

# Notes on Issues Related to the Zero Lower Bound on Nominal Interest Rates

December 12, 2008\*

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December 5, 2008

## 1. Summary

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### Background

Over the past 16 months, the Committee has cut the federal funds rate somewhat more aggressively than estimated policy rules would have suggested. Even so, economic activity in the United States has slowed sharply in recent months. Moreover, Board staff and many private-sector forecasters now project a sizable decline in real GDP during the current quarter and in the first half 2009, followed by a period of sub-par growth with unemployment rising to or beyond 8 percent, despite substantial fiscal stimulus and a federal funds rate close to zero next year. One reason forecasters expect a protracted period of sluggish performance is that many think that conventional monetary policy will be constrained by the zero lower bound (ZLB) on nominal interest rates and so will be unable to provide enough stimulus to generate a robust recovery, perhaps for a protracted period.

The optimal-control policy simulations presented in the October Bluebook illustrate the problem. Those simulations (which took the October Greenbook forecast as their starting point) showed the funds rate dropping to zero in the near term and remaining there into 2012. Unconstrained optimal control simulations would have called for the nominal funds rate to go as much as 3 percentage points below zero for a time; our inability to make the funds rate negative means higher-than-desired unemployment and lower-than-desired inflation for several years. The consequences of recent economic and financial developments for the economic outlook have made the projected shortfall in monetary stimulus even larger.

Moreover, confidence bands around the staff forecast and optimal control simulations suggest a sizable probability of a deep and prolonged economic slump that could result in deflation. Board staff is not alone in seeing a significant risk of such a dire outcome; many private-sector forecasters think the United States faces some risk of a severe downturn and deflation, though such an outcome is not the modal forecast. And, as discussed in Note 14 in the attached package, some survey measures not only indicate that respondents expect the price level to fall in the near term as energy prices decline but also suggest that the perceived risk of longer-term deflation has increased.

Given the risk of a prolonged recession and deflation, the agenda for the December FOMC meeting includes a discussion of issues related to the zero lower bound. As background for that discussion, Board and Reserve Bank staff prepared 21 short notes that summarize current knowledge and thinking about the benefits and costs of pushing the funds rate to zero and about the potential efficacy of a variety of unconventional monetary policy tools, including quantitative easing (defined as a very

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<sup>1</sup> Madigan and Meyer: Division of Monetary Affairs; Reifschneider: Division of Research and Statistics.

large expansion of excess reserves generated by conventional open market operations), targeted purchases of specific securities such as long-term Treasuries or agency debt and MBS, targeted lending, and communication strategies. The remainder of this note provides a high-level overview of that work, focusing on key issues that may be relevant for the discussion of which, if any, unconventional tools the Committee might want to implement or use more heavily.

The Committee last confronted ZLB issues in 2003. Having reduced the federal funds rate to 1 percent by mid-year, and judging that the risk of inflation falling below levels consistent with the dual mandate to promote maximum employment and price stability was its predominant concern, in August of 2003 the Committee communicated its intent to keep the federal funds rate at 1 percent “for a considerable period.” In 2004, as disinflationary forces appeared to diminish, the Committee first stated that it would “be patient in removing its policy accommodation” and later said it believed that policy accommodation could be “removed at a pace that is likely to be measured.” The Committee did not pursue other unconventional policies. As discussed in Note 2, FOMC communications during that period appear to have been reasonably successful in aligning the policy expectations of financial market participants with those of the FOMC itself, although some analysts argue that the Committee’s communications did not sufficiently emphasize the conditionality of its commitment to a policy path.

The current economic and financial environment differs in several key respects from the situation in 2003. First, the economy now appears to be contracting markedly, whereas a severe contraction did not appear likely in 2003. Second, the effective federal funds rate is closer to zero now. Third, the U.S. financial sector is under far greater stress now, increasing the downside risks to the economy. Fourth, the Federal Reserve already has begun to pursue nonstandard policies by creating new liquidity-providing facilities and extending credit on a much larger scale than earlier.

### **Summary of issues**

The zero lower bound raises complicated questions for monetary policy. Many of those questions have been investigated in the voluminous research literature on the topic and in the accompanying notes. A number of key points relevant to the current situation can be drawn from that work.

*Research supports accelerating rather than delaying reductions in the funds rate whenever economic activity becomes so weak that, under conventional monetary policy, the risk of hitting the zero lower bound in coming quarters becomes material.<sup>2</sup>* The logic behind this strategy is that driving the funds rate quickly to zero at such times provides more up-front stimulus to real activity, thereby limiting the future fall in inflation that

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<sup>2</sup> Reifschneider and Williams presented evidence on this point to the FOMC in January 2003. They considered two different policy rules—the standard Taylor rule, and a modified Taylor rule that, whenever the standard rule prescribed cutting the funds rate to 1 percent or less, immediately dropped the funds rate to zero. Based on stochastic simulations of the FRB/US model, they found that the modified rule delivered superior macroeconomic performance.

would occur otherwise. As a result, real short-term interest rates will be lower, when nominal rates are at the zero lower bound, than they would have been if policymakers had delayed cutting the nominal funds rate; lower real rates, in turn, help mitigate the weakness in real activity. This motivation for accelerated rate cuts is relevant even if current problems in financial markets diminish the stimulus from further reductions in the funds rate. As Note 13 indicates, large shares of consumer and business loans carry floating interest rates linked directly or indirectly to money market rates; interest rates on these loans likely would decline if the funds rate target were cut to zero (though perhaps not one-for-one), providing some impetus to consumer spending and business investment.

*Reducing the federal funds rate to zero or nearly zero likely would degrade the functioning of certain financial markets and cause difficulties for some money market mutual funds. On the other hand, it appears that cutting the funds rate further would benefit banking institutions on average. All told, the potential costs to financial markets and institutions do not appear large enough to militate against reducing the funds rate to a very low but still positive level, say 25 basis points. As discussed in Note 11, reducing the funds rate to zero (or nearly zero) would leave T-bill yields and the Treasury general collateral repo rate at or near zero, likely generating a substantial increase in fails-to-deliver in the Treasury and Treasury repo markets.<sup>3</sup> Persistently high fails would result in increased counterparty credit exposures, reduced liquidity, and increased volatility in the Treasury markets, making it more difficult for investors to use the Treasury markets to hedge the interest rate risk associated with positions in other fixed-income securities and reducing their willingness to take such positions. Note 9 indicates that near-zero yields on short-term Treasuries and Treasury repos would also have adverse consequences for Treasury-only and Treasury-repo money market funds. The number and size of such money market funds likely would shrink as a result, potentially reducing the availability of repo financing. In contrast, few prime money market funds would face difficulty in covering their costs while paying positive returns to their shareholders unless currently wide spreads between yields on the assets held by such funds and Treasury yields were to narrow dramatically. Note 12 indicates that trading volumes in some short-term funding markets might decline appreciably, causing traders with specialized human capital to exit those markets—a development that could create problems once the economy began to recover. However, as discussed in Note 4, Japanese experience suggests that trading in such markets rises fairly quickly once short-term rates rise above zero, although in Japan volumes have not returned to earlier levels. Econometric estimates in Note 10 suggest that cutting the funds rate toward zero potentially would increase the price of financial institutions' equity shares as it provides some macroeconomic stimulus; such estimates also suggest that FOMC communications that reduce expected future levels of the funds rate also would have a positive effect on banking institutions. On balance, the macroeconomic consequences of any disruption to*

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<sup>3</sup> Market participants have identified relatively straightforward changes in institutional arrangements and trading practices in the Treasury and Treasury repo markets that would prevent or mitigate a substantial increase in fails, but these changes are unlikely to be implemented before mid-2009, and perhaps not until 2010, because they require coordinated changes in complex back-office systems. Alternatively, problems associated with high fails could be avoided if the Treasury were to receive statutory authority to create and lend new Treasury securities.

market functioning seem likely to be modest. Moreover, some of the disruption to financial markets could be mitigated by changes to market practice. Nevertheless, the likelihood of some market disruption means that the net benefit of pushing the effective federal funds rate all the way down to zero is open to question—although staff analysis suggests that cutting it to 25 basis points would not be unreasonable.

*Research suggests that central bank communications can help stimulate economic activity further once short-term interest rates have fallen to their lower limit.* As discussed in Note 20, articulating a firm long-run objective for inflation, if deemed credible by the public, can help stop inflation expectations from drifting down while the economy is in a protracted slump with monetary policy unable to provide further stimulus through additional rate cuts. Beyond this, central bank pledges to keep short-term rates at or near zero for some time can promote an earlier and more vigorous recovery once short-term rates are driven to the zero lower bound, because such communications can increase agents' valuations of longer-term assets and improve their expectations about future economic activity and prices, leading to higher current consumption, investment, and prices than would otherwise be observed. Of course, the efficacy of this approach rests on the credibility of the central bank's promises; economic agents may not find such promises entirely credible partly because they recognize that discretionary policymakers may have an incentive to renege on their promises once the economy starts to recover. However, as discussed in Notes 2, 5, and 20, the historical experience of the United States, Japan, and Sweden suggests that central bank communications can be effective in reducing medium- and long-term interest rates and stabilizing inflation expectations. The credibility of central bank statements that monetary policy will remain accommodative for an extended period might be enhanced if the central bank also were to announce that it is implementing other unconventional policy tools.

*Unconventional policy tools offer a way to provide additional stimulus when further cuts in the funds rate are not possible.* Along these lines, the Committee might consider several options. As discussed in Note 18, one possibility is to expand ongoing efforts to support credit extension by increasing the scale and scope of the Federal Reserve's targeted liquidity-providing facilities. Another possibility is to engage in quantitative easing by greatly expanding the volume of excess reserves via purchases of conventional SOMA assets (Note 15). The Japanese experience suggests this approach may not provide much macroeconomic stimulus when the banking system and potential borrowers have weak balance sheets (Note 6). The Committee might instead choose a targeted approach by instructing the Desk to purchase a large volume of long-term Treasury debt (Note 16), or to expand the purchases of agency debt and MBS that have already been announced (Note 17), with the objectives of reducing term spreads and credit spreads. Note 19 suggests a way to use discount window facilities and the Federal Reserve's authority to pay interest on reserve balances to control 3-month interbank rates rather than the overnight rate. In principle, the ability to pay interest on reserve balances should allow the Federal Reserve to expand further its credit-granting facilities or its asset purchases while targeting a positive funds rate. In practice, however, the Committee may find it difficult to engage in unconventional policy actions that expand

its balance sheet, without pushing the effective funds rate toward zero, even if it pays interest on reserves (Note 12).

*In theory, unconventional policy tools will provide additional economic stimulus by increasing the availability of credit and reducing borrowing rates. Unfortunately these tools have not been used to any great extent here or abroad, so we have little practical experience from which to judge their effectiveness. Limited experience with these tools implies marked difficulties in calibrating their appropriate usage.* Note 21 presents simulations of various strategies for stimulating the economy when the funds rate is stuck at zero. These results suggest that unconventional tools may have a sizable stimulative effect, particularly if they are used in combination with expansionary fiscal policy and communication strategies intended to influence expectations about the future stance of monetary policy. The evidence from one of the few implementations of unconventional monetary tools—the Bank of Japan’s zero interest rate and quantitative easing policies, discussed in Notes 3 through 8—suggests their effects were modest, but the Bank of Japan did not employ these tools aggressively.

*While unconventional tools offer potential benefits, they are not without costs.* All of the nonstandard tools except communicating future policy intentions would entail a further expansion of the Federal Reserve’s balance sheet and of bank reserve deposits. A sizable further expansion of Federal Reserve lending to financial institutions and nonfinancial borrowers would expose the Federal Reserve to additional credit risk. Large purchases of long-term securities would expose the Federal Reserve to risk of capital losses as the economy recovers and long-term interest rates rise. Moreover, some of these tools may be seen as appropriate in the midst of deleveraging, financial stress, and increasing slack in the economy, but not as the economy recovers. It follows that exit strategies are important. Policymakers will need to be prepared, for example, to raise the price of Federal Reserve credit and to reduce the amounts being auctioned as markets return toward more normal functioning and the economy begins to recover so that the Fed becomes a relatively less attractive source of funds as the need for unconventional policies diminishes. Similarly, the FOMC might choose to reduce SOMA holdings of long-term Treasury securities, agency debt, and MBS as financial markets recover. Some unconventional tools blur the line between providing liquidity and allocating credit. Providing central bank credit to particular sectors may be essential when the sectors’ usual sources of funding shut down, but providing central bank credit at a subsidized rate could slow price discovery and adjustment to a new equilibrium in asset markets. Communication strategies have their own problems. In principle, any communication about the future path of monetary policy should be conditioned on future outcomes. In practice, it is not easy to make statements about future policy and its dependence on the evolution of financial markets and the overall economy that are both clear and complete.

December 5, 2008

## **2. Federal Reserve Experiences with Very Low Interest Rates: Lessons Learned**

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### **Executive Summary**

This memo reviews three episodes in which the Federal Reserve was operating in an environment of very low interest rates. One common thread is that all three episodes demonstrate the importance of communications about future policies as a means of managing expectations about future interest rates and inflation.

The 1930s were characterized by a long period of short-term nominal interest rates close to zero. Nevertheless, there is evidence that the monetary authority could still influence the real economy. Recent evidence suggests that communication regarding future policy is important for understanding the recovery in 1933, the decline in output in 1937, and the renewed recovery in 1938. This episode also underscores the value of supporting communication through other concrete policies.

Between early 1942 and 1951, the Federal Reserve and the Treasury agreed to cap yields on long-term bond yields and peg the rate on short-term Treasury bills. Maintaining the peg on short-term rates eventually required the Federal Reserve to purchase most of the bills issued by the Treasury, but the firm short-term peg resulted in longer-term Treasury rates remaining below the cap. Even after short-term rates were allowed to rise, the Federal Reserve was able to maintain the cap on the long-term bonds without any apparent decoupling of private long-term rates.

In early 2003, the FOMC cut the funds rate target to 1 percent. The Committee was reluctant to cut the rate even more and instead tried to stimulate spending by adding forward-looking comments about policy intentions. This guidance appears to have been successful in lowering expectations of future short-term interest rates and reducing downward risks to inflation expectations. The FOMC conditioned its guidance on a weak outlook for inflation and the economy. Initially, this conditionality appears to have been understood by market participants. But evidence suggests that markets paid less and less attention to the conditions for continued policy accommodation during the “measured pace” tightening cycle. This development may suggest that, if such a situation were to occur in the future, policymakers may have to communicate the conditionality of their policy intentions with greater emphasis.

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<sup>1</sup> Carlson and Mertens: Division of Monetary Affairs. Eggertsson: Federal Reserve Bank of New York.



## Monetary Policy during the Great Depression

The 1930s were characterized by a long period of short-term nominal interest rates close to zero, as seen in Exhibit 1. Even if the current short-term nominal interest rate cannot be reduced below zero, the Federal Reserve can lower expectations regarding future short rates, which in turn can reduce long-term yields and increase inflation expectations, thus leading to lower short and long-term *real* interest rates and stimulating demand. Evidence suggests that shifts in monetary policy communication, as well as policy actions taken that confirmed the credibility of that communication, contributed importantly to three abrupt changes in the macroeconomic outlook during the 1930s: the onset of recovery in March 1933, the downturn during 1937, and the renewed recovery in 1938.<sup>2</sup> This period also suggests that policies that expand government credit may be helpful in reinforcing policy communication.

### The Recovery in 1933-37: Great Expectations

A central element of the New Deal, and of many policies announced in the spring of 1933, was the overarching goal of the Administration to “raise prices,” commonly referred to at the time as “reflation.” During the contractionary phase of the Great Depression, prices fell at a rate of 8-10 percent per annum. This meant that the real rate of interest was exceedingly high – over 10 percent at times, as can be seen in Exhibit 1.<sup>3</sup>

A large shift in expectations occurred during the spring of 1933 when FDR made several announcements that the overriding goal of the Administration was to increase the price level to pre-depression levels. The reference price level was kept deliberately vague but was commonly understood to refer to the 1926 price level. To add credibility to the Administration’s reflation goal, Congress passed into law a set of policies requiring close coordination of fiscal and monetary policy, including effectively eliminating the gold standard and the announcement of relatively broad increases in government spending.<sup>4</sup> Moreover, the National Industrial Recovery Act included several provisions aimed directly at increasing prices.<sup>5</sup>

Although the money stock was unchanged in the spring of 1933, there was a sharp turning point in industrial production and whole sales prices (see the lower panel of Exhibit 1). Furthermore, commodity prices skyrocketed in FDR’s first 100 days, the stock market increased by 55 percent, and investment rebounded. More broadly, after a

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<sup>2</sup> This section draws heavily on recent papers by Christiano, Motto, and Rostagno (2004), Eggertsson (2006, 2008), and Eggertsson and Pugsley (2006).

<sup>3</sup> Eggertsson (2008) also documents several measures of ex ante real rates that show the same pattern.

<sup>4</sup> Dropping the gold standard removed gold-related restrictions on increasing the money supply.

<sup>5</sup> When FDR took office in 1933, monetary policy was essentially made subservient to his goals. Shortly following FDR’s inauguration in March 1933, Congress passed a law authorizing the president to reduce the gold value of the dollar and issue \$3 billion in currency—an amount corresponding to 30 percent of the monetary base. While these provisions were only “authorizations” rather than requiring actions, they effectively ended the independence of the Federal Reserve for the time being. FDR used this power to go off the gold standard and state his goal to increase the price level.

30 percent output collapse from 1929-33, output expanded by 39 percent in 1933-37, the highest 4-year growth rate in U.S. economic history outside of war. The 25 percent decline in prices from 1929-33 was followed by an 11 percent increase over 1933-37 (Exhibit 1).<sup>6</sup>

### The Second Phase: The Mistake of 1937

Further evidence regarding the importance of communication about future prices is apparent during the sharp recession in 1937-38. In 1937, however, it was the Administration's abandonment of a policy of reflation that was the driving force. This policy reversal appears to have resulted from the Administration's belief that the depression was essentially over. This sense of victory over the depression found its way into the Administration's communications about inflation policy, which the market interpreted as a shift away from the reflationary commitment of the early months of 1933. Eggertsson and Pugsley (2006) document a series of government communications, which they characterize as "the mistake of 1937."

