if none of the "other reserves" discussed above were available or utilized.<sup>49</sup> To return to positive equity of \$45 billion would then require roughly the retention of all profit during the next 6 years. However, it can legitimately be questioned whether the underlying assumptions on *earnings* and *banknote issuance* would hold in a truly catastrophic scenario.

As mentioned above, U.S. *banknote demand* appears to rise during periods of foreign economic turmoil which may be associated with a "dark" U.S. financial scenario. This correlation appears to have returned in 2008 which witnessed the highest growth rate in banknote demand since 2001. Estimates suggest strong banknote demand from Latin America, Eastern Europe and the United States, particularly in the second half of the year.<sup>50</sup>

As to the question whether future *earnings* could be assumed in a dark scenario, readers may be interested in an examination of the Fed balance sheet and earnings profile before and after the Great Depression, which is presented in Appendix I. In one of many ironies connected with the Great Depression, the FRB performed "well" financially but only because they took no balance sheet risk. In fact, bills purchased outright and bills discounted—which at the time was virtually the only form of FRB credit to the private sector, fell from 1 percent of GDP in 1929 to virtually zero in 1934 (see Figure 24). Although the balance sheet did expand sharply during the Great Depression it was driven by an accumulation of government securities and gold.

### C. Dynamic Balance Sheet Scenarios

The above discussion might be considered excessively static and it is consequently useful to consider more carefully how the FRB balance sheet might adjust over time to a shock. In what follows, three illustrative scenarios incorporating balance sheet dynamics are presented. In the scenarios it is assumed that a "shock" occurs in 2010 to a hypothesized end-2009 balance sheet that is identical to the end-2008 balance sheet with the following exceptions. The CPFF is assumed to decline to \$125 billion in 2009 and then rise to \$250 billion thereafter; liquidity providing repos are assumed to decline from \$80 billion to zero over the same period; and the TALF is assumed to end 2009 at \$1 trillion. On the liability side, it is assumed demand for currency grows at the rate of nominal GDP and bank reserves adjust to compensate for the remainder of the balance sheet expansion given an assumption concerning the level of Treasury balances maintained at the Fed. The latter assumption differs in the three scenarios and is tied to the assumed evolution of the SFP.

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<sup>49</sup> The possible political economy consequences of this scenario are discussed below.

<sup>50</sup> See FRBNY (2009) page 33.

The prime driver of the stress scenario is an increase in inflationary expectations. The underlying reason for these expectations could be manifold but for the purposes of the paper it is assumed that financial markets become concerned about the volume of U.S. debt issuance that will be needed to finance deficits in the medium term. Coupled with this concern is a belief that the Fed will not act aggressively to raise interest rates owing in part to a desire to keep Treasury financing costs low and in part to avoid the erosion of its own capital that would accompany losses. Scenarios 2 and 3 are designed to examine ways in which the Fed and Treasury might act so as to reduce Fed exposure to balance sheet risk and thereby alleviate or eliminate any market fear that the Fed would hesitate to raise interest rates out of concern for its own balance sheet. This strengthening of Fed credibility might consequently avert the development of inflationary expectations and lead to a superior macroeconomic outcome—i.e., lower inflationary expectations and lower inflation.

Readers familiar with game theory may find it useful to imagine the Fed and financial markets involved in a multistage game where the solution requires Nash subgame perfection. If markets believe that it is not optimal for the Fed to react aggressively to inflationary expectations, expectations of inflation may be self fulfilling and the Fed will be caught in a dilemma where it must either raise interest rates aggressively or lose its inflation-fighting credentials. If, on the other hand, markets believe it is optimal for the Fed to aggressively respond to inflationary expectations (or less costly to the balance sheet to do so) they would be less likely to expect inflation and a pareto superior outcome could be obtained. Scenarios 2 and 3 are designed to examine how the Fed's payoffs in the subgame where high inflation is expected can be manipulated ex ante so that it is optimal for it to respond aggressively. If credible, this will lead to expectations of lower inflation and a pareto superior equilibrium.

Although we will not examine here the analogies with Japan's experience with the zero interest rate bound, we believe that the Bank of Japan (BoJ) faced a similar dilemma during the period of quantitative easing (QE). To the extent that QE merely involved an exchange of deposits at the BoJ for Treasury bills, i.e., there was no reduction in the risk assets held by banks, little appeared to have been gained. The only QE elements which might have been at least marginally effective were those that involved taking some risk on to the BoJ balance sheet through a change in its composition, that is, the *rinban* operations (purchase of long term government debt), and the purchase of equities. In those areas, however, the BoJ was constrained in the amount of risk it could take by the absence of strong monetary and fiscal coordination and a lack of implicit Treasury support in the event of losses.

Even though the BoJ underlying balance sheet was quite strong, market concerns that the BoJ might be less than fully determined to follow through with its unconventional policy in the face of possible losses led to BoJ credibility challenges.<sup>51</sup> The FRB may need to expend considerable communication efforts to avoid a similar perception during the implementation of its intervention and exit strategies. An appropriate risk management strategy is also key.

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<sup>51</sup> See JP Morgan (2002), Business Week Online (2003) and Cargill (2005).

The three scenarios examined here represent variants cast against a common macroeconomic background. In order to make comparisons of the scenarios straightforward, no feedback is assumed from the Fed balance sheet to the policy variable. That is, it is assumed the Fed responds strongly to the shock to expectations with a rise in the fed funds target to 500 bps in 2010 in all three scenarios. Similarly, the paths of inflation and real growth are identical. In all scenarios we assume rising interest rates are accompanied by a material increase in financial distress leading to losses similar in degree to those assumed in Table 9. We adopt these restrictions on the scenarios not with the objective of determining which would be the most likely or to examine whether monetary policy in each would indeed be optimal or even sensible ex post. The objective is to examine how the impact on Fed capital in each scenario would differ and reflect upon the political economy implications of each. In fact, the policy measures assumed to be adopted in Scenario 3 would be motivated precisely to avoid entering into a scenario where inflationary expectations rise. Returning to the game theory analogy, one would structure the payoffs so that expecting high inflation is thought to be suboptimal and the economy would not witness any of the three scenarios examined. The market would then never learn whether the Fed would, in fact, respond aggressively.

The main common details of the scenarios are summarized in Appendix 3. The scenarios *differ* primarily in the extent to which the Fed and Treasury restructure the balance sheet (during 2009) prior to the shock in 2010. That shock triggers losses on the SPVs, AIG loan and the TALF in 2010 and leads to a suspension of earnings accrual on those facilities for several subsequent years. TAF/Primary credit earnings and earnings from the central bank swap facilities are suppressed, particularly during 2010.<sup>52</sup> In all of the scenarios it is assumed that all net FRB earnings (if positive) are retained and added to FRB capital even after the capital to GDP ratio exceeds the 2008 level. Although this latter assumption is not consistent with current FRB policy, it serves to illustrate the speed at which FRB capital can be recovered in a steady state equilibrium with the hypothesized balance sheet size. It should also be noted that no mark to market losses or gains are recognized in any scenario on the portfolio of FRB Treasury and Agency securities. This assumption presumes that the Fed has the ability and intention to hold these securities to maturity and is in line with FRB accounting policy. Nor is any allowance made for potential losses or gains on Agency sponsored MBS (none of which were on the balance sheet at end-2008).

*Scenario 1* considers the time path of FRB profit and capital assuming what may be termed a “business as usual approach” to FRB balance sheet risk management. All 2009 FRB net earnings are assumed transferred to the Treasury, no changes are made to the ownership of the SPVs nor claims on AIG, and there is a sharp unwinding of Treasury deposits at the FRB concomitant with a phasing out of the SFP. Treasury deposits are assumed to fall from \$365 billion in 2008 to \$100 billion at end-2009 and to \$25 billion in 2011.