In particular, on April 2, 1937, the Wall Street Journal reported on remarks made by FDR and by the Chairman of the Federal Reserve Board that indicated "a change in the trend of the government's recovery measures away from the emphasis which has been placed upon stimulation of industrial activity and the recovery of prices." These announcements were in opposition to FDR's previous commitment to restore prices to their pre-depression levels. At the time of the mistake, prices as measured by both the WPI and the CPI were still well below their previous levels.<sup>7</sup> With prices below their perceived targets, one interpretation of this period is that the administration's very public alarm over increasing prices sent confusing signals to the public about its reflation policy.

Exhibit 2 shows the response of leading commodity prices in a one year window around this period. In early 1937, these prices were still trending upward. But after the above-mentioned announcements, the trend changed towards deflation.<sup>8</sup> During the mistake of 1937, long-term interest rates rose beyond what would be implied by the rise in short-term rates, consistent with the market's anticipation of future hikes in nominal interest rates (Exhibit 2, lower panel).

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<sup>6</sup> One obvious problem with attributing the recovery in 1933-37 to the Administration's commitment to increase the price level is that several other actions were taken. First, there was a resolution of the banking crisis. Second, there were several actions taken with the National Industrial Recovery Act (NIRA). Third, the United States left the gold standard and the foreign exchange value of the dollar declined. While one could argue that each of these policies had their effect through supporting the government commitment to increasing the price level, and thus worked through expectations about future policy, one could also argue that they had their effect independently of the expectation channel. The recession in 1937-38 therefore provides a useful perspective, since the price of gold was unchanged during this period, there was no banking crisis, and the NIRA had already been judged unconstitutional.

<sup>7</sup> The WPI was 13 percent below its 1926 average, and the CPI was 20 percent.

<sup>8</sup> While there is no direct data on inflation expectations during this period, alternative estimates of inflation expectations find evidence of an expectations shift in 1937 from inflationary to deflationary (Hamilton 1992 and Cecchetti 1992).

## The Recovery of 1938

The end of the 1937-38 depression is also consistent with the hypothesis outlined above. In early 1938 the Administration restored an inflationary policy. The first announcement of considerable importance was made at a February 15th press conference where FDR said that he once again believed, as he had announced in 1933, that prices should be inflated back to their pre-depression levels.<sup>9</sup> Later that spring the Administration took several steps to support an inflationary program, such as lowering reserve requirements back to their 1936 levels, increasing deficit spending, and desterilizing government gold stocks. The upper right panel of Exhibit 2 shows the rebound in commodity prices after the “reversal of 1938.” The period identified with the reversal of 1938 is February-May of that year. The recovery is also evident from the aggregate variables shown in the lower panel of Exhibit 1. The 1938-42 recovery was even stronger than the 1933-37 one, and by most measures the economy had fully recovered by 1942.

## Actions and Alternative Interpretations

The evidence above does not establish that communication policy was all that mattered during the 1930s. In 1933, for example, FDR also backed up the objective of raising prices with several actions. For example, he declared that “government credit” would be used “when, as and if it may be necessary” to increase prices. Government credit was used for variety of purposes, such as gold purchases, deficit-financed government spending, and the restructuring of the banking system.<sup>10</sup> One can interpret many of these actions as having had their effect mainly through firming up the commitment of the Administration to raise prices (that is, making the communications “credible”), and in the case of 1937, as having worked in the opposite direction.

Other interpretations are possible, however. Some have suggested, for example, that the fiscal policy tightening in 1937 explains the downturn that year, independently of expectations.<sup>11</sup> Alternatively, Hanes (2005) argues that activities, such as the Treasury’s gold purchases, that increased banks’ nonborrowed reserves caused the banks to rebalance their portfolios and purchase more bonds, which pushed down longer-term interest rates, independently of expectations. In this case, the Treasury’s decision at the end of 1936 to sterilize gold inflows, so that they did not add to nonborrowed reserves,

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<sup>9</sup> Three days later FDR called another press conference. On that occasion he read a statement which he had instructed Federal Reserve Chairman Mariner Eccles, Treasury Secretary Henry Morgenthau, and several other senior government officials to prepare. Flanked by senior administration officials FDR announced, “it is clear that in the present situation a moderate rise in the general price level is desirable.”

<sup>10</sup> The deficit in the fiscal year of 1934 was one of the largest in US history outside of wartime (Eggertsson (2008)).

<sup>11</sup> This argument goes back to Smithies (1946). Brown (1956) notes that fiscal policy was decidedly less expansive in 1937, but argues that the variations were not large enough to explain the downturn.

resulted in an inadvertent tightening of monetary policy which is also an alternative explanation for the contraction in 1937.<sup>12</sup>

## Lessons

The 1930s underline the importance of pairing clearly stated communication regarding policy with concrete policy actions designed to add credibility and reinforce those communications. FDR's promise to increase "government credit," for example, was fully consistent with his announced goal of reflation and likely supported expectations about a rise in the price level.

## Wartime and Pre-Treasury-Accord Period (1942-51)

Between early 1942 and 1951, the Federal Reserve and the Treasury agreed that interest rates should be kept low.<sup>13</sup> This episode has sometimes been cited as evidence that the Federal Reserve can not only target short rates, but also long-term interest rates.<sup>14</sup> In this period the Federal Reserve capped yields on long-term Treasury bonds at 2½ percent and, until 1947, pegged the yield on short-term Treasury bills at ¾ percent (Exhibit 3). After 1947, the peg on short-term rates was allowed to change, but only with the approval of the Treasury.

The period 1942-47 highlights the ability of the Federal Reserve to influence long-term interest rates through a commitment to holding short-term rates low. Because the cap on long-term yields was not binding during most of the period, it played a minor role. During a short period in 1947-48, the cap on long rates became binding and the Federal Reserve managed to maintain it through large purchases of these securities, even with the peg on short-term rates. This was achieved without decoupling long-term Treasury rates from long-term rates faced by private parties.<sup>15</sup>

## The Establishment of Interest Rate Caps

The decision to target both short and long-term rates was reportedly the result of a compromise between the Federal Reserve and Treasury. The initial peg of ¾ on the

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<sup>12</sup> Friedman and Schwartz (1963) argue that the increase in reserve requirements constituted a tightening of monetary policy, but more recent scholars have been skeptical of this argument, see e.g. Telser (2001). Eggertsson and Pugsley (2006) argue that the changes in reserve requirements were contractionary mainly because of their effect on expectations about a future tightening.

<sup>13</sup> This low interest rate policy was designed to facilitate the financing of large government outlays needed to pay for the war effort. Between January 1942 and December 1945, outstanding government debt rose from \$60 billion to \$278 billion, after which it held fairly steady.

<sup>14</sup> See for example Bernanke (2002).

<sup>15</sup> The brief period may have been the motivation for "operation twist" in the 1960s which aimed at holding down long rates while raising short rates. "Operation twist," however, was widely viewed as a failure at the time.

three-month Treasury bill was seen as generally innocuous as the rate at the time of the agreement was around  $\frac{1}{4}$  percent, and at that point, the peg was not perceived as an indefinite commitment.<sup>16</sup> As yields on short-term rates rose, the Federal Reserve acted to enforce the peg by purchasing large quantities of Treasury bills. By the end of 1944, the Federal Reserve held around 75 percent of outstanding Treasury bills. The credible peg on short-term rates allowed the Federal Reserve to maintain the caps on longer-term Treasury yields without substantial purchases of long-term securities. The cap on long-term rates did not bind until the peg on short-term rates was lifted in 1947.

The policy of capping the yield curve at longer maturities was not publicly announced, at least at first, but became apparent over the course of 1942 and 1943. It also became clear that longer-term rates were higher than consistent with expectations and that the government would be successful in holding future short-term rates at relatively low levels. Once market participants gradually became convinced that the Federal Reserve would hold the peg on three-month bills for a substantial period of time, there was a gradual decline in the yield on longer-maturity Treasury securities. The period from 1942-47 thus provides little evidence that the Fed can target long rates independently of the expectations of future short rates.

While the Federal Reserve was able to effectively peg the short-term Treasury bill rate, it was less able to control other short-term rates. Inflation picked up in late 1946 as wage and price controls were lifted. At this time, some short-term rates, such as four to six-month commercial paper rates, rose notably and became decoupled from Treasury rates, likely suggesting that investors placed some odds on resurgent inflation leading the Federal Reserve to abandon the bill-rate peg.

#### Experience with Pegging Long Rates in 1947-48

As a result of ongoing inflationary pressures, the Federal Reserve pushed for a new agreement with the Treasury and in July 1947 raised the short-term bill peg, which was moved up to a bit over 1 percent by the end of the year. From this point on, the FOMC decided on the level of the bill peg at FOMC meetings, subject to approval from the Treasury.

Once the Federal Reserve allowed short-term rates to rise in 1947, the  $2\frac{1}{2}$  percent yield on the long-term bond was less attractive and long-term rates also started to rise. In addition, once the Federal Reserve changed the short-term bill peg, market participants may also have become less certain about the credibility of the cap on long-term rates. Federal Reserve officials had to publicly reaffirm their commitment to the continuation of the  $2\frac{1}{2}$  percent cap. At this point the cap on long-term bonds became binding and the Federal Reserve needed to make large purchases of these bonds to enforce the cap. Even

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<sup>16</sup> Friedman and Schwarz (1963) argue that under the interest rate peg, the Treasury gained significant control over monetary policy. By issuing more bills, which the Federal Reserve would need to purchase to enforce the cap, the Treasury could drive up excess reserves in the banking system. Woodford (2001) also provides a detailed treatment of this idea.

though purchases amounted to only a modest share of the market, the Federal Reserve was able to successfully defend the cap.<sup>17</sup> During the period from July 1947 to late 1948 the Federal Reserve was able to defend both the cap on long rates and its peg for the short rate without buying up the entire market for government debt. The recession that began in November 1948, however, reduced inflationary pressures. Consequently, bond yields began to fall in the summer of 1948, which allowed the Federal Reserve to cease purchasing bonds to enforce the yield ceiling on long-term rates.

During the period that the Federal Reserve was defending the cap on long rates, the spread between yields on long-term corporate and Treasury securities widened a bit. However, the spread did not narrow appreciably once the caps on long-term Treasuries ceased to bind in 1949, which suggests that the caps were not significantly distorting the relationship between the two rates. Thus, the Federal Reserve appears to have successfully defended the cap on long-term rates for government bonds with purchases of securities, without causing the long rates faced by private parties to decouple from the term structure implied by Treasuries.<sup>18</sup>

The arrangement to cap long-term rates unraveled with the onset of the Korean War in mid-1950 and the resulting pick-up in inflation. In March 1951, the Federal Reserve and the Treasury negotiated the Accord that ended the ceiling on long-term interest rates. Yields on long-term Treasuries promptly rose above the previous 2½ percent cap.

## Lessons

The period 1942-47 provides some evidence that the Federal Reserve can lower long-term rates by committing to keeping short-term rates low. The brief period from 1947 to 1948 may also provide additional evidence that long rates can be reduced by direct interventions in the market for long-term Treasuries.

## Forward Guidance in FOMC Communications (2003 - 2005)

In June 2003, the FOMC cut the target for the federal funds rate by 25 basis points to 1 percent. This decision was the final reduction in a sequence of rate cuts that began in early 2001 and occurred against a backdrop of decreasing inflation expectations and a sagging economy.<sup>19</sup> At the time, policymakers expressed concern about the possibility of an “unwelcome substantial fall in inflation.”<sup>20</sup>

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<sup>17</sup> Peak holdings of long bonds reached \$11 billion in December 1948, which accounted for just over 10 percent of total outstandings.

<sup>18</sup> Eggertsson and Woodford (2003) predict that such decoupling may take place in the case of these interventions.

<sup>19</sup> Some market participants had even anticipated a larger rate cut, placing a probability of around 70 percent on a funds target below 1 percent. While the low target rate and the configuration of market expectations has some resemblance to the current situation, a key difference is that there were no major

In 2003, the FOMC began adding forward guidance about continued policy accommodation to its statements. This guidance was conditional on a weak outlook for inflation. Overall, this was successful in influencing market expectations and stimulating the economy without further cuts in policy rates. However, there are also concerns as to whether markets paid proper attention to the conditionality of the forward guidance. As a result, if policymakers choose to provide such guidance again, they may wish to increase their emphasis on such conditions in their public statements, and to provide guidance on what factors might lead to a change in policy.

### The Conduct of Forward Guidance

After cutting the target rate to 1 percent in June 2003, the FOMC kept the funds rate unchanged for one year. Keeping the funds rate low and unchanged for an entire year could be interpreted as policy having been inactive and constrained by a lower bound in 2003-04.<sup>21</sup> But in fact, the FOMC sought to add further stimulus to the economy by adding forward guidance about continued future policy accommodation to FOMC statements. Statements had been released since 1994, but this was the first time they included guidance about the likely evolution of future short-term nominal interest rates.<sup>22</sup>

In August 2003, the first statement after the rate cut highlighted that “the risk of inflation being undesirably low is likely to be the predominant concern for the future. In these circumstances, the Committee believes that policy accommodation can be maintained for a *considerable period*.”<sup>23</sup> The subsequently released minutes of the August meeting said that “While the Committee could not commit itself to a particular policy course over time, many of the members referred to the likelihood that the Committee would want to keep policy accommodative for a longer period than had been the practice in past periods of accelerating economic activity.” While the description about the outlook for inflation varied, subsequent FOMC statements maintained the wording of the “considerable period” until the end of 2003.

As the risk of deflation receded, the statement said in January 2004, “With inflation low and resource use slack, the Committee believes that it can be *patient in removing its policy accommodation*.” Keeping the funds rate unchanged, that language

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disruptions in financial markets. At the time, money market spreads were low, and Libor was close to the fed funds rate (upper panel of Exhibit 4).

<sup>20</sup> Fed officials had started commenting on this already in late 2002, generally describing the issue as “unwelcome” but also “minor.” A comprehensive review of Fed statements during this period is given by Bernanke, Reinhart and Sack (2004, Table 8, p. 61).

<sup>21</sup> Accounting for the side effects on money market funds and the Treasury market, policymakers may not be willing to push the fed funds target all the way to zero. As a result, the lower bound for the policy rate might be a small positive number, like 25 basis points, instead of the theoretical limit at zero.

<sup>22</sup> A recent discussion of the FOMC’s forward guidance can also be found in Moessner and Nelson (2008).

<sup>23</sup> In his July 15 testimony to the Congress, Chairman Greenspan already highlighted that the FOMC was prepared to maintain a “highly accommodative policy stance for as long as it takes.” In reaction to his testimony, interest rates rose, however, likely because the testimony also referred to “special policy actions [being] unlikely to arise.”

was reiterated until May 2004 when the FOMC introduced the wording of "... with inflation low and resource use slack, the Committee believes that policy accommodation can be removed at a *pace that is likely to be measured*."

Beginning in June 2004, the FOMC raised the funds rate by 25 basis points at each meeting until the rate reached 5.25 percent in June 2006. Until the end of 2005, this was accompanied by the use of the "measured pace" language in FOMC statements.<sup>24</sup> Between June 2004 and November 2005, the Committee emphasized the conditional nature of this language by adding "Nonetheless, the Committee will respond to changes in economic prospects as needed to fulfill its obligation to maintain price stability."

### The Effects on Market Expectations

The introduction of forward guidance appears to have been successful in holding down expectations regarding monetary policy some months out. As shown in the middle panel of Exhibit 4, near-dated funds rate expectations became firmly anchored at around 1 percent and far-dated expectations shifted in line with changes in the FOMC's forward guidance. Usage of the different phrases is indicated in Exhibit 4 by the letters "C" (considerable period), "P" (patient) and "M" (measured pace), respectively.

Measures of policy surprises shown in the lower panel of Exhibit 4 confirm this. They are taken from Gurkaynak, Sack, and Swanson (2005), who measured surprises by changes in fed funds futures around FOMC announcements. Further, they computed surprises for a "path factor" summarizing updates in market expectations about future policy targets. The exhibit's lower panel shows that surprises for the current rate were remarkably small in the period when the federal funds rate was at 1 percent, while path surprises remained sizable during this episode. This result suggests that the forward-looking language was successful in lowering the expected future path, even when the short-term interest rate remained unchanged. Also, inflation expectations moved up somewhat in the summer of 2003 (Exhibit 4, upper panel).<sup>25</sup>

### The Conditionality of Forward Guidance

Research suggests that a conditional commitment of early policy accommodation can help alleviate deflationary risks when aggregate demand is weak and interest rates are low.<sup>26</sup> Woodford's (2005) Jackson Hole speech prominently referred to the FOMC's

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<sup>24</sup> In December 2005, the wording changed from the measured removal of policy accommodation to "measured policy firming" being likely. In January 2006, this was adapted to "further policy firming may be needed."

<sup>25</sup> The exhibit shows movements in one-year ahead inflation expectations from the Michigan Survey. Inflation expectations derived from TIPS for 5 and 10 year horizons showed similar upward movements, whereas expectations from the Survey of Professional Forecasters moved up less pronouncedly.

<sup>26</sup> See for example Reifschneider and Williams (2000), Clouse, Henderson, Orphanides, Small, and Tinsley (2003), Eggertsson and Woodford (2003), Eggertsson (2006), Bernanke and Reinhart (2004), Bernanke, Reinhart and Sack (2004), Wolman (2005) as well as Adam and Billi (2006, 2007).



communication policy in 2003-04 as being a successful example of optimal policy subject to an interest rate bound. The benefit of commitment is that the expectation of persistently low future interest rates should help to depress long-term interest rates and lift aggregate demand.

Conditionality is important because future shocks can cause inflation to rise again, necessitating a tightening in monetary policy.<sup>27</sup> One risk of conditional statements is that they will not be properly interpreted by market participants, jeopardizing policymakers' flexibility in the face of new developments.

In recent years, some observers have suggested that monetary policy was too loose during 2004-05, perhaps because the FOMC was constrained by its previous commitments when it would otherwise have preferred to respond more aggressively to shifts in the outlook for economic activity and inflation.<sup>28</sup>

Clearly, the FOMC's language was geared at shaping *conditional* expectations about future policies. By mid-2005 the balance of risks had shifted away from the earlier deflationary concerns and this change was reflected in FOMC statements. They mentioned clear concerns about elevated inflation pressures, particularly due to energy prices. However, recognition of those risks did not significantly change the Committee's central outlook for well-contained core inflation. In fact, the Committee maintained its policy throughout 2006 while continuing to emphasize its willingness to tighten earlier if doing so were justified by economic conditions.

There is a deeper concern that markets may have viewed the FOMC's forward guidance as stating *unconditional* policy intentions, and that this could have placed undue constraints on policymakers. Evidence suggest that markets paid more attention to the conditionality 2003-04 than during the "measured pace" tightening.

Bernanke, Reinhart, and Sack (2004) analyzed market reactions to releases of payroll employment data, which are important indicators of changes in economic conditions often referred to in FOMC statements. They report an increase in the sensitivity of market expectations to these releases after the introduction of forward-looking statement language. For 2003-04, this finding suggests that market participants likely understood that the language in the FOMC statement was conditional and that the Committee might react if economic conditions shifted suddenly.

Beechey (2006) extended this evidence by looking at a broader set of economic news and by including also the "measured pace" period. While confirming the results of

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<sup>27</sup> Such shocks could include a faster than expected recovery in real activity or an unanticipated rise in commodity prices.

<sup>28</sup> For example, Taylor (2007) contrasted the low funds rate and the measured tightening with a much higher path of policy rates, mostly above 2 percent, prescribed by the kind of policy rule he had devised in earlier work. However, such calculations are not without controversy; for example, the recovery in employment was weak, and interest rate rules like the Taylor rule that use labor market measures rather than output gaps suggest, at least in some estimates, that monetary policy was not unusually loose, see e.g., Edge, Kiley, and Laforde (2007) and Kohn (2007).

Bernanke, Reinhart, and Sack for 2003-04, she found a marked decrease in the sensitivity of market reactions to economic news starting with the onset of the “measured pace” tightening cycle (Exhibit 5).<sup>29</sup>

A similar picture emerges when looking at the implied volatility of interest rates. Implied volatilities reflect market perceptions about the likely variation in future interest rates in response to *any shock* hitting the economy – not only those to which the conditions of forward guidance apply. Compared to the previous decade, uncertainty was unusually low during the “measured pace” tightening.<sup>30</sup> Initially, it was also low in 2003 while the rate stayed at 1 percent for a “considerable period,” but it spiked in 2004 as conditions for continuing this accommodation clearly changed and the FOMC had changed its guidance to “patient removal” of the low funds rate target (see Exhibit 5).

This suggests two interpretations: Either the market placed a smaller probability on the kind of inflationary shocks that would lead the FOMC to deviate from its “measured pace,” than in earlier times, or the market did not appropriately consider the conditionality of forward guidance. It appears hard to argue why the former interpretation should be plausible. In sum, this evidence gives ground for concern that the market’s understanding of the conditionality may have been insufficient during the “measured pace” period.

## Lessons

Similarly to the previous episodes, the introduction of forward guidance showed that expectations can be used to stimulate the economy even when interest rates are already low.

A distinctive lesson to be drawn from this period seems to be the need for markets to properly understand the conditional nature of policy commitments. If anything, evidence suggests that markets initially understood the importance of a weak outlook for the FOMC to continue with its accommodative policy. But later, markets seem to have paid less and less attention to news of changes in these conditions. One reason for this could have been, that – due to an absence of inflationary shocks – actual policy rates looked as if they were following the forward guidance *unconditionally*. In the light of these dynamics, it appears important for policymakers to keep emphasizing the conditional nature of their intentions.

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<sup>29</sup> The exhibit shows an update of Beechey’s sensitivity index provided by MA’s Monetary and Financial Market’s Analysis section. The index is calculated as a latent factor in a regression model with time-varying coefficients relating daily changes in yields to the surprise component of fourteen major data releases. An index value of one indicates that market reactions are close to the sample average.

<sup>30</sup> Hovering at around 100 basis points, the six month volatility was around 50 basis points lower than during the previous five years (1998 – 2003) and about 100 basis points lower than during the bond market upheavals of 1994.

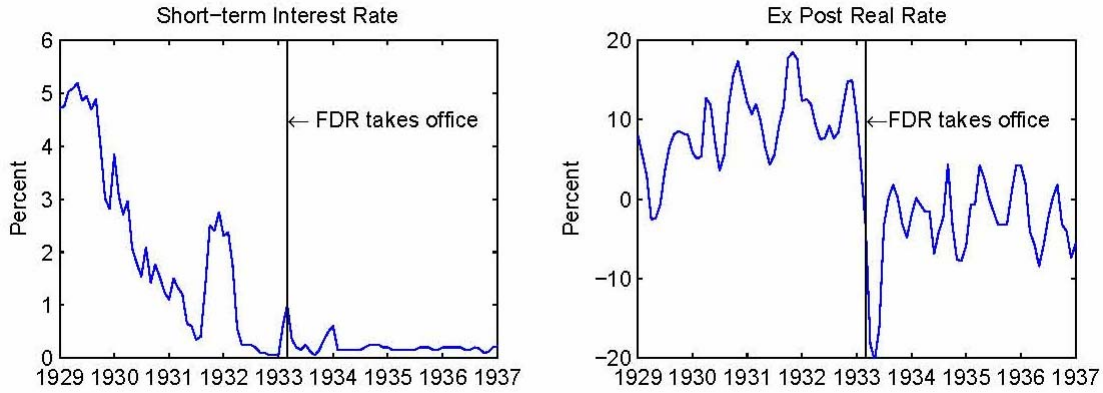
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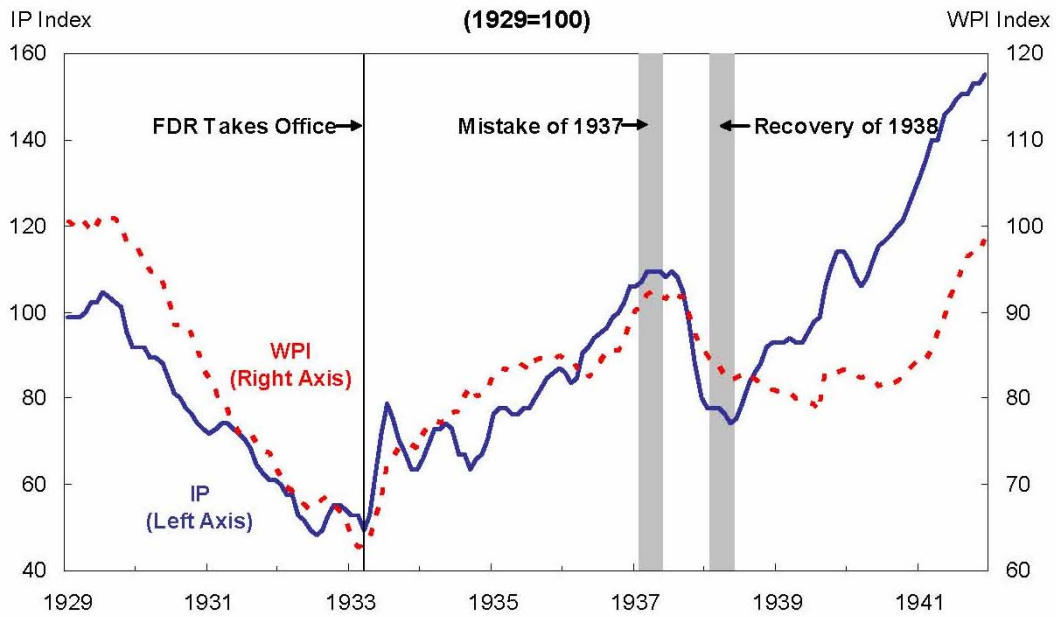
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Exhibit 1  
Interest rates and economic conditions in the 1930s



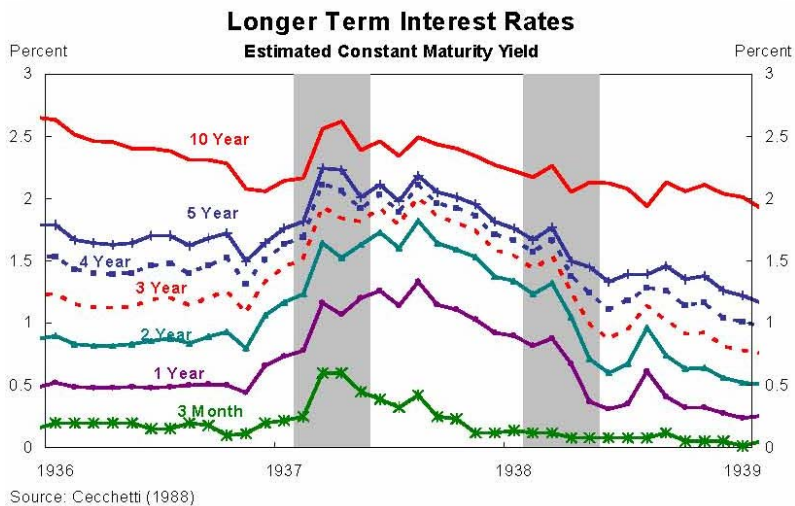
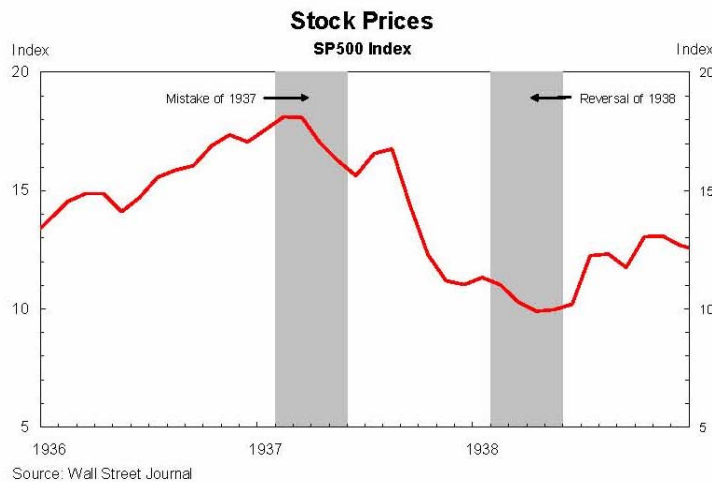
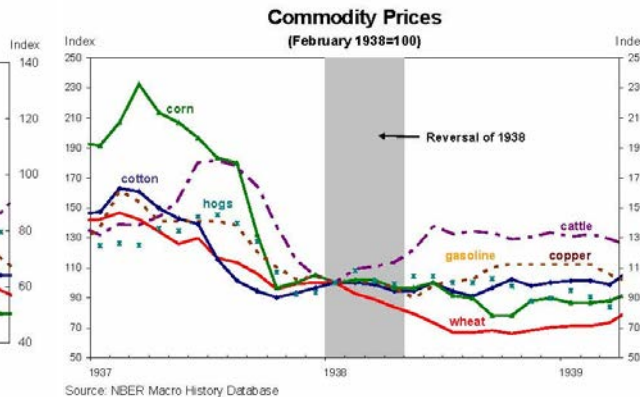
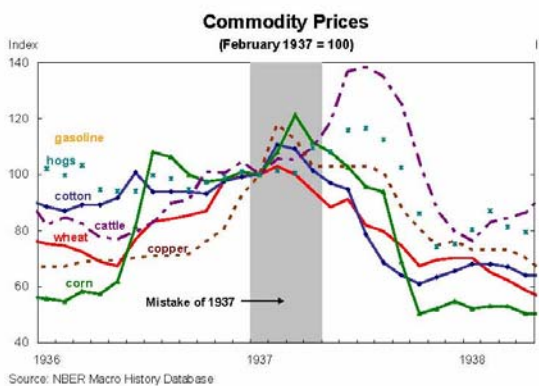
**Economic Conditions in the 1930's**



Source: Federal Reserve Board, NBER Macrohistory Database

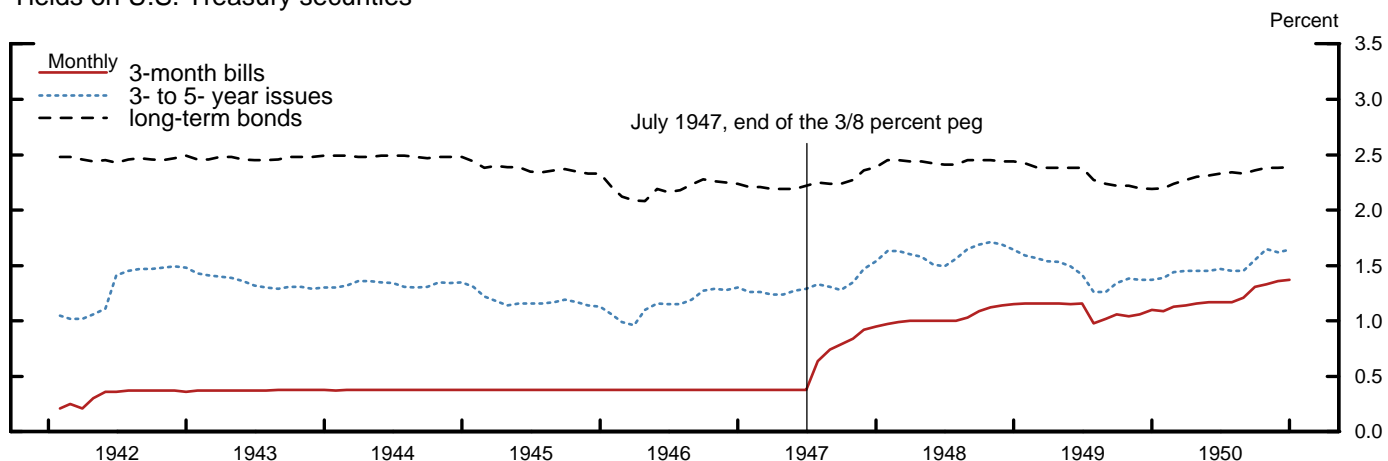
Note. WPI is the whole-sale price index and IP is industrial production

### Exhibit 2 Commodity Prices, equity prices, and long-term interest rates (1936-1938)

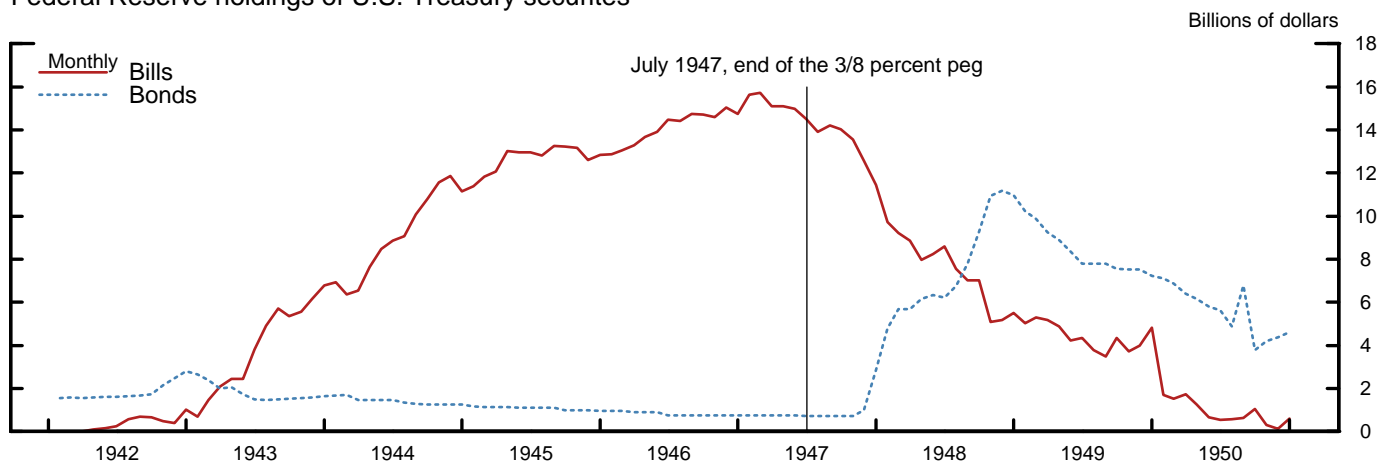


### Exhibit 3 Selected Interest Rates and Federal Reserve Treasury Holdings, 1942-1950

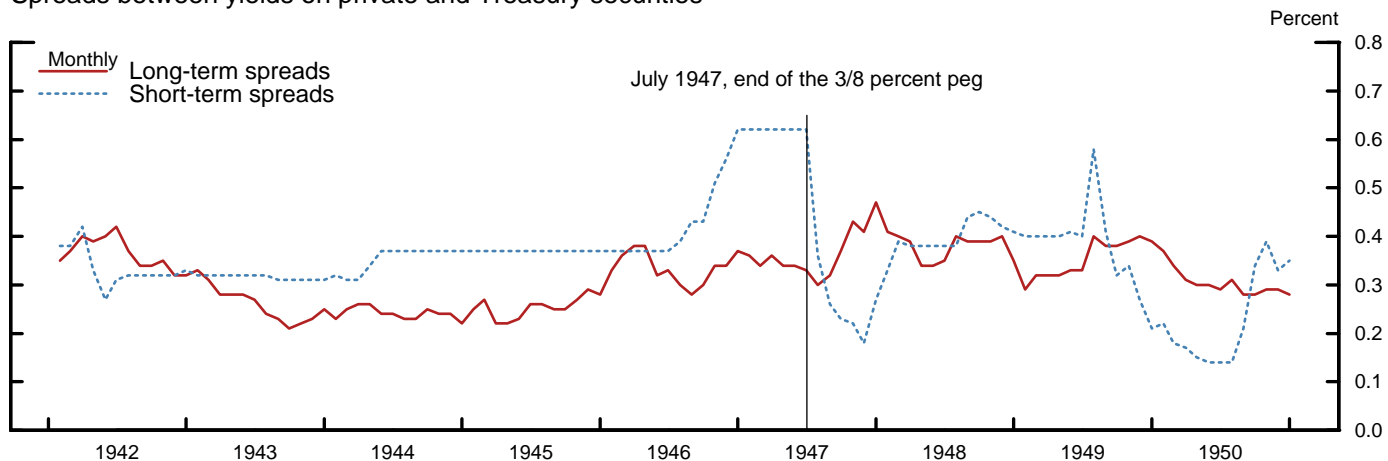
Yields on U.S. Treasury securities



Federal Reserve holdings of U.S. Treasury securities



Spreads between yields on private and Treasury securities



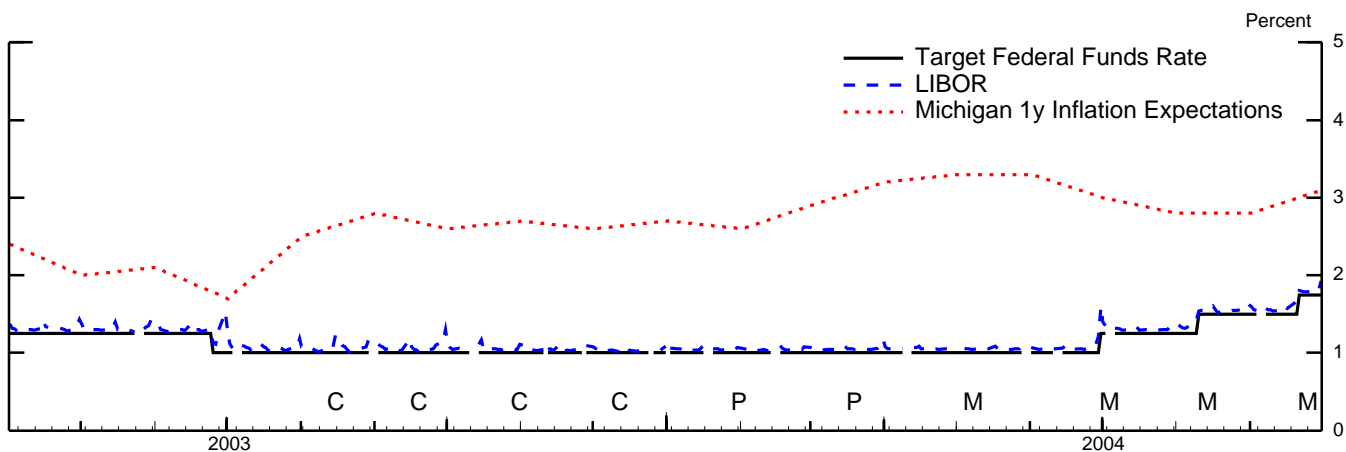
Note. The spread on short-term yields is between yields on four- to six- month prime commercial and the three-month Treasury bill. The spread on long-term yields is between yields on AAA-rated corporate bonds and long-term Treasury bonds