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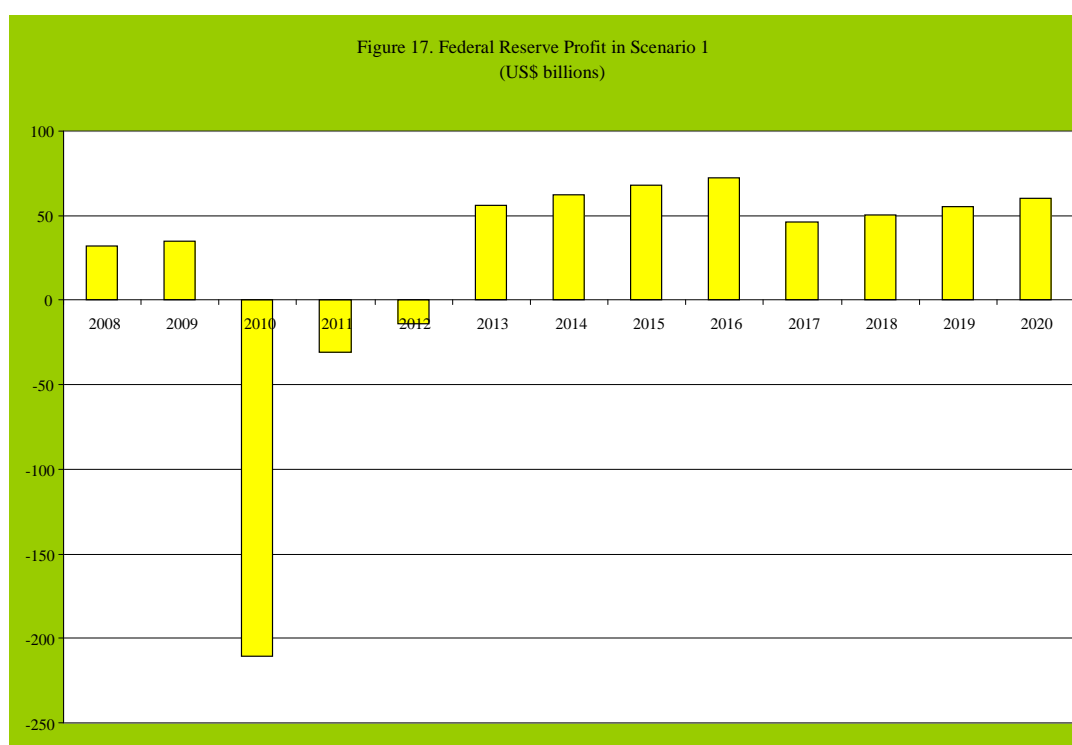
<sup>52</sup> It is assumed that the 2010 effective rate of return on the TAF/Primary credit and swap portfolios is only 50 bps. This is equivalent to a 300 bps return reduced by the 250 bps loss assumed in Table 9. In 2011 it is assumed the effective rate of return rises to 300 bps .



*Scenario 2* considers the following actions: (i) the FRB retains all of its 2009 profit; (ii) The Treasury uses \$115 billion in its deposits at the Fed to purchase the loan to AIG and the Maiden Lane SPVs in 2009; (iii) The Treasury maintains a higher level of deposits at the Fed than in Scenario 1 during the years 2009-2012, implying a more gradual wind down of the SFP. Measure (ii) naturally transfers part of the balance sheet risk from the Fed to the Treasury and reduces Fed losses when those SPVs are assumed default in 2010.

*Scenario 3* encompasses measures (i) and (ii) above but the 2009 reduction in Treasury deposits at the Fed is the same as in Scenario 1 (\$265 billion). However, in addition to purchasing the SPVs and AIG loan, an additional \$100 billion of Treasury deposits is assumed to be allocated to provide a further \$100 billion in TALF insurance to the Fed.<sup>53</sup>

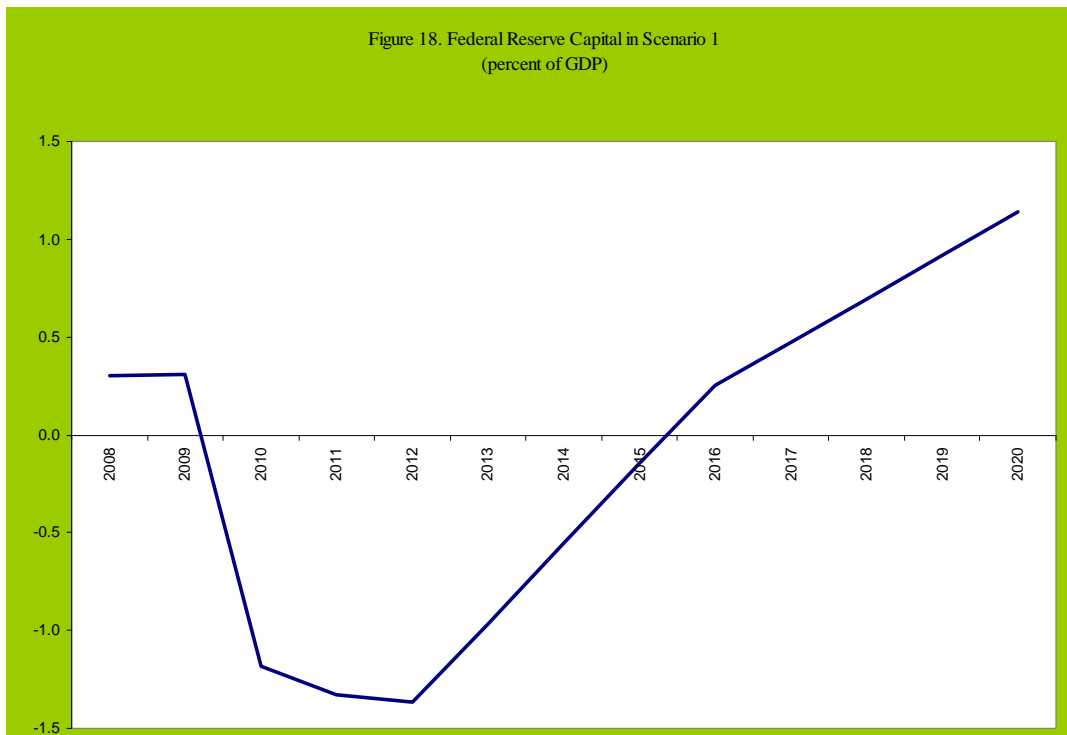
The Scenario 1 evolution of FRB profit and capital is illustrated in Figures 17-18.



Source: Author's projections.

Consistent with the discussion above, FRB net worth declines sharply with the impact losses and continues as a result of the rise in sterilization costs tied to the fed funds rate. A gradual return to profitability follows along with an increasing proportion of finance derived from banknote issuance and an improvement in FRB gross interest margins.

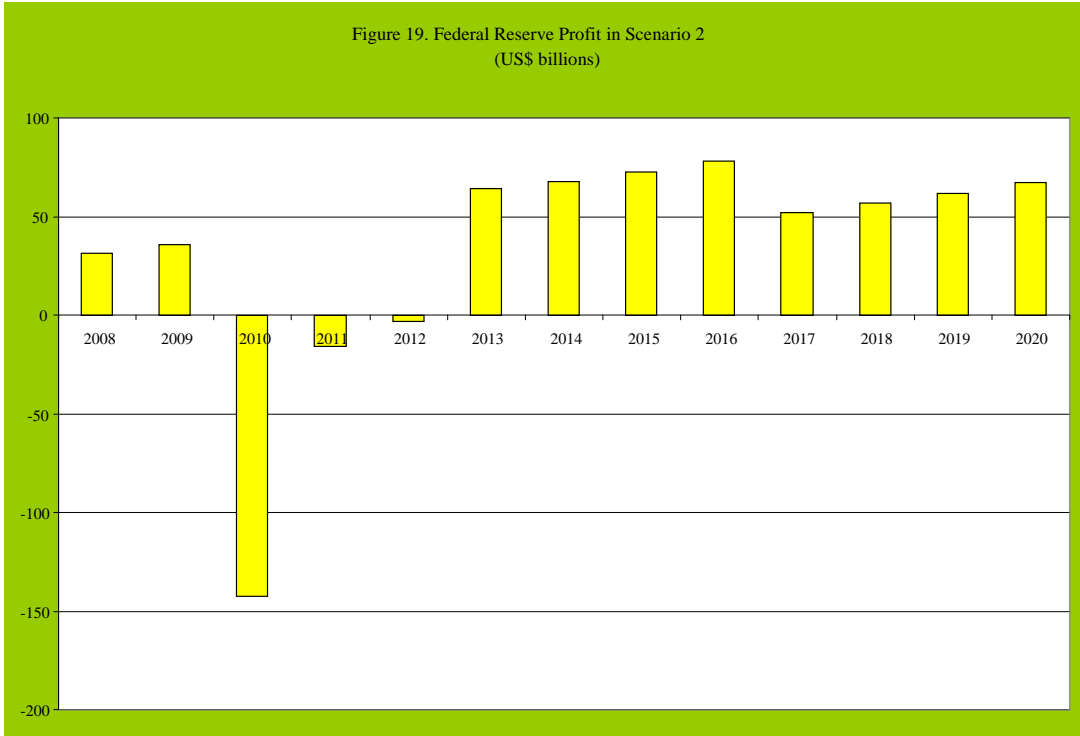
<sup>53</sup> In scenario 1, deposits fall by \$265 billion in 2009. In scenario 3 this same reduction is used to finance the SPV purchase (\$115 billion), general expenditure (\$50 billion) and insure against TALF losses (\$100 billion).