Source. Banking and Monetary Statistics 1941-1970

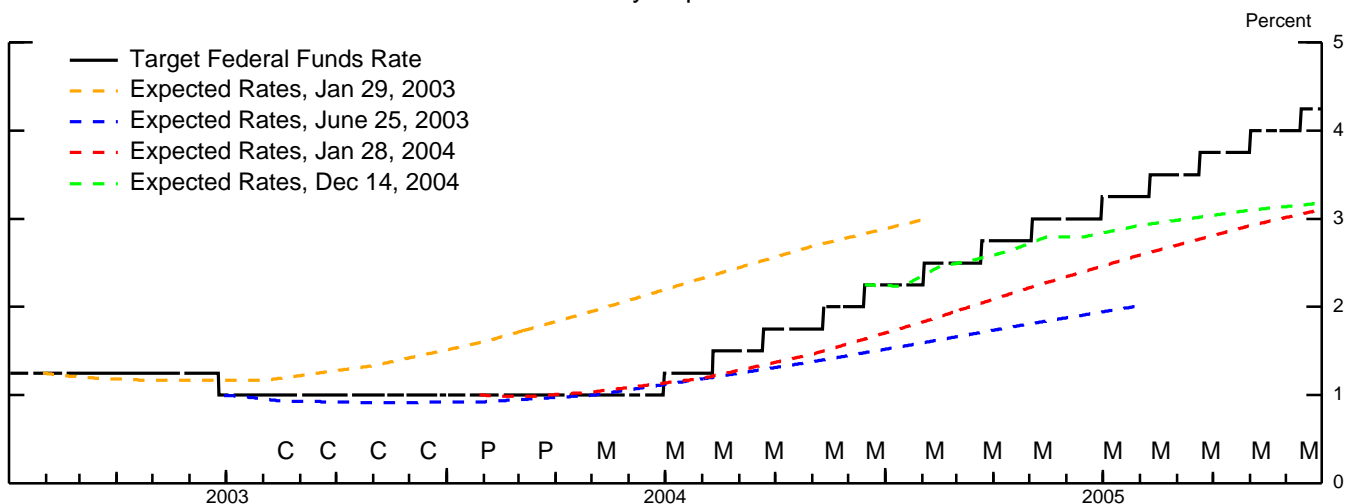


EXHIBIT 4

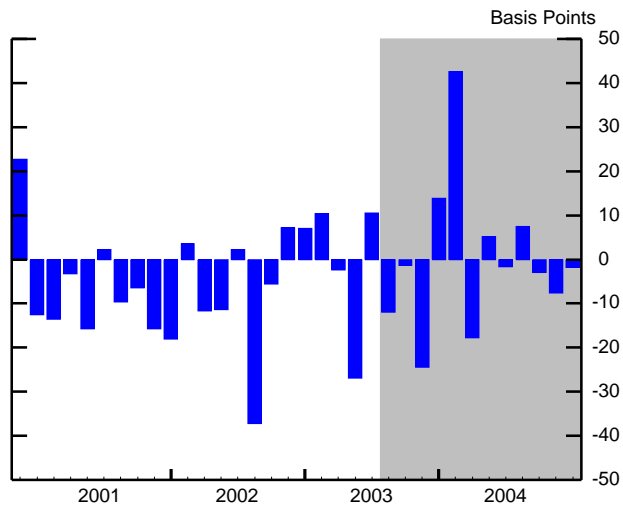
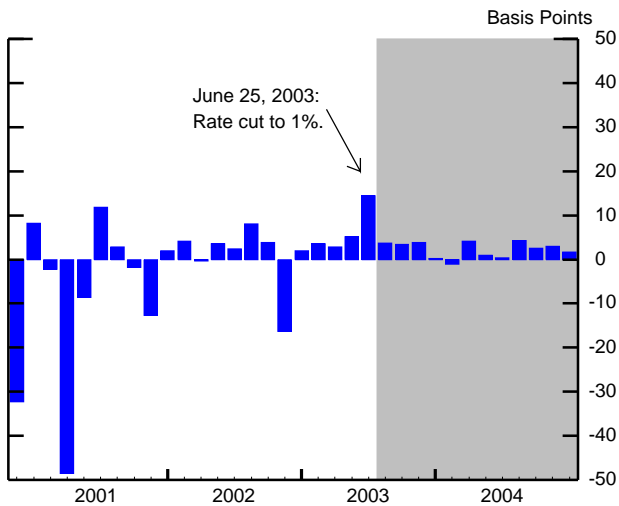
Expected Inflation and Policy Rates



Evolution of Policy Expectations in 2003



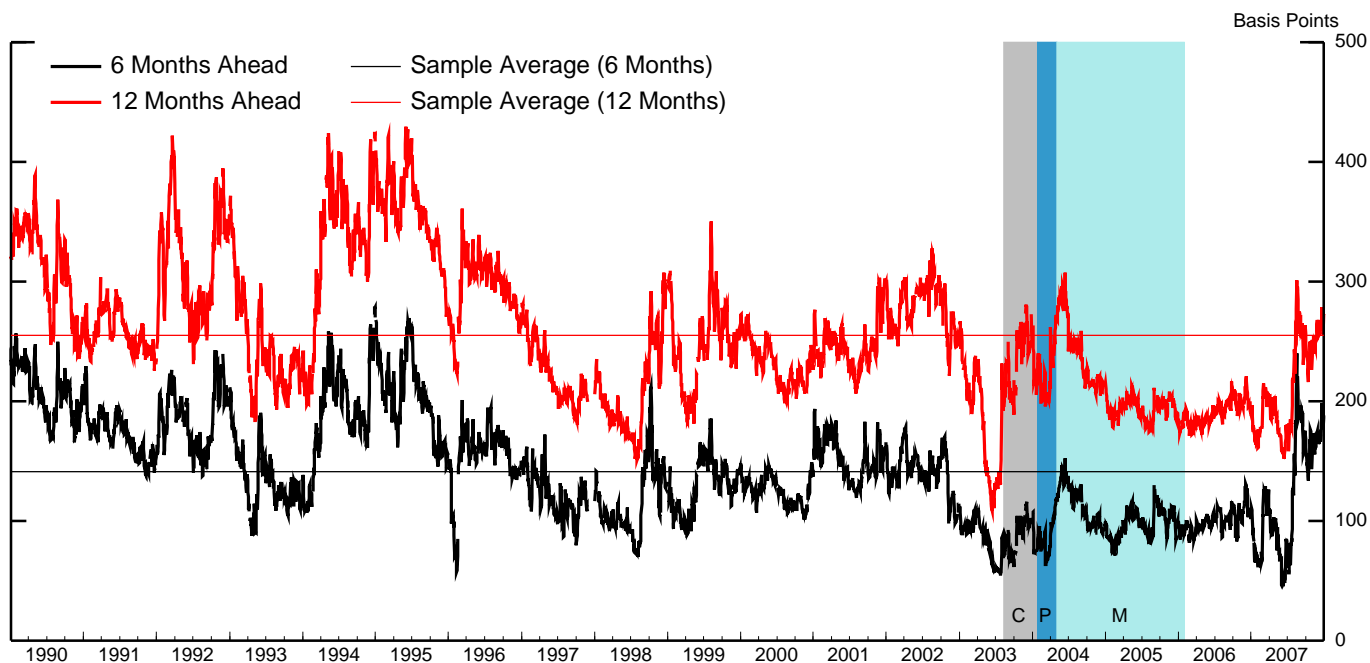
Policy Surprises in...\*  
Current Month Federal Funds Futures      Path of Future Federal Funds Rates



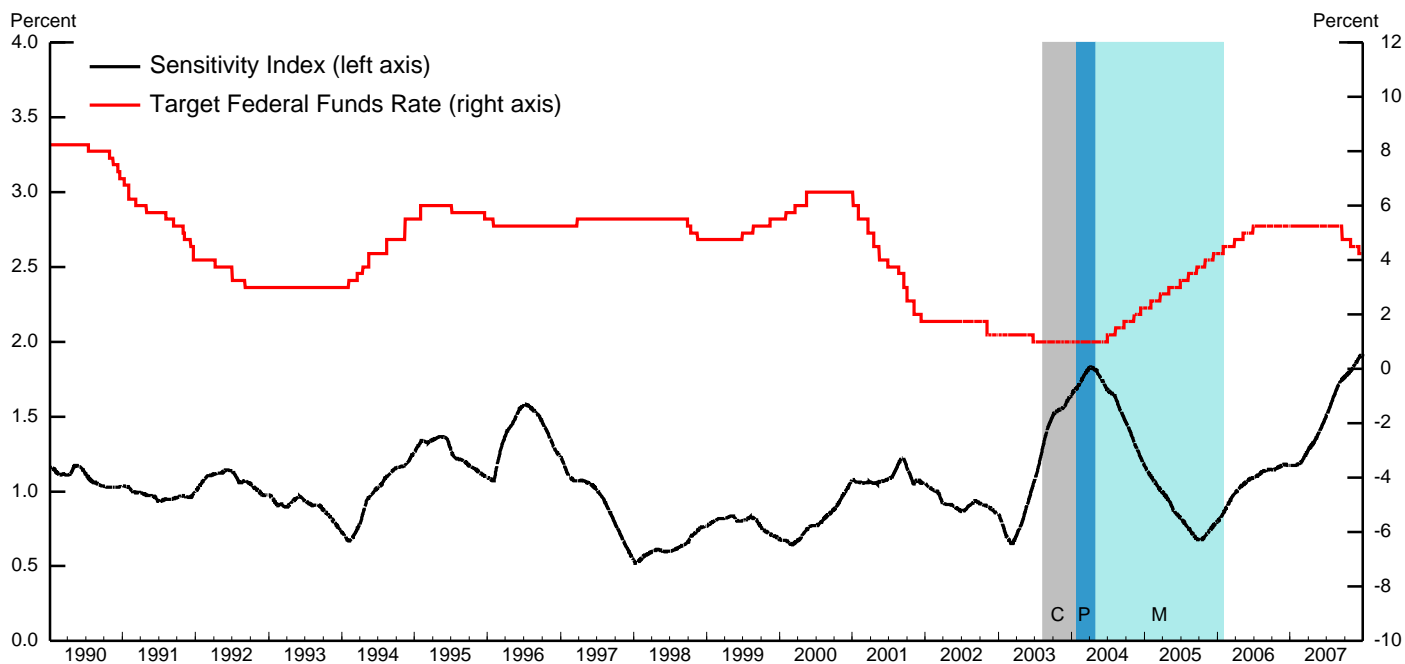
\*Source: Gürkaynak, Sack, and Swanson (2005).

**EXHIBIT 5**

**Eurodollar Implied Volatility of Federal Funds Rate**



**Sensitivity to Major Macroeconomic Data Releases**



Note: "C" denotes the period during which "considerable period" appeared in FOMC statements; "P" denotes the period during which "patience" appeared; "M" denotes the period during which "measured pace" appeared.

Note on the second graph: Sensitivity index of Beechey (2006), updated by MA's Monetary and Financial Market's Analysis section. The index is calculated as a latent factor in a regression model with time-varying coefficients relating daily changes in yields to the surprise component of fourteen data releases. An index value of one indicates that market reactions are close to the sample average.

December 5, 2008

### 3. Overview of Japan's Monetary Policy Responses to Deflation

Linda Kole and Robert Martin<sup>1</sup>

Japan's experience with low or zero interest rate policy (LIRP or ZIRP) and quantitative easing policy (QEP) can be best understood from the perspective of the "bubble economy" of the late 1980s and its subsequent collapse.<sup>2</sup> As shown in Exhibit 1, land and stock prices soared in Japan between 1985 and 1989, but since then have reversed their gains: Average land prices are still well below their 1985 level, and in 2008, equity price also have dropped well below their 1985 level. In addition, the nominal and real foreign exchange value of the yen rose significantly between the mid-1980s and the mid-1990s, diminishing the competitiveness of Japanese exporters. As a result, after growing nearly 5 percent per year between 1985 and 1990, Japan eked out a mere 1.5 percent average growth rate over the next five years. (See Exhibit 2.) Growth continued to decline over the remainder of the 1990s, which eventually became known as Japan's lost decade.

Japan has undergone three recessions since 1990 and another is likely underway. The first recession lasted from February 1991 through October 1993. In response to this economic slowdown, the Bank of Japan (BOJ) cut its policy rate target for the uncollateralized call money rate (the solid black line in Exhibit 2), to 2 percent by 1994.

With the benefit of hindsight, many outside observers argued that a faster and more aggressive policy response would have forestalled many of Japan's economic problems. Although the Bank of Japan's policy rate fell sharply and, at least early in the period, government spending increased (see Note 8 on Japanese fiscal policy), these changes were not enough to boost growth for an extended period nor were they successful in avoiding the deflation that emerged later in the decade (as shown by the dotted green line in the top panel).

In late 1995, the BOJ lowered its policy rate to 50 basis points, thus entering the first period of low interest rate policy (LIRP). By then, the Japanese economy had already begun to recover from the recession and by 1996, four-quarter GDP growth was above 3 percent. Despite the rebound in growth and very low policy rates, inflation remained very low at around ½ percent.<sup>3</sup>

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<sup>1</sup> Division of International Finance.

<sup>2</sup> We define LIRP as a policy regime in which the policy rate is greater than zero and less than or equal to 0.5 percent, ZIRP as a policy regime in which the policy rate is zero, excluding QEP. QEP as implemented by the BOJ is defined later in this note, but in general it is a policy regime in which an alternative "quantitative" policy target is adopted that requires liquidity injections beyond what would be necessary to drive the overnight interbank interest rate to zero. The BOJ adopted QEP from March 2001 to March 2006.

<sup>3</sup> The rise in inflation from early 1997 to early 1998 owed almost entirely to an increase in the consumption tax.

However, Japan's recovery did not last. By early 1997, real GDP growth began to slow. The government raised the consumption tax from 3 to 5 percent in 1997 in an effort to restore fiscal health, contributing to a decline in consumption just before the Asian financial crisis hit. As the economies of all of its regional trading partners ground to a standstill, the Japanese economy fell into a deep recession.

With its policy rate already quite low, the BOJ veered away from traditional monetary policy measures to try to stem the crisis. (A detailed time line of the BOJ's monetary policy actions is attached.) In November 1998, the BOJ extended commercial paper repo operations from 3 months to 1 year and established a temporary lending facility to support firms' financing activities. These measures did not keep bank lending from falling. The outstanding amount of bank credit (the top panel of exhibit 3) fell 21 percent between the fourth quarter of 1998 and the second quarter of 2005.

With the economy still in recession, the Bank of Japan lowered its policy rate to zero in February 1999, entering the period of zero interest rate policy (ZIRP). At the time, the Bank promised to continue the easy stance of monetary policy until deflationary concerns abated. In October 1999, the Bank began outright purchases of short-term government securities and expanded its repo operations to include two-year government securities.

By late 1999, real GDP growth had become solidly positive, and by the end of 2000, growth topped 3 percent. The recovery was led by exports and coincided with East Asia's rebound from financial crisis. Notwithstanding the pickup in economic growth, deflation became more firmly entrenched in 1999 and 2000. Despite its promise to maintain its policy stance until inflation returned, the BOJ exited ZIRP in August 2000, raising the policy rate to 25 basis points in response to a seemingly solid economic recovery. The move was criticized widely at the time, and, again with the benefit of hindsight, almost certainly was a mistake. The interest rate hike was small, but it took place in the context of falling equity prices and the collapse of the high-tech boom. The Japanese economy fell back into recession, as its exports were relatively dependent on technology products and so too, were its major trade partners. The recession lasted until January 2002.

In March 2001, with the economy in recession and prices falling at faster rates than before, the BOJ cut its policy rate back to zero. Along with this move, the BOJ announced its quantitative easing policy (QEP). QEP consisted mainly of three pillars:

- 1.) To change the BOJ's operating target to the outstanding current account balances held by financial institutions at the BOJ;
- 2.) To maintain the policy until the core consumer price index (ex. food prices) stopped falling on a year-on-year basis;
- 3.) To increase purchases of long-term Japanese government bonds.<sup>4</sup>

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<sup>4</sup> QEP policy is defined in "Effects of Quantitative Easing Policy: A Survey of Empirical Analyses," BOJ Working Paper, No. 06-E-10.

The BOJ proceeded to gradually expand the target for outstanding current account balances held at the BOJ from ¥4 trillion (almost 1 percent of GDP) initially to ¥10-15 trillion in December 2001 and continued to ratchet the target up to ¥30-35 trillion (about 6 percent of GDP) from March 2004 through March 2006. (See Note 5 as well.) As shown in the middle panel of Exhibit 3, the Bank of Japan's measures during QEP considerably boosted their balance sheet. One of the most striking aspects of QEP was the sharp increase in M1 at the beginning of the period; M1 increased 32 percent between April 2001 and April 2002.<sup>5</sup> The growth in M1 slowed after April 2002, however. Moreover, growth of M1 did not extend to broader definitions of money; the growth rate of M2 actually slowed during the QEP period.

With the announcement of QEP, the BOJ increased its outright purchases of long-term government bonds to ¥400 billion per month. By August 2001, it raised this limit to ¥600 billion, and by February 2002, monthly purchases rose to ¥1 trillion. Between March 2001 and March 2004 (the peak) the BOJ's holdings of all government securities grew 73 percent to ¥100 trillion (20 percent of GDP). Their holdings of Japanese long-term government bonds peaked in August 2004 at ¥67 trillion (about 13 percent of GDP).

During the same period, the BOJ expanded the range of instruments that could be used as collateral and in September 2002, the BOJ announced that it would purchase ¥2 trillion (0.5 percent of GDP) of stocks from banks, which it did by early 2004. In 2003, the BOJ began direct purchases of commercial paper, amounting to ¥1 trillion. During QEP, lower long-term rates as well as these other measures may have helped banks write off their bad loans and restore their balance sheets.

Despite pronouncements by the BOJ, there was considerable market uncertainty about the length of time that the BOJ would maintain its policy. (Note 5 provides further details on the BOJ's communication strategies during this period.) In October 2003, in an attempt to convince markets of its commitment to QEP, the BOJ clarified that it would keep the policy in place until inflation became positive on a 12-month basis and was forecasted to remain positive thereafter. The BOJ maintained QEP until March 2006, when it discontinued the policy in the context of sustained solid GDP growth. As the current account balances held at the BOJ were unwound (these are liabilities on the Bank's balance sheet), the BOJ rapidly shrank the asset side its balance sheet. Total assets of the BOJ, which had peaked at ¥155 trillion in December 2005, reached a post-QEP low of ¥100 trillion in July 2007. The decrease was equal to 11 percent of GDP. Over this period, BOJ holdings of long-term government bonds fell 19 percent and holdings of bank stocks fell 9 percent. The BOJ raised the overnight rate 25 basis points in June, 2006.

Despite the solid economic performance that led the BOJ to end QEP, core inflation remained negative. Indeed, headline inflation did not turn positive until early this year, when the contribution from energy and food price increases became overwhelming. Japan is quite likely to return soon to deflation, as inflation excluding

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<sup>5</sup> It is interesting to note that the growth rate of Japanese M1 during the early part of QEP is similar to the growth rate of M1 in the United States between October 2007 and October 2008.

food and energy never rose meaningfully above zero and the recent fall in commodity prices is likely to pass through, at least somewhat, into core inflation.

In response to the more recent financial crisis, the BOJ has taken steps to ensure ample liquidity provision, enacting several policies reminiscent of its policies under QEP. As liquidity pressures increased in both the government bond and the corporate financing markets, it expanded the types of Japanese government bonds it would accept in repo operations and increased the size and frequency of commercial paper repo operations. In addition, the BOJ along with the Ministry of Finance agreed to stop selling bank stocks still held on their balance sheet until financial markets stabilized. Finally, on October 31 the BOJ lowered its policy rate 20 basis points to 0.3 percent. However, following the rate cut, Governor Shirakawa made several statements highlighting the risks of moving the policy rate lower and the limited benefits of doing so. Nevertheless, our forecast and that of many outside observers is for Japan to return to ZIRP at some point over the next 6 months.

Exhibit 1

**Collapse of the Bubble**

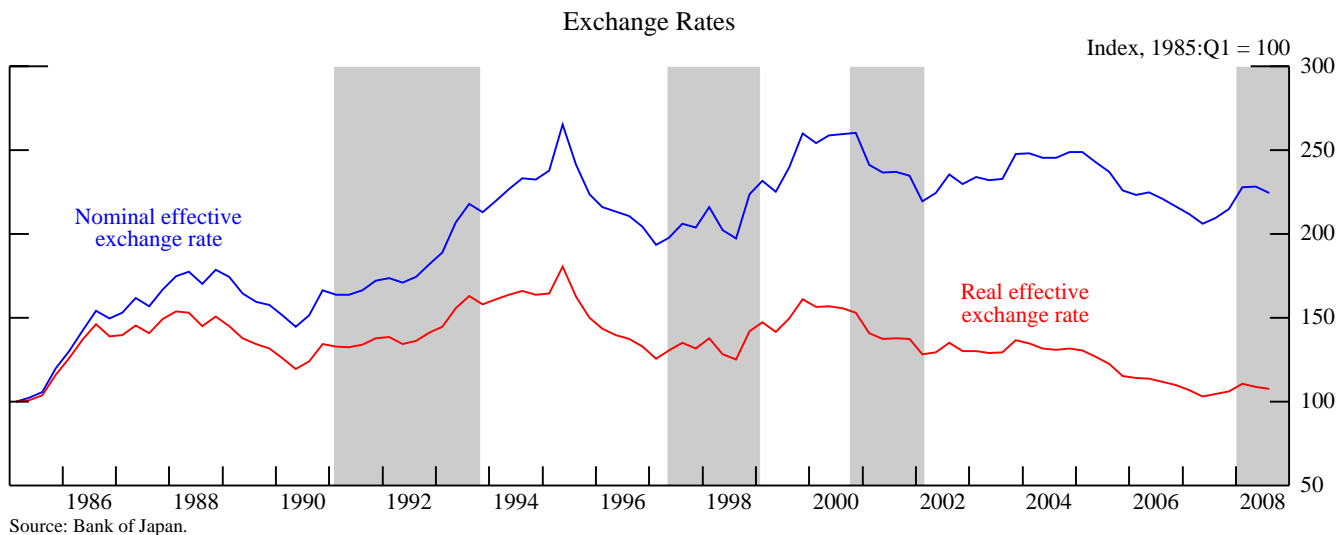
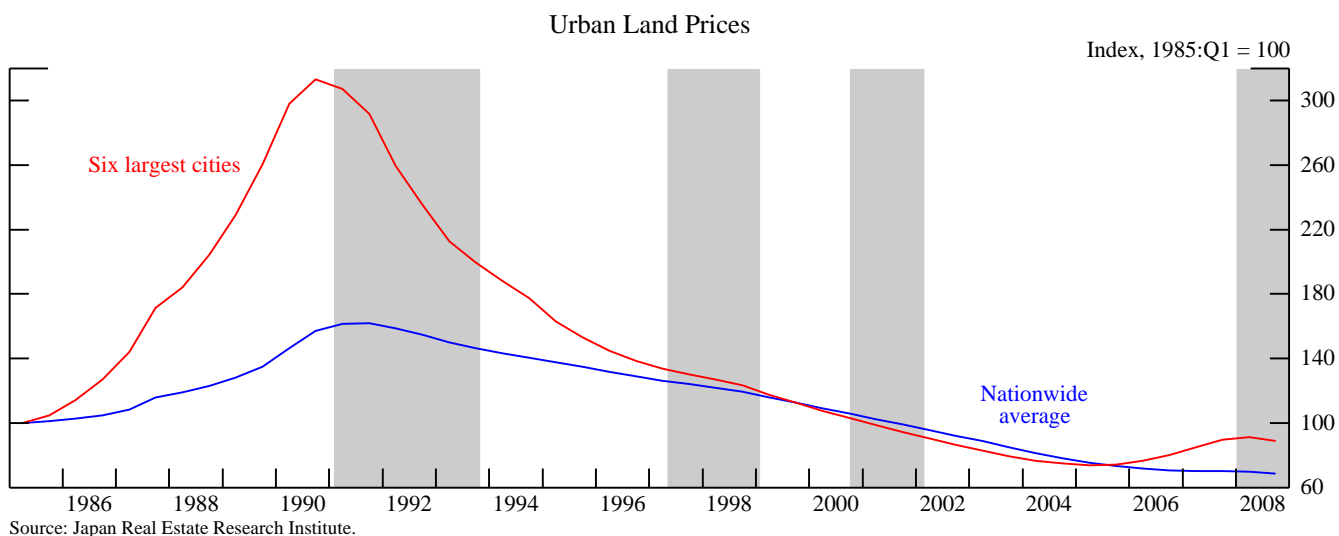
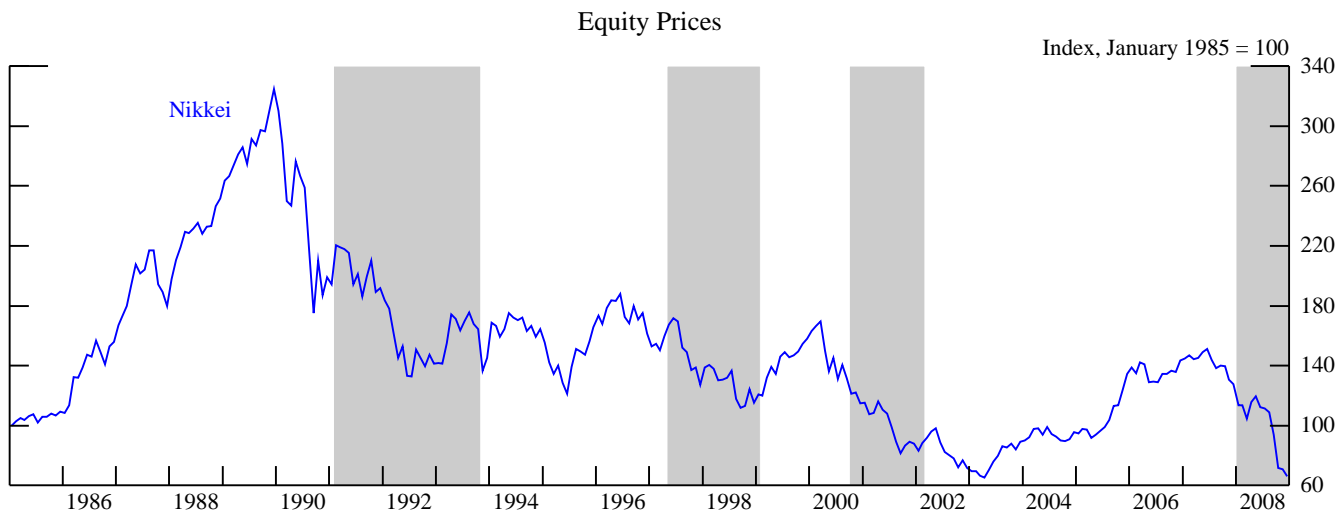
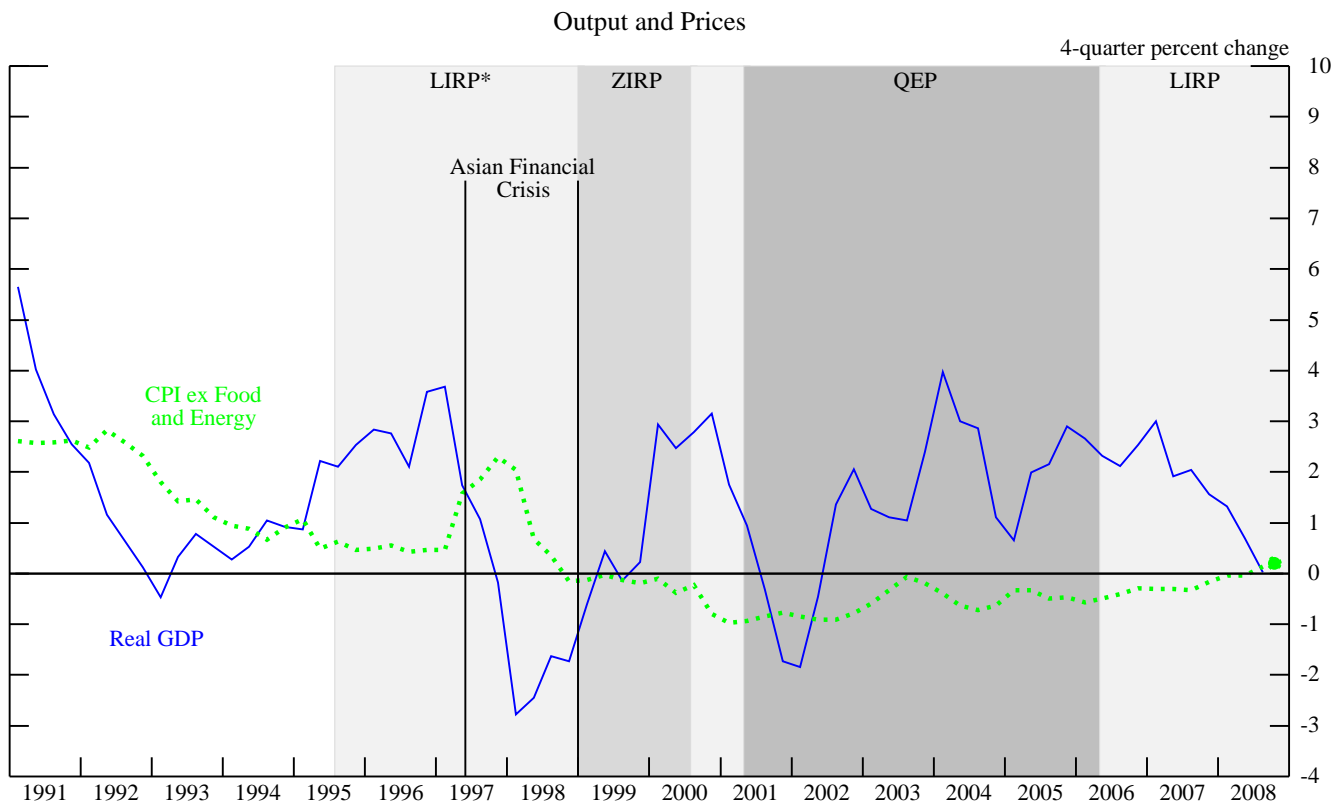


Exhibit 2

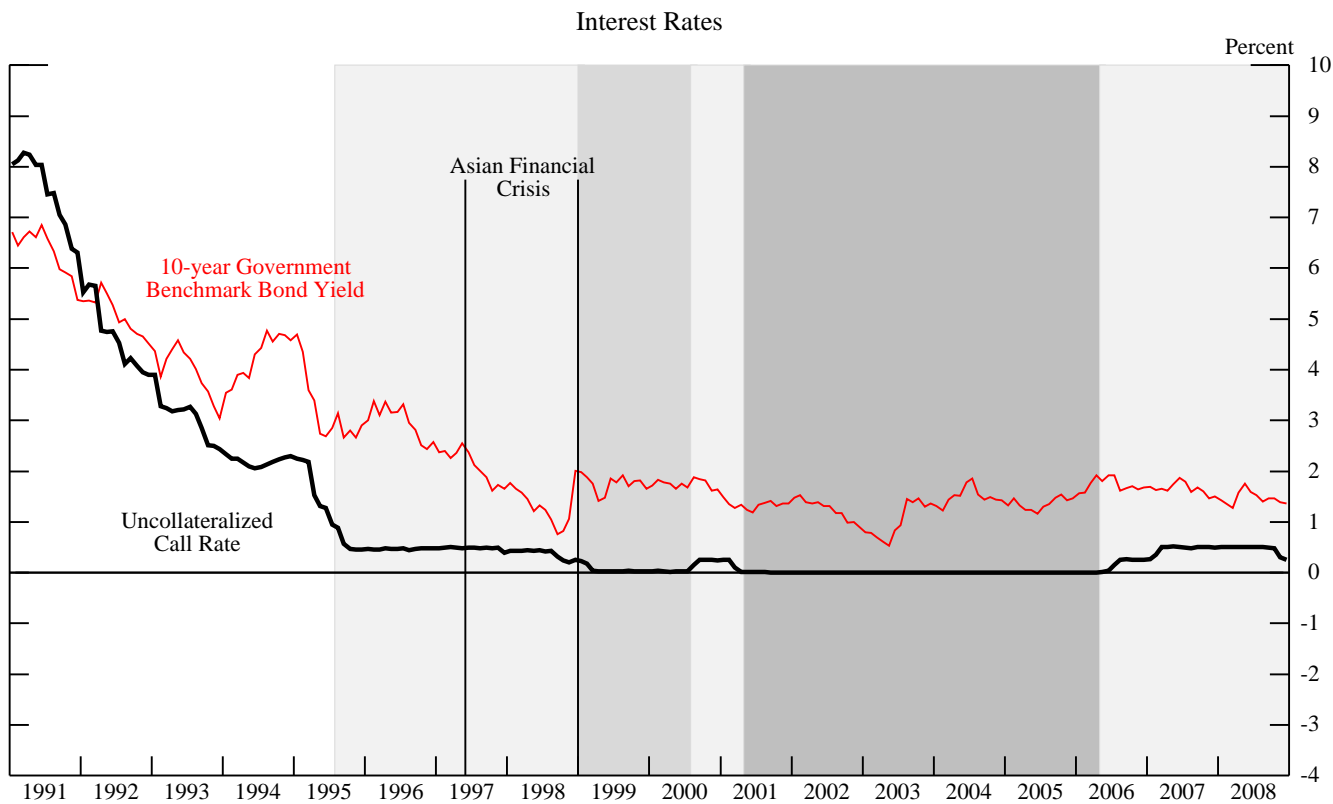
**Monetary Policy , Growth, and Inflation**



\*LIRP: Low Interest Rate Policy; ZIRP: Zero Interest Rate Policy; QEP: Quantitative Easing Policy.

\*\* Solid dot represents 12-month rate of inflation for October.