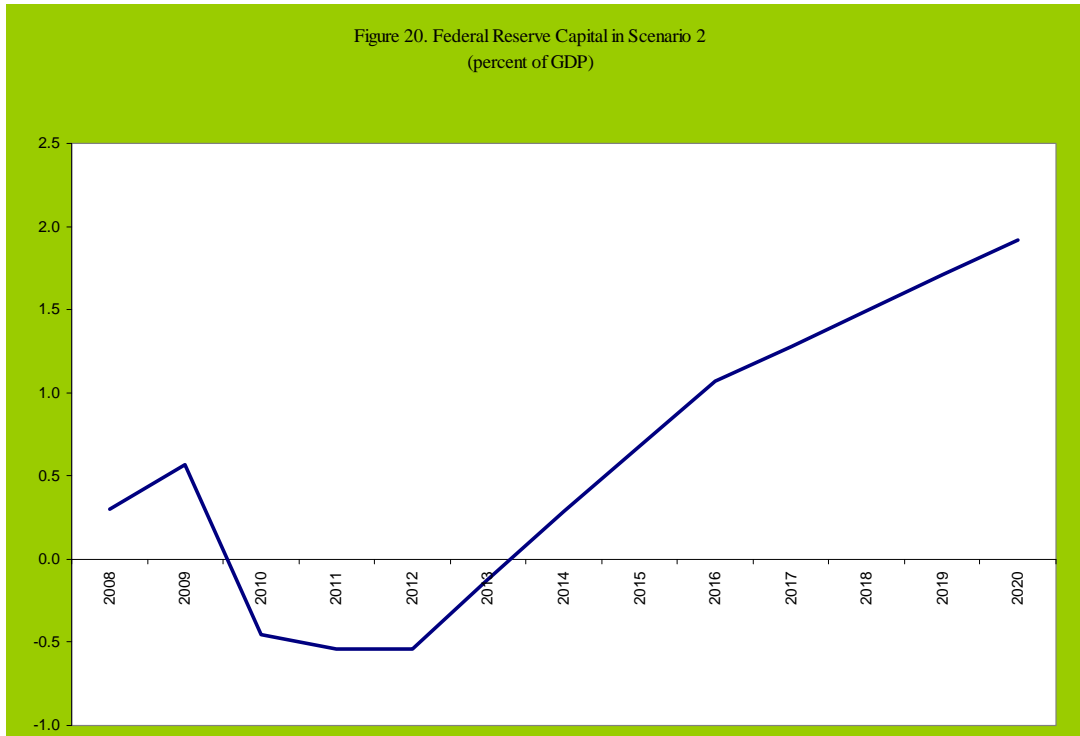
Source: Author's projections.

Capital as a percentage of GDP attains the 2008-2009 level in approximately 2016 implying that a resumption of transfers to the Treasury could resume in 2017 or 7 years after the shock.

The Scenario 2 impact on the Fed balance sheet is less severe than in Scenario 1 but not by enough to avoid a period of negative capital.



Source: Author's projections.

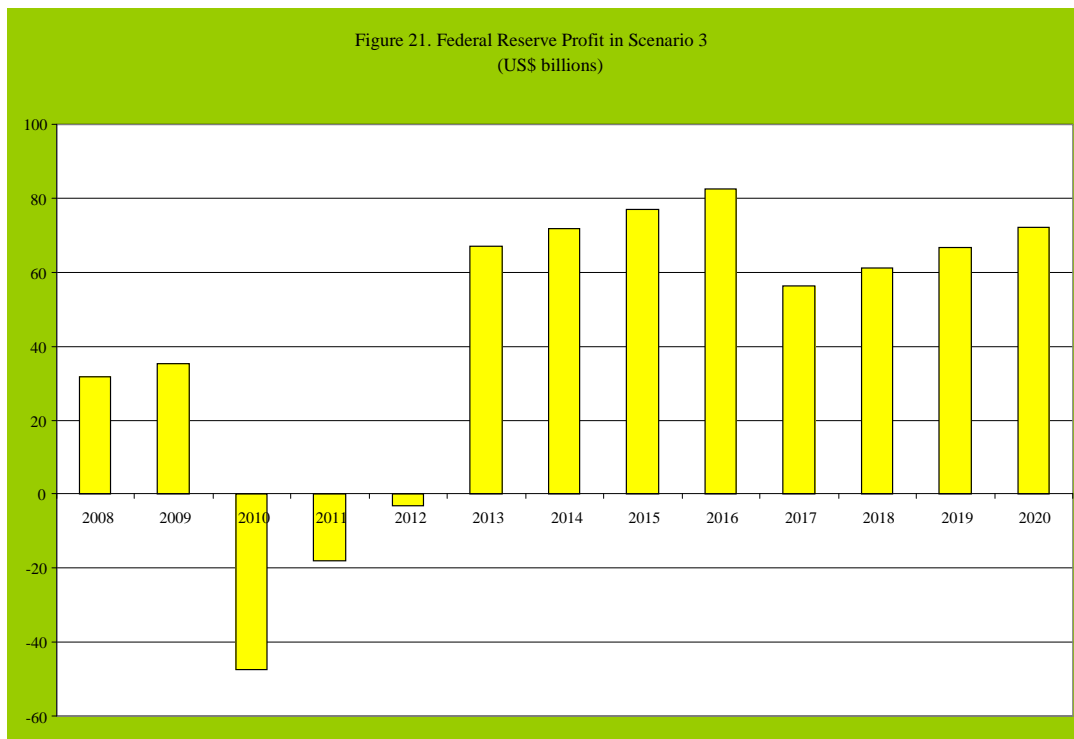


Source: Author's projections.

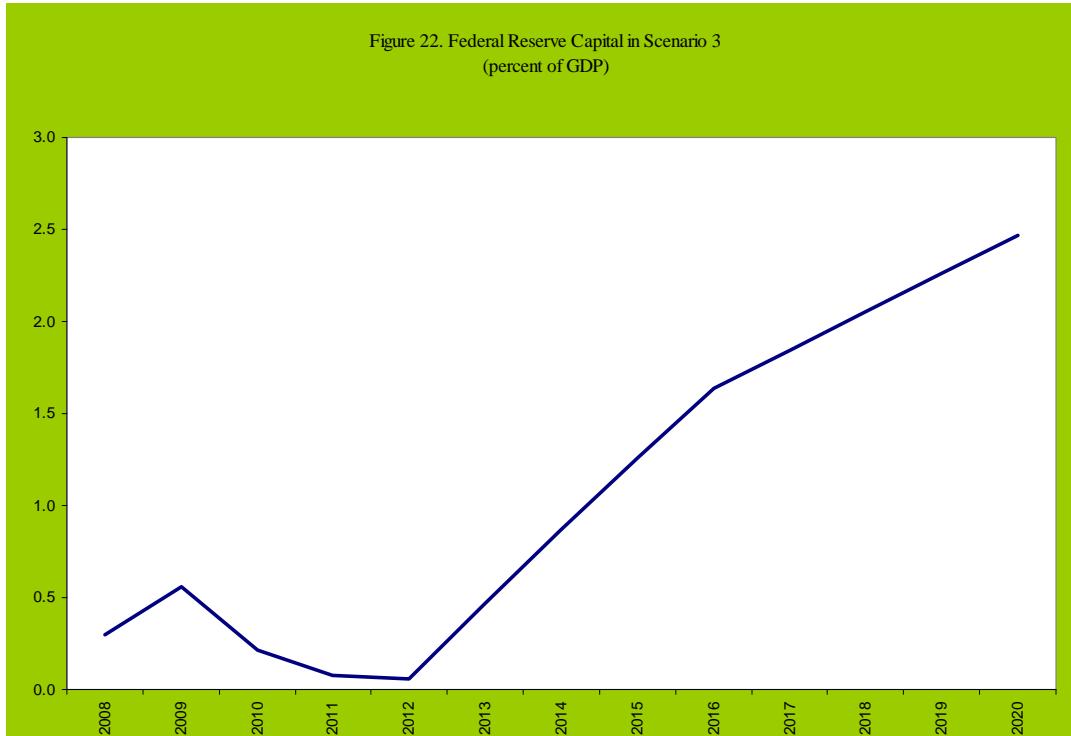
Capital returns to the 2008 level in 2014 allowing a full resumption of Treasury transfers in 2015. The policy measures assumed in Scenario 2 both lessen the size of the shock on the Fed balance sheet and reduce the ultimate fall in the level of capital (the starting point for capital is higher in 2009 owing to the assumption that all 2009 profit is retained by the Fed).

In neither Scenario 1 nor Scenario 2 does the FRB suffer catastrophic losses that would necessitate an abandonment of an aggressive response to rising inflationary expectations. What is apparent though, in both scenarios, is that the FRB would suffer significant losses and capital would fall below zero. That event and the corresponding loss of Treasury nontax revenue would likely not escape the attention of legislators who might then raise questions as to the legitimacy of the FRB's ability to undertake operations that entail fiscal risk. A belief in financial markets that the Fed will refrain from tightening policy to avoid this political economy risk to operational independence may foster heightened expectations of inflation.

Scenario 3 outlines the most aggressive Treasury actions to preserve the soundness of the FRB balance sheet and results in the Fed averting negative balance sheet capital despite significant losses.



Source: Author's projections.



Source: Author's projections.

Whether confidence in the avoidance of negative FRB capital would have a material impact on market participants' expectations in the current U.S. context can only be speculated. As argued in Stella (1997), a central bank need not have positive capital as conventionally defined as long as the underlying strength of its balance sheet (essentially future earnings capacity) is sufficient to allow it to achieve its policy objectives and preserve its financial independence under plausible risk scenarios. Nevertheless, to the extent financial markets may correctly, or erroneously, believe a strong central bank would deviate from stated policy objectives to avoid losses, a strengthened balance sheet may enhance policy credibility.

#### **D. Central Bank Fiscal Risk Management**

The first step in risk management is to ensure that policy decisions are taken on the basis of the best information available including the likely cost in different scenarios. Risk management does not directly provide guidance as to whether a particular policy *should* be chosen but it can determine whether it is sustainable. It was argued above that the Fed is highly likely to be able to withstand considerable losses without necessitating a fundamental change in policy. Here we will consider how the risk already undertaken can be appropriately managed. This subsection discusses risk identification and quantification; how on-balance sheet risk may be managed; and motivations for explicitly shifting fiscal risk from the central bank to the treasury and clarifying fiscal, monetary and macrofinancial stability responsibilities. It concludes with a discussion of issues which may need to be considered when designing a superior framework to deal with future crises.

## **Identifying and quantifying risk**

In its regular monetary operations, the Fed has been very careful to manage risk. It provides recourse lending, usually of a short maturity, against very high quality collateral with adequate haircuts to a select group of primary dealers. It also allows for different pricing for lending against different pools of collateral thus avoiding the potential operation of “Gresham’s law of collateral.”<sup>54</sup>

As discussed above, the Fed has taken increased financial risk in expanding the scope of its operations. Its risk control measures have included: purchasing only highly rated, AAA quality paper; applying significant haircuts to unconventional collateral; requesting indemnity from the Treasury for certain operations or portions thereof. Nevertheless, questions remain as to how the valuation of collateral has been undertaken; the validity of credit ratings agencies’ ratings, particularly with regard to asset backed securities; and the likely magnitude of the current economic turmoil. The FRB has also to be concerned with liquidity risk. Should demand for the current level of excess reserves wane during a period when the monetary stance is being tightened, the FRB will have to reduce liquid interest earning assets or pay an increasingly higher rate of interest on its liabilities.

A number of central banks worldwide have enhanced their financial disclosure and risk management practices in recent years as part of a trend toward greater accountability.<sup>55</sup> For example, Reserve Bank of Australia (RBA) has a separate risk disclosure section in its Annual Reports. The sensitivity of the RBA balance sheet to both interest rate and foreign currency risk are explicitly illustrated. This lays the foundation for an annual discussion with Treasury as to the appropriate level of RBA reserves to cover those risks.

## **Managing balance sheet risk**

As discussed above, the Fed’s capital structure and policy is largely unchanged since 1913 and could benefit from an overhaul to make it more sensitive to risk and divorced from the vagaries of the development of commercial banking capital. Now would appear an opportune time to set aside additional reserves for expected and unexpected losses, a factor particularly important in considering that profit transfers are made weekly. However the ability to set aside profits may be restricted by the Federal Reserve Act. Nevertheless, adopting the more conventional approach of making transfers to the Treasury only after the publication of the audited annual report might be considered.

It may be insightful to examine the RBA profit distribution model which involves three separate conceptual steps. First, the profit and loss account is presented according to

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<sup>54</sup> For a discussion of Gresham’s law of collateral and central bank collateral policy more broadly, see Chailloux, Gray and McCaughrin (2008).

<sup>55</sup> Stella (2008) provides some quantification of this trend by measuring the decline in the proportion of “other items net” reported by 150 central banks and monetary authorities during 1992-2005.

International Financial Reporting Standards (IFRS). Second, a distinction is made between profit and profit available for distribution. In the case of the RBA, unrealized foreign exchange gains are excluded from profit available for distribution.<sup>56</sup> Third, RBA directors and Treasury discuss a prudent allocation to RBA reserves and the dividend to government.

### **Shifting balance sheet risk and the exit strategy**

It is clear that the Fed's role in the money and broader financial markets has increased rapidly and enormously. The problems that may ensue with deep public sector, and in particular central bank, involvement in commercial banking systems were widely discussed in the early 1990s, with a focus both on the impact on credit misallocation and the direct fiscal risk.<sup>57</sup> Presuming that the Fed's intention is to revert back toward the situation before 2007, the design of an exit strategy must be contemplated.

As noted in Bernanke (2009), some of the Fed's recent interventions will be relatively easy to unwind—in a technical sense. Short duration operations will simply be allowed to expire and rising interest rates (given that the policy rate is at zero it is clear this is the future direction!) will act as a disincentive to continue to use the Fed as a counterparty. Longer term assets, with fragile market prices, may be more difficult to offload. But a question remains as to how the fed funds rate can be raised with excess reserves amounting to \$800 billion. In order to raise rates without draining this excess the Fed will need to exercise its new ability to raise the interest rate at which it remunerates reserves in combination with the gradual reduction in the size of the balance sheet. But this will imply a hit to the profit and loss account both on the interest expenditure side and mark-to-market losses on some of its longer duration assets that may remain “frozen” on the balance sheet such as the Maiden Lane SPVs and the TALF.

Many central banks have been saddled with the consequences of crisis intervention for decades. Having borne the initial financial burden of sterilization, they have yet to be fully compensated by their respective Treasuries. Even in circumstances where the integrity of the balance sheet is preserved and the central bank is capable of managing the fiscal risks, after years of managing their own interest bearing liabilities—often in securitized forms—the attention of the monetary authority becomes divided between domestic debt management and monetary operations. This frequently leads to domestic debt market bifurcation and conflict with treasuries who usually are responsible for sovereign debt management. Consequently it is important to prevent overlaps in responsibilities from becoming entrenched. As noted above, the FRB is clearly placing fiscal revenue at risk while the SFP has opened the door to the Treasury extending its monetary policy influence.

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<sup>56</sup> Many central banks with significant foreign exchange holdings which are not hedged against currency fluctuations make adjustments to their accounts to avoid paying unrealized foreign exchange gains to government as this is seen as economically equivalent to unrequited money creation.

<sup>57</sup> See Mackenzie and Stella (1996).

The occurrence of losses, even if immaterial to monetary policy, could easily raise the ire of Congress, particularly as transfers of nontax revenue to Treasury would be immediately reduced and Treasury might have to compensate individual FRB whose shareholders are private commercial banks. The outcome of a full debate about the financial structure of the Federal Reserve and the legal authorities invested in the FRB to undertake what could be construed as fiscal actions might jeopardize monetary policy independence. Managing this risk would appear a significant priority which the Fed and Treasury appear to be taking the preliminary steps to address with their joint statement of March 23, 2009.