Sources: CPI: Ministry of Internal Affairs and Communications; Output, Cabinet Office.

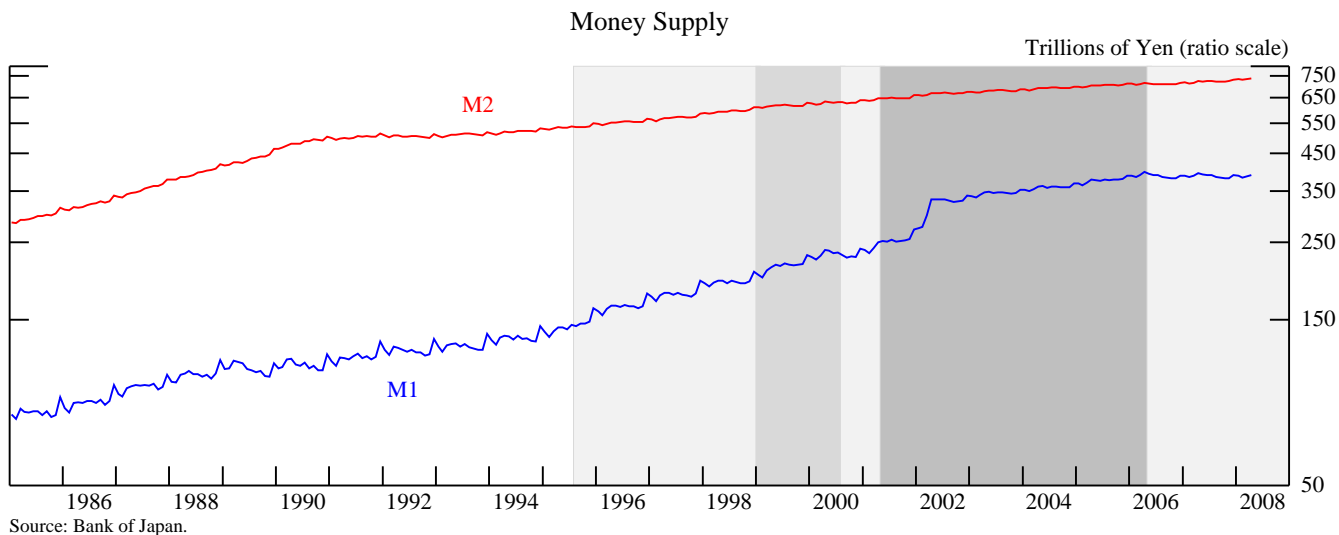
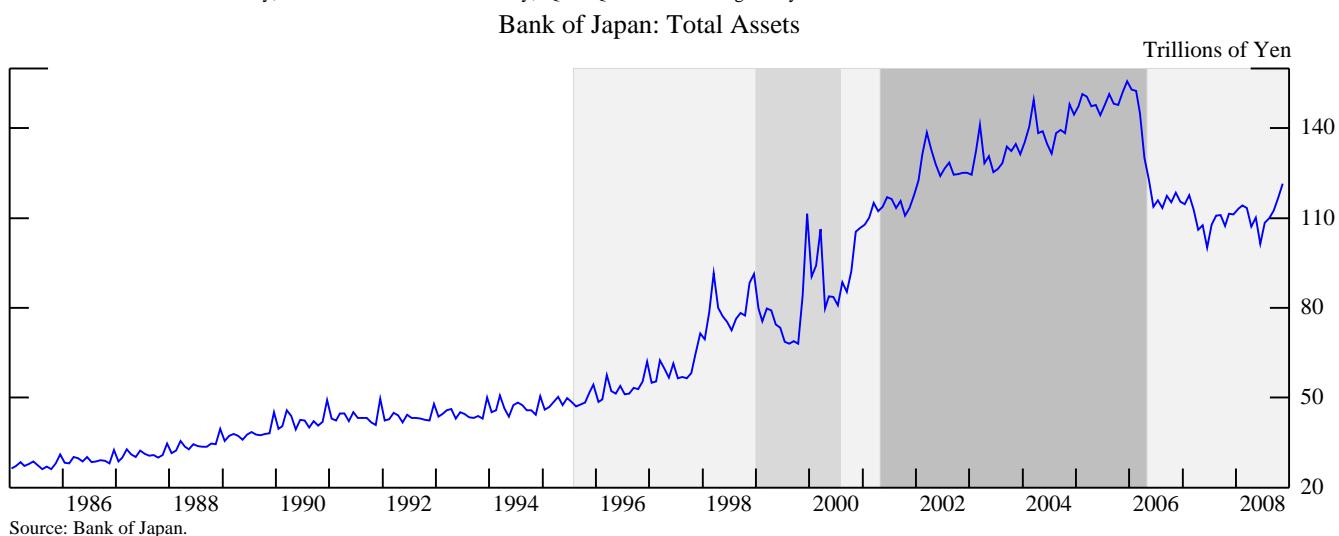
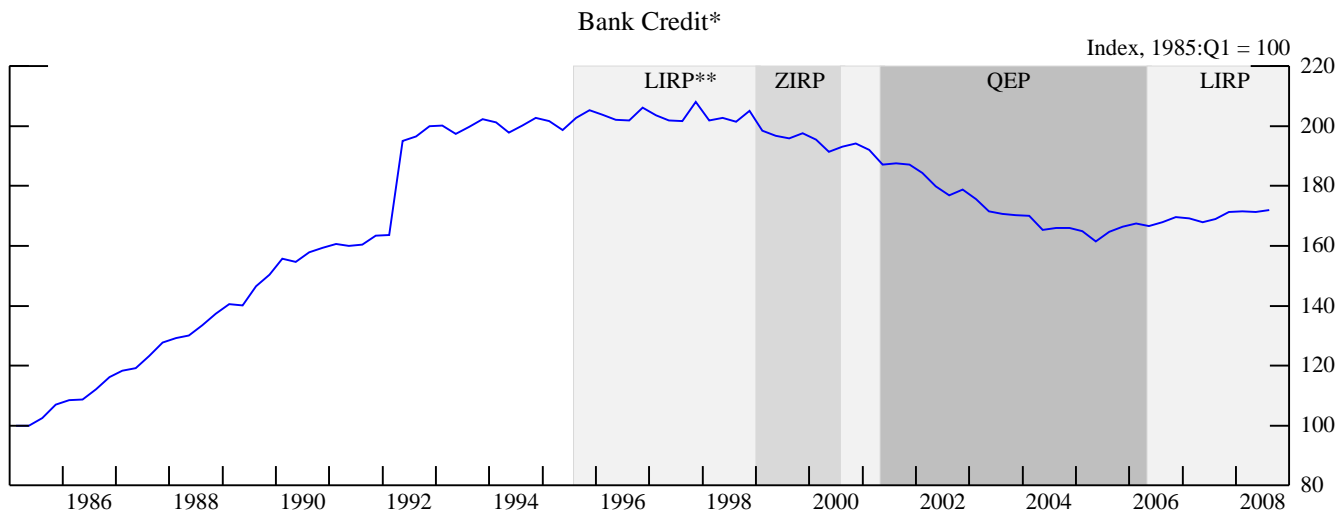


Sources: Call Rate: Assoc. of Call & Disc Companies/Nihon Keizai Shinbun; Government Benchmark Rate: Japan Securities Dealers Association.



Exhibit 3

Money and Credit



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**A Timeline of the Bank of Japan's Monetary Policy Decisions**

Monetary Policy Meetings	Interest Rates		Target Outstanding Current Account Balances at BOJ	Other Policy Actions
	Target Uncollateralized Overnight Call Rate	Official Discount Rate		
January 16, 1998	Maintain on average slightly below the official discount rate of 0.5 percent.	0.5 percent		
September 9, 1998	0.25 percent	0.5 percent		
November 13, 1998	0.25 percent	0.5 percent		(1) Extend commercial paper repo operations from 3 months to 1 year. (2) Establish a temporary lending facility to support firms' financing activities.
February 12, 1999	Introduction of Zero Interest Rate Policy (ZIRP); aim to guide rate as low as possible.	0.5 percent		
September 21, 1999	0.0 percent	0.5 percent		Promise to continue the current easy stance of monetary policy until deflationary concerns subside.
October 13, 1999	0.0 percent	0.5 percent		(1) Begin outright purchases of short-term government securities. (2) Add two-year government securities for repo operations. (3) Utilize a full range of measures against the Y2K problem.

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**A Timeline of the Bank of Japan's Monetary Policy Decisions**

Monetary Policy Meetings	Interest Rates		Target Outstanding Current Account Balances at BOJ	Other Policy Actions
	Target Uncollateralized Overnight Call Rate	Official Discount Rate		
August 11, 2000	End of ZIRP -- returns to 0.25 percent	0.5 percent		(1) Convert the discount window to a Lombard-type facility, allowing pre-approved banks and securities firms to obtain overnight central bank credit on request within the limits of their collateral, with the loans renewable up to a number of days determined by the BOJ Governor. (2) Will increase outright operations of short-term government securities (no amount specified).
February 9, 2001	0.25 percent	0.35 percent		
February 28, 2001	0.15 percent	0.25 percent		
March 19, 2001	0.0 percent (in effect)	0.25 percent	¥5 trillion (previously ¥4 trillion at time of announcement)	(1) Change the operating target for money market operations, from the uncollateralized overnight call rate to the outstanding balance of banks' deposits at the BOJ. (2) Maintain this policy until the core consumer price index (excluding fresh food) shows inflation of zero or more (on a year-over-year basis) (3) Increase the amount of its outright purchases of long-term government bonds from ¥400 billion per month if the BOJ considers that to be necessary for providing liquidity smoothly
August 14, 2001	0.0 percent (in effect)	0.25 percent	¥6 trillion	Raise outright purchases of long-term government bonds to ¥600 billion per month.

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**A Timeline of the Bank of Japan's Monetary Policy Decisions**

Monetary Policy Meetings	Interest Rates		Target Outstanding Current Account Balances at BOJ	Other Policy Actions
	Target Uncollateralized Overnight Call Rate	Official Discount Rate		
September 18, 2001	0.0 percent (in effect)	<b>0.10 percent</b>	<b>"above" ¥6 trillion</b>	Increase the maximum time period for its Lombard-type facility from 5 to 10 business days during the current reserve period (through October 15).
December 19, 2001	0.0 percent (in effect)	0.10 percent	<b>¥10-15 trillion</b>	(1) Increase the monthly amount of outright purchases of long-term JGBs to ¥800 billion per month. (2) Will increase the amount of commercial paper it purchases under repurchase agreements (3) Will broaden the range of instruments that can be used as collateral for open market operations to include asset-backed commercial paper, mortgage loans, and real-estate backed securities
February 28, 2002	0.0 percent (in effect)	0.10 percent	<b>Can move above ¥20 trillion through March 31, whatever amount necessary</b>	(1) Increase the monthly amount of outright purchases of long-term JGBs to ¥1 trillion per month. (2) From March 1st to April 15th, the end of the March reserve maintenance period, the Bank will apply the official discount rate to the Lombard-type lending facility on any business day, no restrictions on duration.
September 18, 2002	0.0 percent (in effect)	0.10 percent	¥10-15 trillion	Will purchase ¥2 trillion worth of stocks from banks between now and September 2003 at the current market price.
October 30, 2002	0.0 percent (in effect)	0.10 percent	<b>¥15-20 trillion</b>	(1) Increase the monthly amount of outright purchases of long-term JGBs to ¥1.2 trillion per month. (2) Will extend maturities for bills purchased in bill purchasing operations from six months or less to a year or less.

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**A Timeline of the Bank of Japan's Monetary Policy Decisions**

Monetary Policy Meetings	Interest Rates		Target Outstanding Current Account Balances at BOJ	Other Policy Actions
	Target Uncollateralized Overnight Call Rate	Official Discount Rate		
December 17, 2002	0.0 percent (in effect)	0.10 percent	¥15-20 trillion	(1) Will accept a broader range of loans on deeds as eligible collateral. Loans on deeds with original maturity of more than five years and up to ten years will be accepted as eligible collateral. In addition, collateral value ratios will be raised for loans on deeds with original maturity of three years and less. (2) Relax standards for asset-backed commercial paper as eligible collateral (ABCP); until end of March 2005, the ABCP guaranteed by the Bank's counterparty financial institutions will be accepted as eligible collateral and be eligible for Bank's market operations to purchase commercial paper under the repurchase agreement.
March 25, 2003	0.0 percent (in effect)	0.10 percent	<b>¥17-22 trillion from April 1st</b>	Increase purchase of stocks from banks to ¥3 trillion from ¥2 trillion.
April 8, 2003	0.0 percent (in effect)	0.10 percent	¥17-22 trillion	Will examine buying asset-backed securities in the future. In particular, the BOJ will consider outright purchases of commercial paper backed by accounts-receivable held by small- and medium-sized enterprises.
April 30, 2003	0.0 percent (in effect)	0.10 percent	<b>¥22-27 trillion</b>	Include loans to Industrialization Revitalization Corporation as eligible collateral for the BOJ's open market operations.

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**A Timeline of the Bank of Japan's Monetary Policy Decisions**

Monetary Policy Meetings	Interest Rates		Target Outstanding Current Account Balances at BOJ	Other Policy Actions
	Target Uncollateralized Overnight Call Rate	Official Discount Rate		
May 20, 2003	0.0 percent (in effect)	0.10 percent	¥27-30 trillion	
June 11, 2003	0.0 percent (in effect)	0.10 percent	¥27-30 trillion	Will begin direct purchase of asset-backed securities in late July. Will initially limit total purchases to ¥1 trillion, commercial paper must have an A-1 rating and longer-term securities must be BB or higher.
October 10, 2003	0.0 percent (in effect)	0.10 percent	¥27-32 trillion	Extension of the maturity of the purchase of Japanese government securities with repurchase agreements.
October 10, 2003	0.0 percent (in effect)	0.10 percent	¥27-32 trillion	Enhancement of monetary policy transparency -- presenting the basic thinking on the conduct of monetary policy and the evaluation of the developments of the economy and prices in amore timely and lucid manner.
October 10, 2003	0.0 percent (in effect)	0.10 percent	¥27-32 trillion	Clarification of QEP policy. Commitment to maintaining zero interest rates until a return to positive inflation.

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**A Timeline of the Bank of Japan's Monetary Policy Decisions**

Monetary Policy Meetings	Interest Rates		Target Outstanding Current Account Balances at BOJ	Other Policy Actions
	Target Uncollateralized Overnight Call Rate	Official Discount Rate		
April 9, 2004	0.0 percent (in effect)	0.10 percent	¥30-35 trillion	Introduction of the securities lending facility to provide the markets with a secondary source of Japanese government securities.
May 20, 2005	0.0 percent (in effect)	0.10 percent	¥30-35 trillion	The BOJ may allow current account balances to fall below target.
March 9, 2006	0.0 percent (in effect)	0.10 percent	¥30-35 trillion	Exits QEP.
July 1, 2006	0.25 percent (in effect)	0.40 percent		
February 1, 2007	0.5 percent (in effect)	0.75 percent		
October 1, 2008	0.3 percent (in effect)	0.50 percent		

December 5, 2008

#### **4. Japanese Money Markets During Periods of Low or Zero Interest Rates**

Fang Cai and Clara Vega<sup>1</sup>

##### **Executive Summary**

Very low short-term interest rates may be expected to reduce the profitability of trading in money markets and thus to reduce the scale of activity in those markets. This note discusses the impact of Japan's very low policy interest rates since 1995 on activity in the yen money market, with an eye towards possible lessons to be learned. Our main findings are as follows:

- During periods of very low but non-zero interest rates (as low as 25 basis points), the uncollateralized money markets were able to maintain a moderate level of activity. However, periods of zero overnight interest rates in Japan were associated with very low levels of activity in uncollateralized money markets.
- In contrast, the size of collateralized money markets grew during zero interest rate periods. With overnight call rates close to zero and the spread between uncollateralized and collateralized rates near zero, lenders may have shifted to collateralized markets where lending was less risky.
- Periods of zero interest rates may have had permanent effects on some markets. Activity in the uncollateralized call market rebounded when, on two occasions, the policy rate rose from zero. But activity did not climb back to the levels prevailing immediately before the rate had reached zero. However, the decline in activity in that market may also have resulted from the deregulation of competing markets.
- As was the case for other uncollateralized markets, the commercial paper (CP) market shrank during periods of zero overnight interest rates. However, any adverse impacts this may have had were likely limited because of the relatively small size of the CP market in Japan. Because the U.S. corporate sector is relatively more dependent than Japan's corporate sector on non-bank sources of funding such as commercial paper, a decrease of CP market activity during zero interest rate periods could have a more adverse impact on the U.S. economy.

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<sup>1</sup> Division of International Finance.



## **The impact of very low interest rates on Japanese money markets**

We consider three distinct interest rate regimes: (i) a “regular” monetary policy period, when the policy rate (the red line in Chart 1) was on average near 3 percent; (ii) three low interest rate periods (LIRP) which are shaded in green in Chart 1, when the policy rate was 15-to-50 basis points; and (iii) the periods of the zero interest rate policy (ZIRP) and quantitative easing policy (QEP), which are shaded in grey in Chart 1, when the policy rate was near zero.<sup>2</sup>

### Uncollateralized Money Markets

During the “regular” monetary policy period, the uncollateralized call market was the largest uncollateralized money market of any kind in Japan. This market is a short-term interbank market comparable to the federal funds market in the United States, although it is bigger in size, both on absolute terms and as a share of GDP (see Table 1).

As shown in the upper left panel of Chart 1, when the overnight call rate dropped from 2.25 percent in March 1995 to 50 basis points in October 1995, the amount of loans outstanding in the uncollateralized call market did not register much change. In early 1999, however, when the Bank of Japan (BoJ) put in place the ZIRP, the amount of outstanding loans in the call market dropped sharply. Conversely, during the short period from August 2000 to March 2001, when the BoJ raised its target for the uncollateralized call rate to 25 basis points, the amount outstanding in the market doubled immediately, from about 9 trillion yen in July 2000 to 18 trillion yen in August 2000. Outstanding amounts dropped again in early 2001 when the BoJ introduced the QEP and brought overnight rates back to zero. The average amount outstanding in the uncollateralized call market during the QEP was 6 trillion yen, the lowest level of the periods we describe. BoJ researchers report that, along with the decline in outstanding amounts in the market at that time, banks also shut down many of the lines of credit they had established with each other.<sup>3</sup>

As with the uncollateralized call market, the amounts outstanding in the certificates of deposit (CD) and the commercial paper markets (shown in the middle and bottom left panels of Chart 1) decreased during periods of zero interest rates and rebounded significantly in the short period from August 2000 to March 2001, when the BoJ raised its target for the call rate from zero to 25 basis points. The top panel of Chart 2 shows that this basic pattern holds for domestic non-financial CP, although financial CP appears to have been less sensitive to the varying regimes.