Why is it important to clarify the roles of the Fed and Treasury, particularly when certain measures seem merely to shift risk from the Fed to the Treasury? Primarily to completely define their respective institutional roles in determining monetary and fiscal policy. Ideally, such a clarification would take place in the context of a broader clarification of the lead player in the task of preserving macrofinancial stability and an assignment of instruments to enable the attainment of that objective.

Second, it would place quasi-fiscal actions fully on the Treasury balance sheet, alleviating any concerns about the Fed's financial independence. As discussed below, such concerns at this time appear unfounded, however the structure of Fed and Treasury financial relations might benefit from a definitive review as they remain substantively unchanged since 1913.<sup>58</sup>

Third, transparency may be improved *or deteriorate* with a transfer of responsibilities to the Treasury. Central banks increasingly are adopting modern accounting methodologies and have extensive experience publishing detailed financial information, in some cases daily balance sheets. Treasury accounts are rarely accessible with granular detail with this rapidity. As discussed below the Fed might actually be better equipped, at this given moment, to provide financial information on its exposure to fiscal risk as well as to manage that risk. Consequently, however desirable it might be from an institutional perspective to shift particular operations to the Treasury balance sheet, Treasury must adequately prepare for the assumption of proper disclosure should responsibility be transferred.

Lastly, it may be that the optimal governance structure for the public body charged with preserving financial sector stability and intervening in stressed financial markets may correspond neither to that of the optimal monetary nor fiscal authority. Therefore an alternative governance structure could be contemplated, one combining political representation from Treasury with participation of independent agencies and/or third parties.

The global consensus that emerged over the past two decades stressing the benefits of independent monetary policy is worth preserving. But we would draw a distinction here between "monetary policy" and "central bank" independence. While the case for an independent monetary authority is clear, the case for central bank autonomy in the field of crisis intervention—when fiscal resources are placed at risk—is much less so. In light of contentious political debates over fiscal policy it is not evident that the political champions of

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<sup>58</sup> At the request of Congress, reviews were conducted by GAO (1996) and GAO (2002).



central bank independence intended to provide central banks “fiscal” independence.<sup>59</sup> Should political authorities find current central bank activism an affront to their legislative authority a backlash may ensue whereupon monetary policy independence is curtailed. For this reason, it may be wise to develop an alternative governance structure to handle the “banking” or, in the modern financial system, “market making” roles that had been assigned to central banks in legislation crafted when they were subject to fiscal authority.

The possibility to separate the balance sheet consequences of banking and monetary policy was foreshadowed in Section I. Until 2007, the FRB and its major central bank counterparts had managed quite successfully through operations of minimal size to steer short term interest rates to influence economic activity and inflation. Intervention in the crisis, however, required an immense balance sheet expansion and important changes in asset composition. This intervention quickly expanded to include not only conventional monetary operations counterparties but also more distant institutions—including investment banks and insurance companies—and more distant markets such as those for commercial paper and ABS.

Central banks have effectively placed their capital at risk to become market makers to the broader financial system. In this role they have attempted to replace the withdrawn capital of bankrupt or diminished market intermediaries, in order to curtail the widening of spreads. The theoretical basis for this approach is clear in Shleifer and Vishny (1997). In practice, however, it is not necessary for the intervention to take the form of money, that is, be conducted by the monetary authority. The private traders who are being replaced are not able to create central bank money. Therefore an entity with an ability to issue high quality securities—backed by government—could undertake this role.

The exact structure of the entity, which might be named the Market Liquidity Maintenance (MLM) corporation, would need to be spelled out. In concept, the MLM would be intended to be active in capital markets—as the founders expected the BoE and FRB to be in the money market. The capacity to quickly scale up activity, should market conditions dictate, is also important. While in normal times MLM would engage in a modest amount of activity, in a panic it would need to quickly scale up. Its capital structure should therefore allow for scalability—relatively small paid in capital with legislative pre-authorization to expand under certain conditions. The risks and profit from the MLM would be clearly on the fiscal accounts—avoiding potential conflict with monetary operations.

Alternatively, the functions of the MLM could reside in the Treasury or the Fed as long as a separate governance structure is created. That separate structure would need to have the authority to rapidly expand its balance sheet financed through the issuance of government-guaranteed debt. The speed with which the central bank can act is frequently posed as the reason for locating this power there. This emphasis on speed is perhaps no more colorfully put than by Bagehot quoting from the Governor of the BoE regarding the panic of 1866: “It was not unnatural that in this state of things a certain degree of alarm should have taken possession of the public mind, and that those who required accommodation from the bank

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<sup>59</sup> See Cukierman (2008) for further discussion of the development of the idea of central bank independence.

should have gone to the Chancellor of the Exchequer and request the Government to empower us to issue notes beyond the statutory amount, if we should think that such a measure was desirable. But we had to act before we could receive any such power, and before the Chancellor of the Exchequer was perhaps out of his bed we had advanced one-half of our reserves, which were certainly thus reduced to an amount which we could not witness without regret. But we could not flinch from the duty which we conceived was imposed upon us of supporting the banking community...” (*Lombard Street*, page 158).

The idea of assigning a different governance structure to different functional roles is new neither in the United States nor in other countries and might be considered an evolutionary rather than revolutionary change.

In the United States, the powers exercised under the Gold Reserve Act of 1934 to manage the U.S. foreign reserves are shared by the U.S. Treasury and the Federal Reserve.<sup>60</sup> Monetary policy authority is also shared between two governance structures. The FOMC determines the policy rate and directs open market operations while the Board of Governors has the authority to set required reserves and authorize changes in the discount rate. Authority granted the Fed under the FRA under section 13.3 is further refined: “in unusual and exigent circumstances” to provide discounts to individuals, partnerships and corporations, requires “...the affirmative vote of not less than five [out of seven] Board members....”<sup>61</sup> Similarly, the European System of Central Banks, Argentina, Chile, Costa Rica, Korea and the Philippines require a super majority vote to authorize extraordinary or emergency central bank operations.

In Japan, BoJ emergency lending must be approved by the Prime Minister and the Minister of Finance. In Thailand, both the Bank of Thailand Financial Institutions Policy Board and the Cabinet must approve emergency lending. Such operations must be approved in Jordan by both the central bank board and the Council of Ministers. In both Korea and the Philippines, the Monetary Policy Board, not the general board, holds power in an emergency.

#### IV. REFLECTIONS

The degree to which the Federal Reserve has explicitly intervened in the U.S. money and capital markets is historically unprecedented. The dramatic role reversal of the Fed’s balance sheet from supporting average daily transactions of \$25 billion in the fed funds market to the central linchpin and key to global financial market stability has raised concerns about its ability to exit once normality returns; the risk to its balance sheet and potential financial and operational independence. The contrast of the flexible and rapid response of the Fed and the more complex response of the U.S. Treasury has also raised more fundamental issues as to

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<sup>60</sup> See Broaddus and Goodfriend (1996).

<sup>61</sup> The FOMC consists of all 7 Board members, the President of the FRBNY and 4 Reserve Bank presidents alternating among the remaining 11 FRBs.

the appropriate roles of monetary and fiscal policy, Congressional oversight and institutional independence.

One aim of this paper has been to bring some clarity to the size of the FRB intervention and quantify both the risks being borne and its ability to cope with potential losses. While the risks are material, the Fed's ability to independently cope with potential losses is ample. While other central banks have abandoned policies owing to actual and prospective losses, there would seem little possibility that the FRB would be compelled to change course for similar reasons. Effective communication of this message could enhance the credibility of current FRB interventions and quell speculation that it may not be willing to respond aggressively to an incipient rise in inflationary expectations owing to balance sheet concerns.

The strength of the FRB balance sheet coming into the crisis, the risk control measures that have been employed to date and a cooperative relationship with the Treasury have ensured that the risks taken by the innovative liquidity management operations are well contained. That does not imply, however, that enhanced risk management measures cannot be taken.

First, a risk-adjusted level of equity could be agreed with Treasury and nontax revenue transfers adjusted to allow a closer correspondence of reserves and likely recourse to them. This process is in place in other central banks, for example, the RBA. Determining the level of transfers only following the publication of the audited financial statements might also be considered. This is best practice among central banks.

Second, loan loss reserves could be established to cope with expected losses. Determination of the appropriate level of loan loss reserves would not require revelation of details behind the loan-by-loan loss estimates.<sup>62</sup> Setting aside provisions for expected losses would have the impact of reducing profit, and the transfer to the Treasury, during financial downturns while increasing them in cyclical upturns. Not taking adequate provisions overstates income during the period of asset growth and understates it when losses are recognized.

Third, risks can be shifted directly to the Treasury balance sheet. Treasury deposits could be used to purchase the riskier assets from the FRB balance sheet thereby lessening the need for explicit capital. Most rapidly, the Treasury could purchase (e.g., with its deposits at the Fed), the Maiden Lane LLCs and a portfolio of other loans. Furthermore, enabling the Treasury to take future programs on to its balance sheet would help clarify the institutional roles of the FRB and Treasury. These measures could be carried out over the course of several years but an explicit end point might assist in avoiding the perpetuation of a situation which has caused difficulties for a number of central banks around the globe.

Last, consideration needs to be given to the future structure of U.S. financial regulation and who should execute the role(s) of financial market macroeconomic prudential supervision and capital market crisis intervention. It has been argued here that it is important to maintain the independence of monetary policy and to recognize that policy intervention in a systemic

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<sup>62</sup> See Enoch, Khamis and Stella (1997) for a discussion of the difference in ex-ante and ex-post transparency.

crisis inevitably has fiscal dimensions. The scope of that fiscal dimension is properly influenced by the legislature and executive powers of government. Thus mechanisms should be sought to isolate capital market policy interventions from monetary policy.

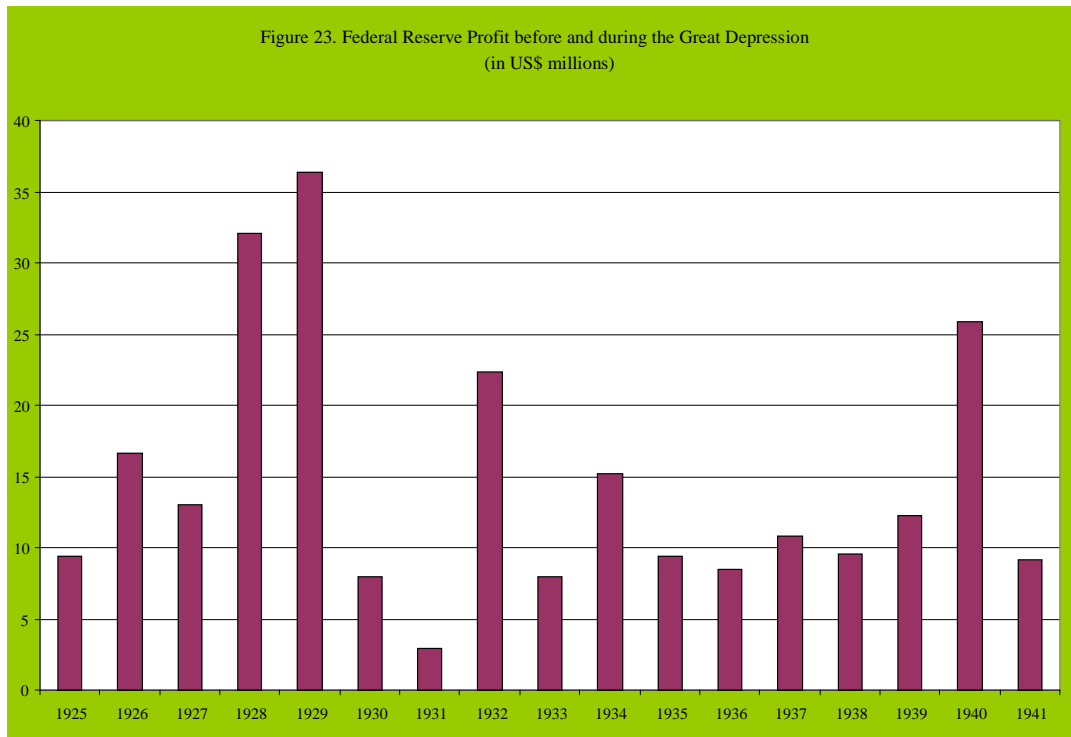
Central banks in many different countries have quickly taken a leading role in stemming financial crises, with varying degrees of success. Exit from this role has rarely been easy and the damage to the balance sheet and/or central bank institutional reputation in some cases has taken decades to fully repair. It may be, however, that the strength of the Fed balance sheet entering the crisis and the unique closeness of the relationship between the U.S. central bank and Treasury could make implementation of an exit strategy easier than what has been observed in some other countries. However, even if that is true, the conventional model of central bank independence may need to be revisited.

In the case of the United States, such a revisitation might lead to adjustments in FRB governance structure and changes to their financial model, for example, the aggregation of all monetary policy power under the FOMC (or alternative structure) executed through a small balance sheet isolated from credit risk; and the establishment of a financial market stability entity with market intervention capacity under a separate governance body with a modest but scaleable balance sheet—absent the power to create money. The careful design of such an entity, its governance structure and particularly how it would work within a revised supervisory and regulatory framework represent one among many challenges that await the designers of the new financial architecture to emerge after the crisis.

## Appendix I. Fed Balance Sheet and Earnings Before and During the Great Depression

It is legitimate to question whether 2003-2008 provides an accurate benchmark for future FRB seignorage and whether banknote growth and profits would continue in a very adverse environment such as is projected in Section III. In pondering this question a review of the FRB financial situation preceding and during the Great Depression may be illuminating.<sup>63</sup> As noted above, the current situation and its likely evolution is several orders of magnitude more mild than the Great Depression. For example, in the US, *nominal* GDP fell by 46 percent between 1929 and 1933 and did not return to the 1929 level until 1941. There is no reasonable expectation that this is a suitable stress test for the current turmoil.

Perhaps surprisingly, the FRB made profits every year during the Great Depression although it should be noted that its “return on equity” was much lower than in more recent years. The profile of profit is shown in Figure 23. Profit did fall in 1930 and 1931 but rebounded to steady levels thereafter.

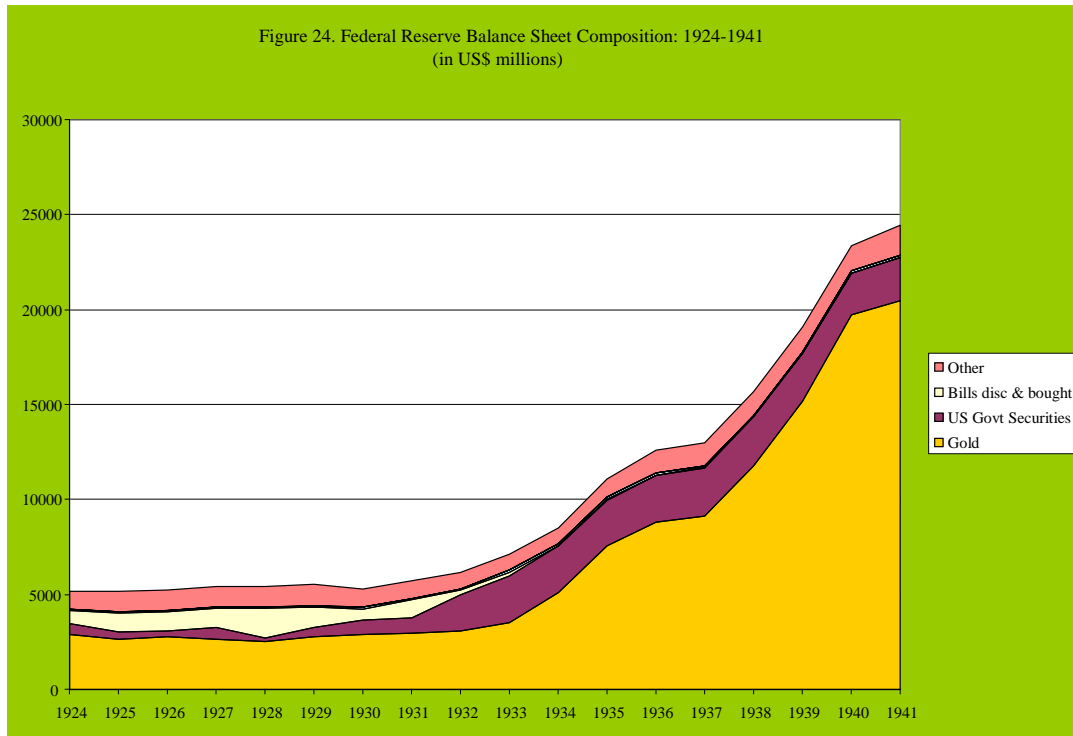


Source: *Banking and Monetary Statistics 1914-41*, Board of Governors of the Federal Reserve.