### Collateralized Money Markets

In contrast to the uncollateralized markets, the collateralized money markets we study (the collateralized call market and the market for repurchase agreements, shown in the right-hand side of Chart 1) tended to grow during ZIRP and QEP and to stabilize or shrink during low but

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<sup>2</sup> The regular monetary policy period is from January 1992 to August 1995. The LIRP periods lasted from September 1995 to February 1999, August 2000 to March 2001, and April 2006 to December 2008 respectively. The ZIRP and QEP periods are from March 1999 to August 2000 and March 2001 to March 2006 respectively.

<sup>3</sup> Financial Markets Department, Bank of Japan (2006), “Financial Markets Report – Supplement – Issues Regarding Money Markets after the Conclusion of the Quantitative Easing Policy.”

non-zero interest rate periods. There are two complementary factors that may have contributed to the growth of these markets when overnight interest rates were zero. First, the growth during the period of QEP reflected a simultaneous increase in Japanese government bonds (JGBs) held by large financial institutions, which led to an increased use of JGBs for collateral.<sup>4</sup> Second, with overnight uncollateralized call rates close to zero, the spread between uncollateralized and collateralized rates was also near zero, and in such circumstances it may have made economic sense for lenders who were able to do so to move to collateralized markets, where lending was less risky. During the QEP, the average spread between uncollateralized and collateralized overnight call rates was only one half of a basis point, which may have been too low to cover the additional risk of making an unsecured loan relative to a collateralized loan.

### Comparing the Impact of a Zero Target Rate to Low but Positive Target Rates

As can be seen in the charts, the activity in uncollateralized markets showed very large declines when the policy interest rate moved from a small but positive rate to zero, raising the question as to whether a zero rate has a disproportionate impact on money markets. To answer this question, we regress the monthly amount outstanding in the call markets on the level of the uncollateralized call rate and a dummy variable equal to one during the zero interest rate periods (ZIRP and QEP), also controlling for lagged industrial production, lagged outstanding liabilities, and seasonal dummy variables.<sup>5</sup> We then test the hypothesis that the amounts outstanding during the zero-interest rate regime are different from what would be predicted by a simple linear relation between the amount outstanding in the money market and the level of the uncollateralized call rate. We find that, controlling for economic activity and the level of the interest rate, the size of the uncollateralized call market decreased substantially during zero interest rate periods, while the size of the collateralized call market increased substantially (Table 2). Thus, the move from low interest rates to a zero interest rate regime did appear to have had a disproportionate impact on money markets in Japan.

### Market Recovery after the QEP

At the end of QEP, BoJ researchers expressed concerns that the time needed for institutions to re-establish their creditworthiness in the market might be prolonged. However, there were relatively few problems associated with the recovery of money market activity.<sup>6</sup> That said, the data show that, with the uncollateralized call rate target in both cases at 50 basis points, the outstanding amount in the uncollateralized call market in 2008 remained less than half of what it was in 1997. This may indicate that the period of zero interest rates had a permanent impact on the uncollateralized call market, although some of the activity in that market may also have been replaced by the CD and CP markets, whose growth was encouraged by deregulation in

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<sup>4</sup> Financial Markets Department, Bank of Japan (2006), "Financial Markets Report – Supplement – Issues Regarding the Money Markets after the Conclusion of the Quantitative Easing Policy." The increase of Japanese government bonds (JGB) held by large financial institutions reflected the increase in issuance of these bonds by the government to finance its increasing deficit.

<sup>5</sup> We exclude from our analysis the amount outstanding in the commercial paper, certificate of deposit and repurchase agreement markets because these markets were heavily regulated during the "regular" monetary policy period and the first LIRP period.

<sup>6</sup> Some foreign banks, which were unable to immediately reestablish lines of credit, did experience minor problems after the end of QEP.

the late 1990s.<sup>7</sup> In contrast, the current amounts outstanding in the collateralized call market are similar to those in 1997. Thus, the period of zero interest rates may have had a permanent effect on the uncollateralized call market, but not in the collateralized call market.

### **Possible implications for the United States**

ZIRP and QEP were intended to reduce financing costs, increase liquidity, and thus support lending and aggregate spending. However, by compressing activity in the money markets, it is possible that these policies might have disrupted the flow of credit by financial institutions to the non-financial sector. Japan's experience during the zero interest rate periods provides some interesting implications for the United States.

During the QEP period, the BoJ acted as the market maker by providing ample liquidity to banks. As a result, interbank money markets were, in effect, replaced by central bank lending, and likely without a significant negative impact on the ability of banks to make loans. Further, interbank markets appear to have recovered smoothly (if in some cases incompletely) after QEP ended.

However, the one nonbank money market we examined, the domestic nonfinancial commercial paper market, did decline noticeably during the ZIRP and QEP periods. The impact of the decline in nonfinancial CP on the real sector in Japan is difficult to gauge. As shown in the lower panel of Chart 2, overall private bank loans to the non-financial sector declined as well, so nonfinancial corporations do not appear to have replaced CP funding with lending from other sources. Even so, it remains unclear whether the contraction of the CP market adversely affected nonfinancial firms to a significant extent. First, Japanese firms are relatively less dependent on CP markets and more dependent on bank loans for their funding (see the comparison of Japan and the United States in Table 1). Additionally, at least some of the decline in both nonfinancial CP outstanding and in loans to the nonfinancial sector, both shown on Chart 2, may owe to reductions in the demand for borrowing rather than reduction in its supply. Notably, corporate savings rose significantly during this period in Japan as well as in many other countries, and firm's needs for external finance diminished as their retained earnings rose.

However, a contraction of non-bank money markets in the United States might generate greater complications than likely was the case in Japan during the QEP period. Many U.S. firms depend more heavily on non-bank money markets for their funding than in Japan. And to the extent that the on-going recession eats into cash-flow and profits, U.S. firms may be less able to forego financing than their Japanese counterparts were earlier in this decade, when economic growth was recovering and profits were rising.

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<sup>7</sup> The CD market experienced considerable growth in October 1995 when the minimum issuance unit was lowered, restrictions on maturities were relaxed, and issuance limitations based on the company's net worth were eliminated. Prior to 1998, CP issuers were not allowed to sell CP directly to institutional investors and banks were not allowed to issue CP.

**Table 1. Comparison of the US and Japanese Money Markets**

Amounts outstanding are in billions of dollars or as a share of GDP as of June 2008.

	Japan Markets			US Markets		
	Market	Amount Outstanding in billions of US dollars	Amount Outstanding as a share of GDP (%)	Market	Amount Outstanding in billions of US dollars	Amount Outstanding as a share of GDP (%)
Interbank Market	Uncoll. Call	\$140	2.9	Federal Funds	\$109	0.8
				Eurodollar	\$430.2*	3.1
Other Money Markets	Coll. Call	\$97	2.0			
	CD	\$3,065	63.0	CD	\$3,617	26.2
	CP	\$161	3.3	CP	\$1,741	12.6
	Repo	\$1,184	24.3	Repo	\$1,755	12.7
MMMF	MMMF	\$2,82	57.2	MMMF	\$3,480	25.2

\*Source: Federal Reserve Board H.6 release. The data is as of February 2006. The Japanese call markets are short-term interbank money markets comparable to the federal funds market in the United States.

**Table 2. Does a target call rate of 0 basis points have a significant effect on money markets?**

We regress the monthly amount outstanding in each call market on its own lag, a dummy variable equal to one during the zero interest rate periods (ZIRP/QEP) and zero otherwise, the level of the call rate, lagged industrial production growth, and monthly dummies to control for seasonality in the data. The sample period is from January 1992 to August 2008.

	Uncollateralized Call Market		Collateralized Call Market	
	Coef.	t-stat	Coef.	t-stat
ZIRP/QEP	-1738.692	-3.83	843.760	4.5
Call Rate	118.292	0.94	293.035	3.98
Lagged IP	-13.279	-0.13	87.990	1.89
Lagged Dep. Var.	0.910	41.43	0.7531	17.36

Chart 1

12-03-08

### Japan's Uncollateralized and Collateralized Markets

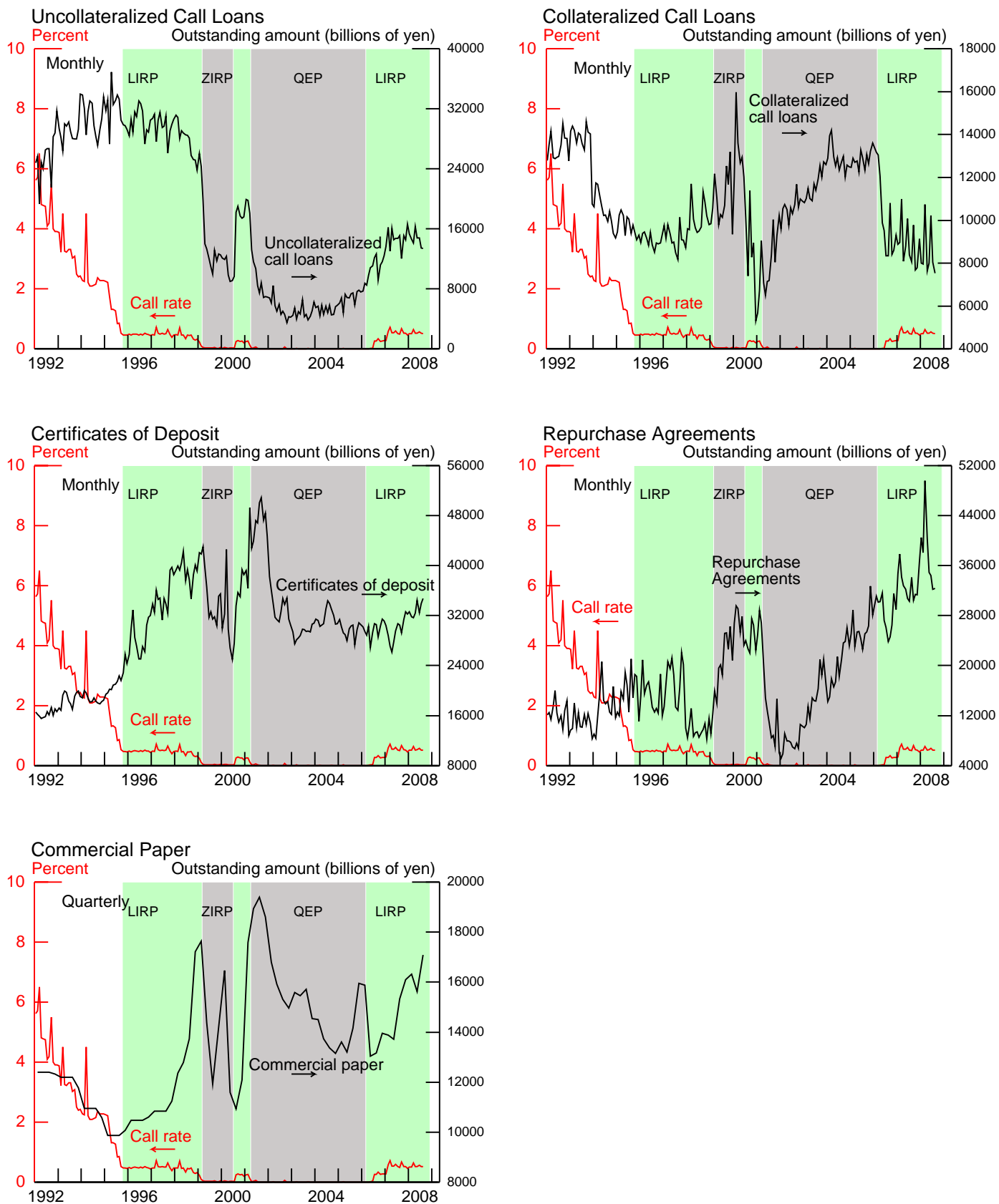
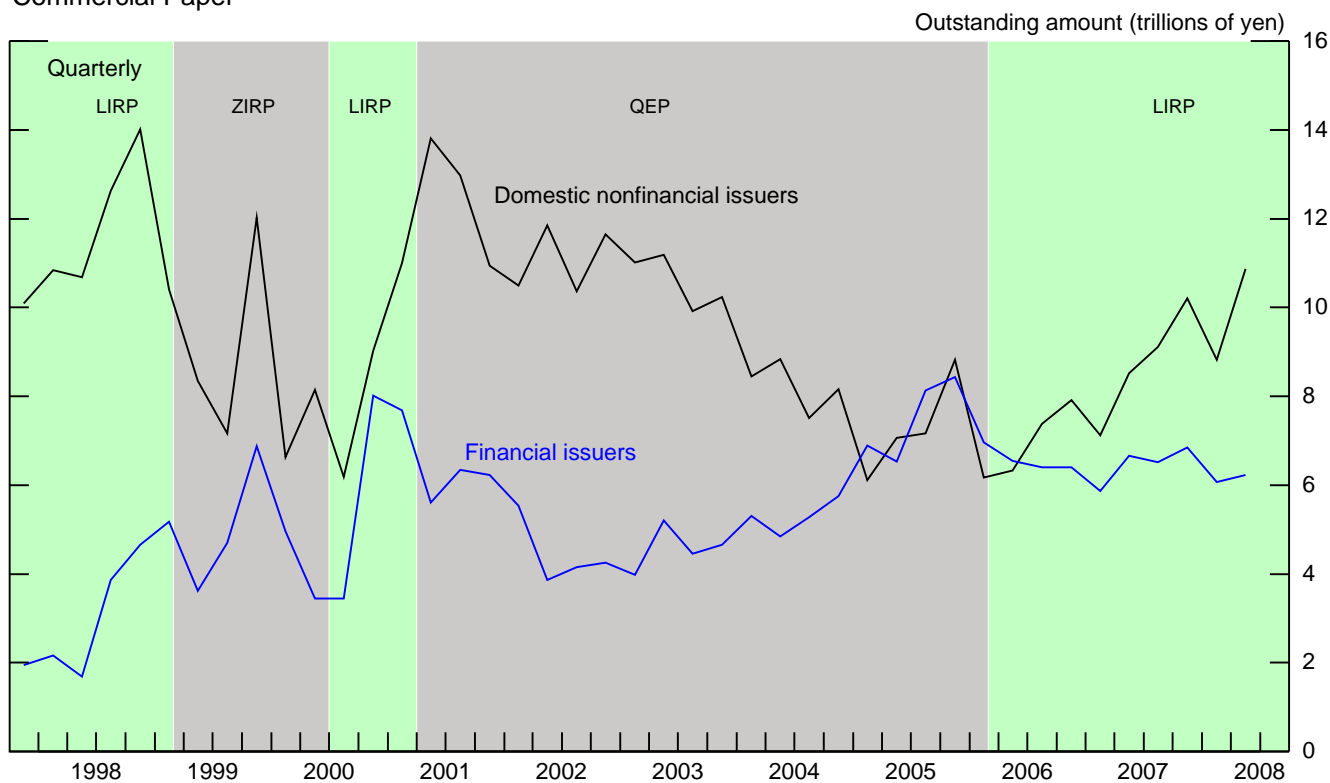


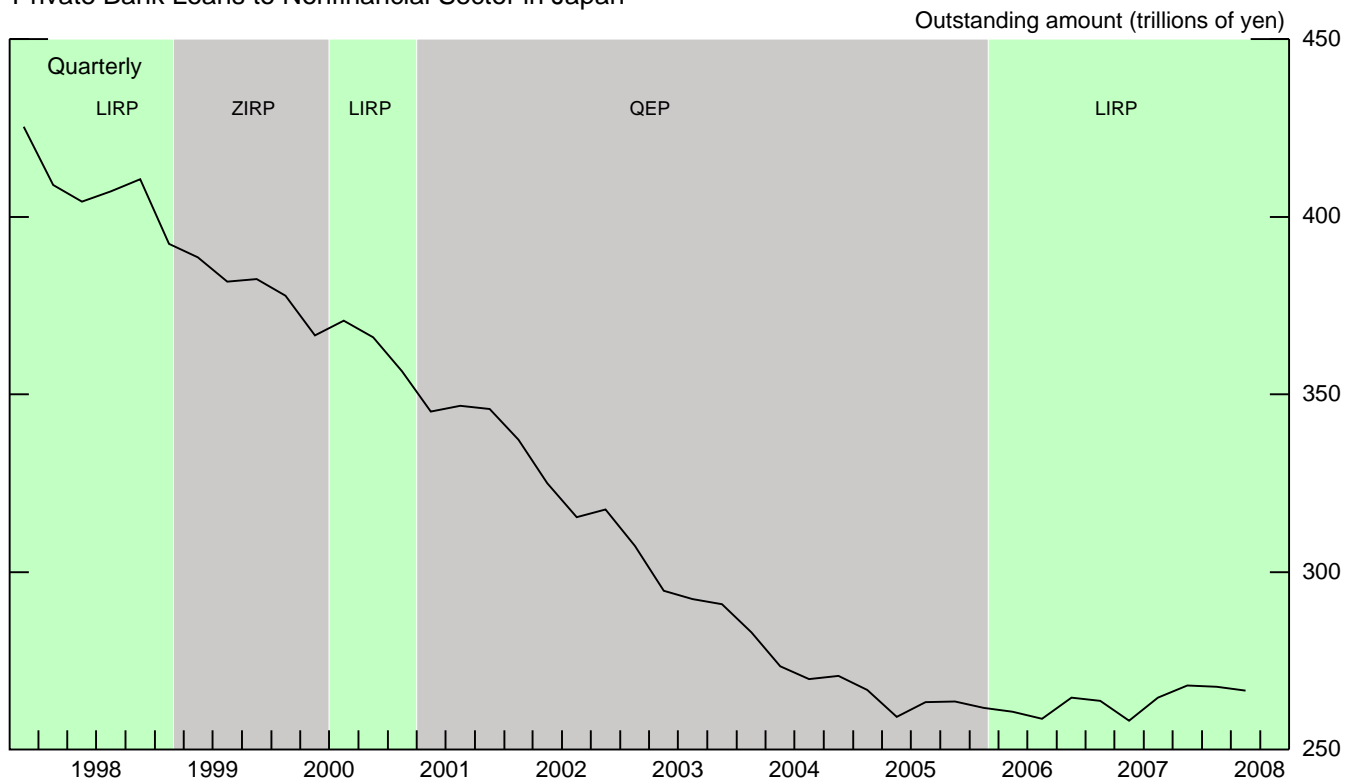
Chart 2

12-04-08

Commercial Paper



Private Bank Loans to Nonfinancial Sector in Japan



December 5, 2008

## 5. Effects of the Bank of Japan's Communication Strategy at the Zero Lower Bound

David Bowman and Brian Doyle<sup>1</sup>

We present evidence suggesting that during the period of its quantitative easing policy (QEP), the Bank of Japan (BOJ) more effectively committed itself to maintaining highly stimulative monetary policy than had been the case during the earlier period of its zero interest rate policy (ZIRP). Interest rates at a range of maturities appear to have declined during QEP by more than can be explained by macroeconomic developments alone. However, the impact of the BOJ's communication strategy *per se* is hard to disentangle from other factors, such as the rise in current account balances under QEP and the BOJ's purchases of longer-term Japanese government bonds (JGBs) and other assets.