How is it possible that despite extensive financial turmoil and bank failures the FRB managed a profit? The answer would appear rather straightforward—it took almost no risk on to the balance sheet. Not only were the FRB slow to expand the balance sheet (the obverse of being slow to expand the monetary base), after 1929 there was a sharp reduction in bills

<sup>63</sup> Friedman and Schwartz (1963), among others, have thoroughly examined the Fed’s role in the Great Depression.

and notes discounted and purchased. The evolution of the components of the balance sheet can be seen in Figure 24. After the passage of the Glass-Steagall Act relaxing the constraints on the ability of the FRB to purchase government debt, the volume of commercial bills and notes discounted and purchased dwindled to virtually zero.<sup>64</sup>

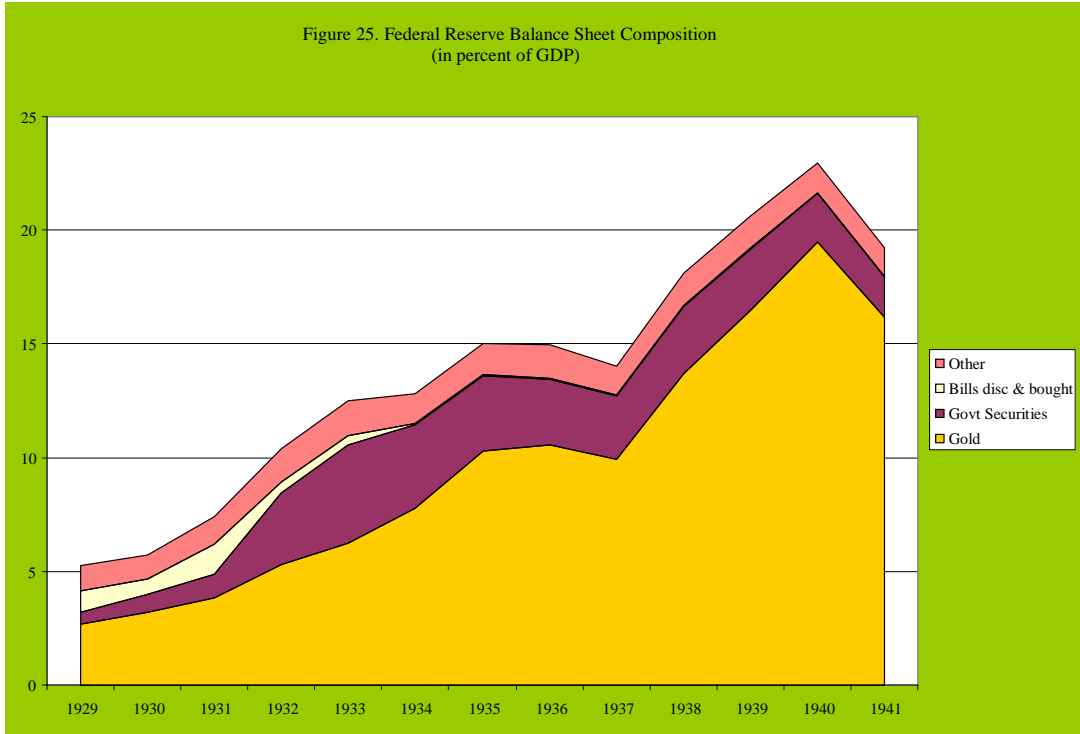


Source: *Banking and Monetary Statistics 1914-41*, Board of Governors of the Federal Reserve.

As is evident in Figure 25, almost the entire driving factor behind the expansion of the Fed's balance sheet was an accumulation of gold.<sup>65</sup>

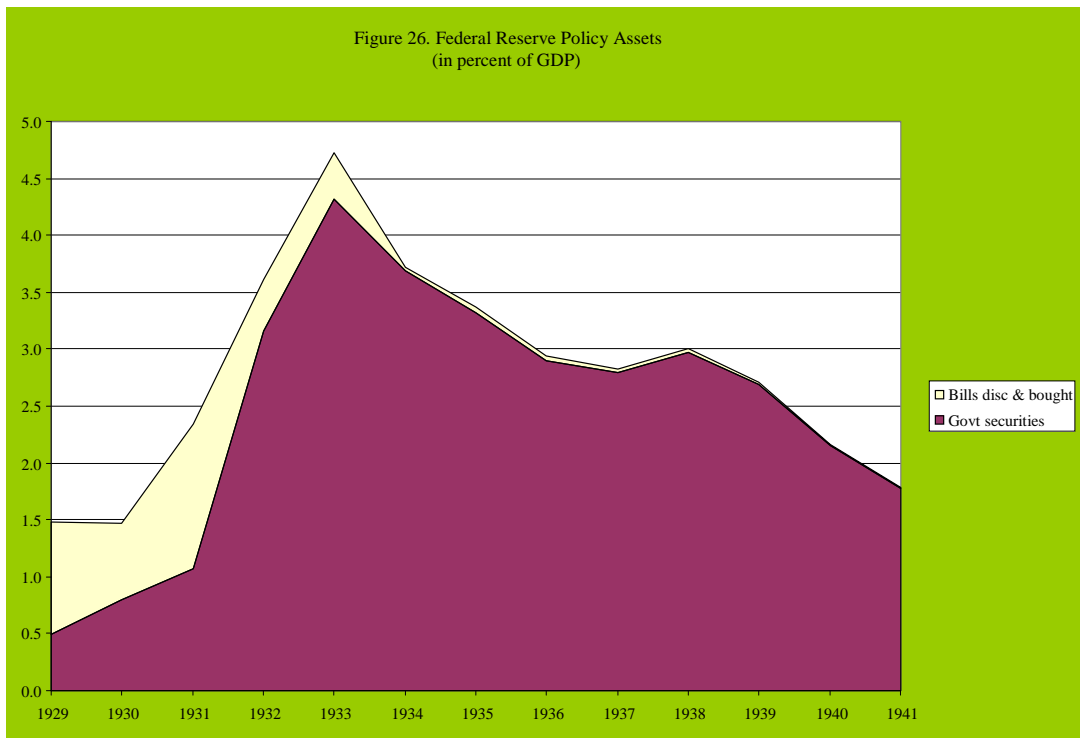
<sup>64</sup> Figure 24 also includes "industrial loans" but the volume of these loans was zero before 1934 and not significant enough thereafter to influence the total enough to make it visible in the Figure.

<sup>65</sup> The official price of gold was changed from \$20.67 per ounce to \$35 per ounce in January 1934. In 1934 U.S. citizens were prohibited from buying, selling or holding gold.



Source: *Banking and Monetary Statistics 1914-41*, Board of Governors of the Federal Reserve.

Removing the passive accumulation of gold (required by the rules of the gold standard), the dominance of U.S. government securities accumulation by the Fed can be seen in Figure 26.



Source: *Banking and Monetary Statistics 1914-41*, Board of Governors of the Federal Reserve.

Compared with its posture during the Great Depression, the Fed today is taking considerably more risk and the scope for possible profit and loss outcomes is much greater. Among the scenarios considered in section III, the Fed would realize both its most profitable and least profitable years in history—in succession—owing first to higher returns on an expanded lending portfolio and then considerable losses as a consequence of a hypothesized deterioration in that same portfolio.



**Appendix II Federal Capital Policy from U.S. Code****§ 209.4 Amounts and payments**

(a) *Amount of subscription.* The total subscription of a member bank (other than a mutual savings bank) shall equal six percent of its capital and surplus. Whenever any member bank (other than a mutual savings bank) experiences a cumulative increase or decrease in capital and surplus requiring a change in excess of the lesser of 15 percent or 100 shares of its Reserve Bank capital stock, it shall file with the appropriate Reserve Bank an application for issue or cancellation of Reserve Bank capital stock in order to adjust its Reserve Bank capital stock subscription to equal six percent of the member bank's capital and surplus. Such application shall be filed promptly after the first report of condition that reflects the increase or decrease occasioning the adjustment. In addition, every member bank shall file an application for issue or cancellation of Reserve Bank capital stock if needed in order to adjust its Reserve Bank capital stock subscription to equal six percent of the member bank's capital and surplus as shown on its report of condition as of December 31 of each year promptly after filing such report.

**Appendix III Common Assumptions of the Scenarios in Section III**  
(in percent)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Macroeconomic</b>											
Real Growth	-2	1	2	2	2	3	3	3	3	3	3
Inflation	0.5	2	3	2	2	2	2	2	2	2	2
<b>Effective interest rate</b>											
Sterilization instruments	0.5	5	5	4	4	4	4	4	4	4	4
Treasuries/Agencies	3	4	3	3	3	3	3	3	3	3	3
CPFF	0.5	5	5	4	4	4	4	4	4	4	4
AIG Loan	3	0	0	0	0	0	4	4	4	4	4
TALF	2	0	0	0	7.5	7.5	7.5	7.5	4	4	4
TAF/Primary	0.5	0.5	3	3	3	3	3	3	3	3	3
Maiden Lane LLC	-5	0	0	0	0	7.5	7.5	4	4	4	4

## Notes:

1. Assuming a 4 percent yield on an asset is equivalent (in the profit/loss sense) to removing it from the balance sheet as it is financed on the margin by sterilization instruments paying an equivalent yield. This interpretation means that in Scenario 1 the AIG loan exits the balance sheet in 2015, the Maiden Lane SPVs in 2016 and the TALF in 2017.
2. The 2 percent effective yield on TALF in 2009 arises from an assumed 5 percent yield and an average exposure of \$400 billion during the year.
3. Returns on assets of 7.5 percent reflect partial recovery of asset values—beyond the depressed 2010 levels—prior to asset disposals according to the timetable stated in note 1.

## REFERENCES

- Adrian, Tobias, and Hyun Song Shin, 2008a, “Financial Intermediary Leverage and Value-at-Risk” *Federal Reserve Bank of New York Staff Reports* # 338, Revised August 2008.
- Adrian, Tobias, and Hyun Song Shin, 2008b, “Liquidity and Leverage” *Federal Reserve Bank of New York Staff Reports* # 328, May 2008, revised January 2009.
- Bagehot, Walter, 1873, *Lombard Street: A Description of the Money Market* (London: H. S. King & Co). Fourteenth edition May 1915.
- Bernanke, Ben S., 2009, “Federal Reserve Policies to Ease Credit and Their Implications for the Fed’s Balance Sheet”, National Press Club Luncheon, Washington, D.C. February.
- Bindseil, Ulrich, 2005, *Monetary Policy Implementation: Theory, Past, and Present* (Oxford University Press).
- Borio, Claudio and William Nelson, 2008, “Monetary operations and the financial turmoil”, *BIS Quarterly Review*, March.
- Broadus, J. Alfred Jr., and Marvin Goodfriend, 1996, “Foreign Exchange Operations and the Federal Reserve,” *Federal Reserve Bank of Richmond Economic Quarterly*, Volume 82, No.1 (Winter).
- Business Week Online*, 2003, “Is the Bank of Japan Barreling toward a Bailout?”(February 3). [http://www.businessweek.com/magazine/content/03\\_05/b3818169.htm](http://www.businessweek.com/magazine/content/03_05/b3818169.htm)
- Cargill, Thomas F., 2005, “Is the Bank of Japan’s Financial Structure an Obstacle to Policy,” IMF Staff Papers, volume 52 number 2 (Washington: International Monetary Fund).
- Chailloux, Alexandre, Simon Gray, Ulrich Klueh, Seiichi Shimizu, and Peter Stella, 2008, “Central Bank Response to the 2007-08 Financial Market Turbulence: Experiences and Lessons Drawn”, IMF Working Paper 08/210 (Washington: International Monetary Fund).
- Chailloux, Alexandre, Simon Gray, and Rebecca McCaughrin (2008) “Central Bank Collateral Frameworks: Principles and Policies.” IMF Working Paper 08/222 (Washington: International Monetary Fund).
- Cukierman, Alex, 2008, “Central bank independence and monetary policymaking institutions—Past, present and future” *European Journal of Political Economy*, December.
- Curry, Timothy and Lynn Shibus, 2000, “The Cost of the Savings and Loan Crisis: Truth and Consequences,” *FDIC Banking Review*.

- Enoch, Charles, May Khamis, and Peter Stella, 1997, “Transparency and Ambiguity in Central Bank Safety Net Operations”, IMF Working Paper 97/138 (Washington: International Monetary Fund).
- Federal Reserve Bank of New York, 2009. “Domestic Open Market Operations During 2008” [www.newyorkfed.org](http://www.newyorkfed.org) (January).
- , 2008. “Domestic Open Market Operations During 2007. [www.newyorkfed.org](http://www.newyorkfed.org)
- Federal Reserve Banks, 2009, Combined Financial Statements, 2007–2008. <http://www.newyorkfed.org/aboutthefed/annual/annual08/MaidenLanefinstmt2009.pdf>
- Federal Reserve Board (1914). First Annual Report of the Federal Reserve Board (Washington).
- Friedman, Benjamin. *The Future of Monetary Policy: The Central Bank as an Army With Only a Signal Corps* NBER Working Paper 7420, November 1999.
- Friedman, Milton and Anna Schwartz, 1963, *A Monetary History of the United States 1867-1960*, Princeton University Press.
- Goodfriend, Marvin, 1994, “Why We Need an ‘Accord’ for Federal Reserve Credit Policy: A Note,” *Journal of Money, Credit and Banking*, Vol. 26, No. 3, pp. 572–80.
- JP Morgan, 2002, *Japan Markets Outlook and Strategy*, (January 24).
- Keister, Todd, Antoine Martin, and James McAndrews, 2008, “Divorcing Money from Monetary Policy” Federal Reserve Bank of New York Economic Policy Review September. [www.newyorkfed.org/research/epr/08v14n2/0809 keis.pdf](http://www.newyorkfed.org/research/epr/08v14n2/0809_keis.pdf) .
- MacKenzie, George A. (Sandy), and Peter Stella, 1996, “Quasi-Fiscal Operations of Public Financial Institutions,” IMF Occasional Paper No. 142 (Washington: International Monetary Fund).
- Meltzer, Allan H., 2003, *A History of the Federal Reserve, Volume 1: 1913-1951*, University of Chicago Press.
- Restrepo, Jorge, Salomó, Luis and Rodrigo Valdés, 2009, “Macroeconomía, Política Monetaria y Patrimonio del Banco Central de Chile”, *Economía Chilena*, Volumen 12, Numero 1, Abril.
- Shleifer, Andrei and Robert Vishny, 1997, “The Limits of Arbitrage,” *Journal of Finance*, March.

- Sims, Christopher A., 2003a, “Fiscal Aspects of Central Bank Independence,” (mimeo; Princeton, New Jersey: Princeton University) (February 15).
- , 2003b, “Limits to Inflation Targeting” (mimeo; Princeton, New Jersey: Princeton University) (March 17).
- Stella, Peter, 1997, “Do Central Banks Need Capital?” IMF Working Paper 97/83 (Washington: International Monetary Fund).
- , 2005, “Central Bank Financial Strength, Transparency, and Policy Credibility,” IMF Staff Papers, volume 52 number 2 (Washington: International Monetary Fund).
- , 2008, “Central Bank Financial Strength, Policy Constraints and Inflation,” IMF Working Paper 08/49 (Washington: International Monetary Fund).
- Stella, Peter and Ake Lonnberg, 2008, “Issues in Central Bank Finance and Independence”, IMF Working Paper 08/37 (Washington: International Monetary Fund).
- Taylor, John, 2009, “The Need to Return to a Monetary Framework.”
- U.S. General Accounting Office, 2002, *Federal Reserve System: The Surplus Account* (Washington). Available via Internet: [www.gao.gov/cgi-bin/getrpt?GAO-02-939](http://www.gao.gov/cgi-bin/getrpt?GAO-02-939)
- , 1996, *Federal Reserve System: Current and Future Challenges Require Systemwide Attention* (Washington).
- U.S. Treasury and Federal Reserve, 2009, “Foreign Exchange Operations (October–December 2008).”