### Background

The Japanese economy contracted sharply in 1998, but the BOJ had already decreased its policy rate in first half of the 1990s, leaving the overnight call rate (shown in red in the top panel of Chart 1) at just 50 basis points. The BOJ introduced the ZIRP in February 1999, and in an attempt to manage the market's expectations of future policy actions, Governor Hayami announced later in April that the policy would be continued until "deflationary concerns are dispelled." However, Hayami refused to set more specific conditions, and it was left unclear what the BOJ meant by deflationary concerns.<sup>2</sup> In fact, the BOJ ended the ZIRP by raising its policy rate to 25 basis points in August 2000, even though both headline and core consumer price indexes remained in deflation (the middle panel).

Economic indicators began to point to a slowdown in activity (shown in the bottom panel) almost immediately after exiting ZIRP. The small increase in policy rates was likely not an important contributor to this slowdown, as most of the world was feeling the effects of the aftermath of the high-tech bubble, but the poor timing of the decision may have harmed the BOJ's credibility.<sup>3</sup> The BOJ came under pressure to reverse its decision and, after resisting, surprised markets by cutting rates by 10 basis points in February 2001.

The BOJ introduced QEP in March 2001. As an important element of QEP, the BOJ changed its policy target from the overnight call rate to the current account balances (CAB) held at the BOJ and set a target level for CAB that was calculated to keep overnight rates at zero.<sup>4</sup> In addition, the BOJ was more explicit about the conditions required to end this new policy

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<sup>1</sup> Division of International Finance.

<sup>2</sup> For example, Deputy Governor Yamaguchi indicated that it may not be appropriate to judge deflationary pressures "simply by looking at the decline in the CPI and the GDP deflator alone."

<sup>3</sup> Indeed, the United States entered recession in March 2001 and the Federal Reserve began cutting the federal funds rate target in January 2001.

<sup>4</sup> The BOJ targeted current account balances, which it defined as the monetary base excluding cash in circulation, rather than the monetary base itself because it believed that it would be difficult to control short-run movements of cash in circulation.



framework, stating that quantitative easing would be pursued until “the consumer price index (excluding perishables) registers stably at zero percent or an increase year on year.” Toshihiko Fukui replaced Governor Hayami in March 2003, and soon reinforced the BOJ’s commitment to QEP. The exit conditions were clarified in October 2003, with a commitment that year-over-year core deflation must have ended for at least a few months and that the BOJ must forecast that it would not return. The target for current account balances was raised several times during the period, reaching a high point of ¥30-35 trillion yen in January 2004.<sup>5</sup> The BOJ took several other extraordinary steps over this period, including expanding its purchases of JGBs, buying asset-backed securities and bank equity, and relaxing its collateral requirements. The Bank of Japan formally ended QEP in March 2006, returning to the overnight call rate as its policy target, although it did not actually raise the call rate until July as it first allowed current account balances to be drained.

At the time that it exited QEP, the BOJ announced that it would move policy to control inflation over a one-to-two year horizon. While it stated that most Board members had definitions of price stability that fell within a range of 0-to-2 percent inflation in the consumer price index, it was careful to note that this did not constitute a target. It is noteworthy that the BOJ resisted the idea of setting a specific target for inflation throughout its battle with deflation, although many outside commentators had recommended doing so. The BOJ frequently downplayed the importance of deflation, leaving it unclear exactly what inflation rate it was seeking to achieve.<sup>6</sup>

The BOJ also frequently sparred with officials at the Ministry of Finance (MOF), as members of the BOJ argued that fiscal policy should take the lead in the economic recovery and MOF officials emphasized the need for the BOJ to do more. Prior to the introduction of quantitative easing, BOJ officials at times publicly questioned the ability of monetary policy to either help the real economy or end deflation.<sup>7</sup> Governor Fukui generally maintained a more positive posture, stressing the role played by QEP in ensuring financial stability and in preventing stronger deflationary pressures from emerging, but tensions with the MOF did not end under his administration – particularly during the period near the end of QEP, when many MOF and other government officials argued publicly that the policy should be maintained.

### **Assessing the Impacts**

The BOJ’s commitment to maintaining ZIRP was perceived by many as weak. In comparison, the BOJ appeared to more effectively convince markets of its commitment to the QEP. As can be seen in the top panel of the second chart, yen Libor rates were about 10 basis points lower and more stable under QEP than under ZIRP. Near-dated three-month euro-yen futures rates, shown in the middle panel, were also about 10 basis points lower under QEP, while

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<sup>5</sup> This level was much larger than the level of required reserves, which was roughly ¥6 trillion. The BOJ also announced that it was ready to purchase long-term government bonds to meet the target.

<sup>6</sup> Governor Hayami at one point stated that “Japan’s economy is not in the middle of deflation,” even as headline and core consumer price indexes were declining, saying instead that price declines were not generalized.

<sup>7</sup> For example, in a speech given in 2000, Governor Hayami minimized the power that monetary policy had in fighting deflation and instead emphasized that “the primary economic policy responses available at this time are inevitably (1) direct demand creation measures centered on fiscal policy, and (2) confidence building measures, including financial system stabilization and structural reforms of the economy.”

longer-dated futures were on average 30 basis points lower, although they did rise in the second half of 2003 as the economic recovery appeared to solidify. The reduction in borrowing costs appears to have been fairly uniform across banks. Baba et al. (2005a) document that differences between bank borrowing costs seemed to diminish under QEP. Evidence of this can be seen in the bottom panel, which graphs the standard deviation of one-month borrowing costs reported by Japanese banks in the Libor panel.

Overall, these developments indicate that participants in the interbank market were more convinced that the BOJ would keep interest rates near zero for sustained period under QEP than they had been under ZIRP. While most of the decline in interest rate futures occurred between the end of the ZIRP and the start of the QEP, suggesting that at least initially the weakening economy may have convinced people that the BOJ would keep rates low, it is worth noting that rates remained low even as the economy recovered.

The impacts of QEP and the BOJ's communications strategy on banks' short-term borrowing costs, while discernable, were fairly modest given that most short-term interest rates were already quite low when these policies were put in place. Impacts on longer-term interest rates may have been of greater economic importance. The top panel of the third chart shows two segments of the yield curve for JGBs, graphing the 2-5 year and 5-10 year forward rates. Both rates are lower under QEP. Much of this decline took place during the economic slowdown in 2001-02, but there are several papers that provide empirical support for the view that the Bank of Japan's policies lowered longer-term yields even controlling for the macroeconomic environment.<sup>8</sup> Bernanke, Reinhart and Sack (2004) find that long-term yields were about 35 basis points lower than predicted by a no-arbitrage term structure model under both ZIRP and QEP, which they interpret as evidence that the policies may have been effective, although using an event study they find little evidence that BOJ policy statements *per se* affected yields. Employing a structural term structure model, Baba et al. (2005b) find that while ZIRP and the early stages of QEP had only modest impacts on long-term JGB yields, the commitment to QEP did appear to lower yields by about 20 basis points in 2003 (the end of their sample). Extending a similar methodology to a longer sample, Oda and Ueda (2007) find a slightly larger impact of about 35 basis points. Okina and Shiratsuka (2004) also find an impact on the JGB yield curve, suggesting that the expected time that interest rates would remain at zero increased from six months under ZIRP to about a year under QEP. Overall, these estimated impacts are modest but not negligible. While each of the papers cited does attempt to isolate the impact of the BOJ's policies by controlling for other macroeconomic variables, it is difficult to determine whether the effects they find are the result of the BOJ's communications strategy or the more direct measures taken under QEP.

We conclude by briefly looking for an impact of the BOJ's policies on inflation expectations. The Japanese government did not begin issuing indexed debt until 2004, so there are no direct measures of inflation compensation over most of the period of interest. However, survey measures of inflation, shown in the middle panel, are available and they show that

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<sup>8</sup> The sharp rise in forward rates in June 2003 appears to have little to do with BOJ policies. Long-term rates also rose sharply over the same period in the United States and other countries, and this seems related to a sudden reversal in market expectations that the Federal Reserve would reduce its target for the federal funds rate to near zero.

expectations declined over the first half of the QEP period and subsequently picked up as the economic recovery strengthened. Although it is possible that the clarification of exit conditions in 2003 also positively affected inflation expectations, a simple regression (not shown) of inflation expectations on actual inflation and oil prices does not reveal any unusual rise in expectations over this period. The lower panel, which shows the standard deviation of inflation forecasts across participants in the survey, also gives reason to doubt that the clarification helped more firmly anchor inflation expectations. If QEP had helped anchor inflation expectations, then we would expect to see this variable decline, but instead it remained fairly steady over most of the ZIRP and QEP periods.

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Chart 1

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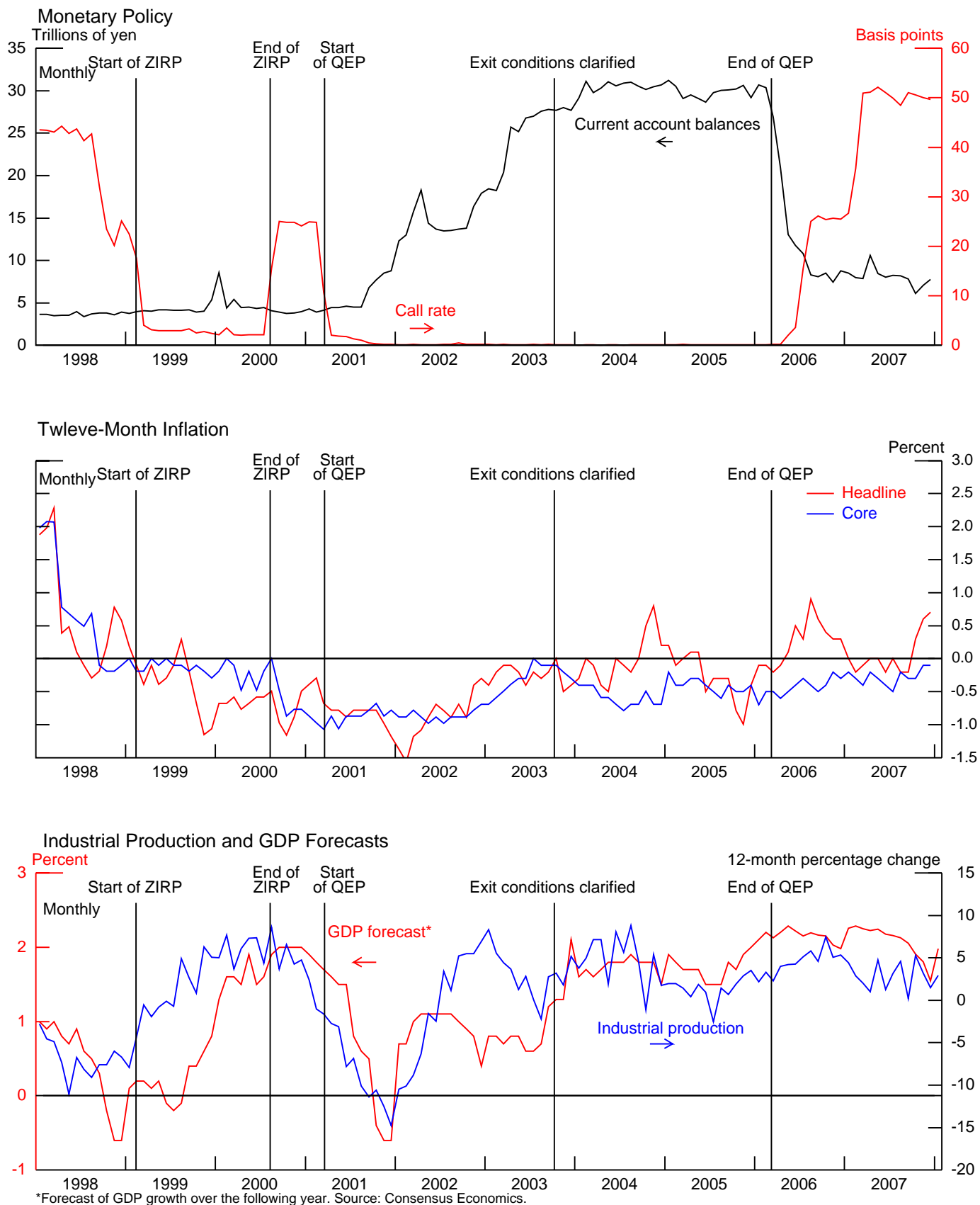
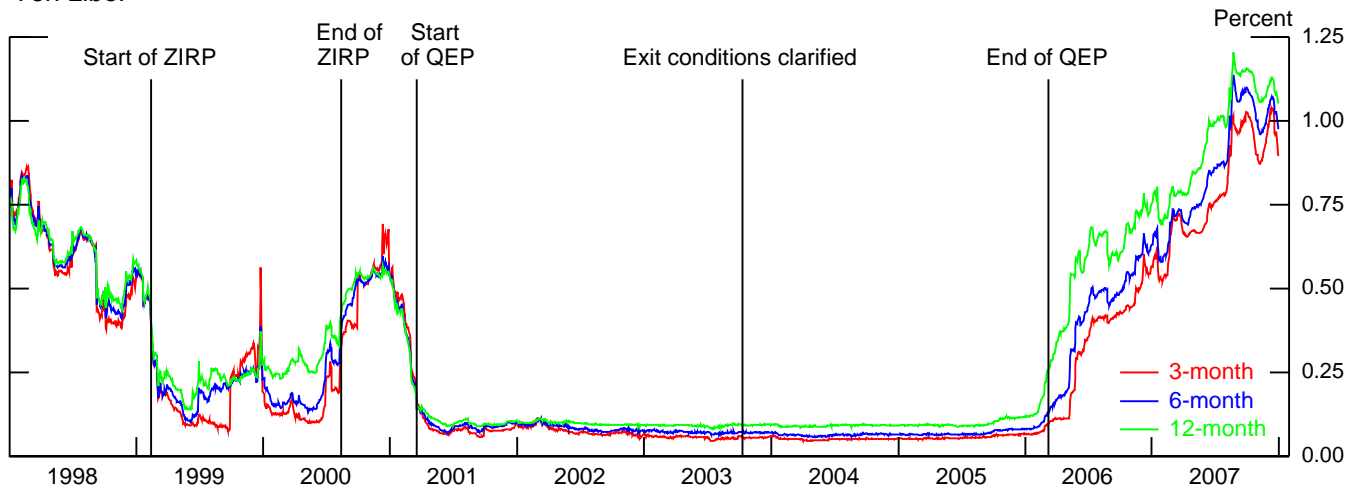


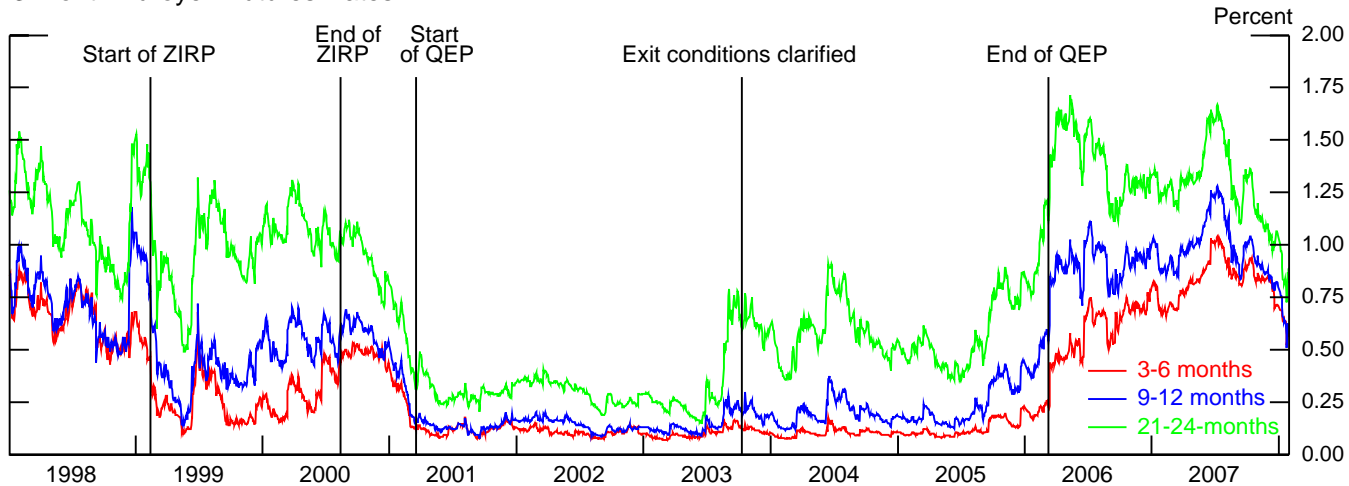
Chart 2

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Yen Libor



3-Month Euroyen Futures Rates



Standard Deviations of Borrowing Costs Across Banks in Yen Libor Panel

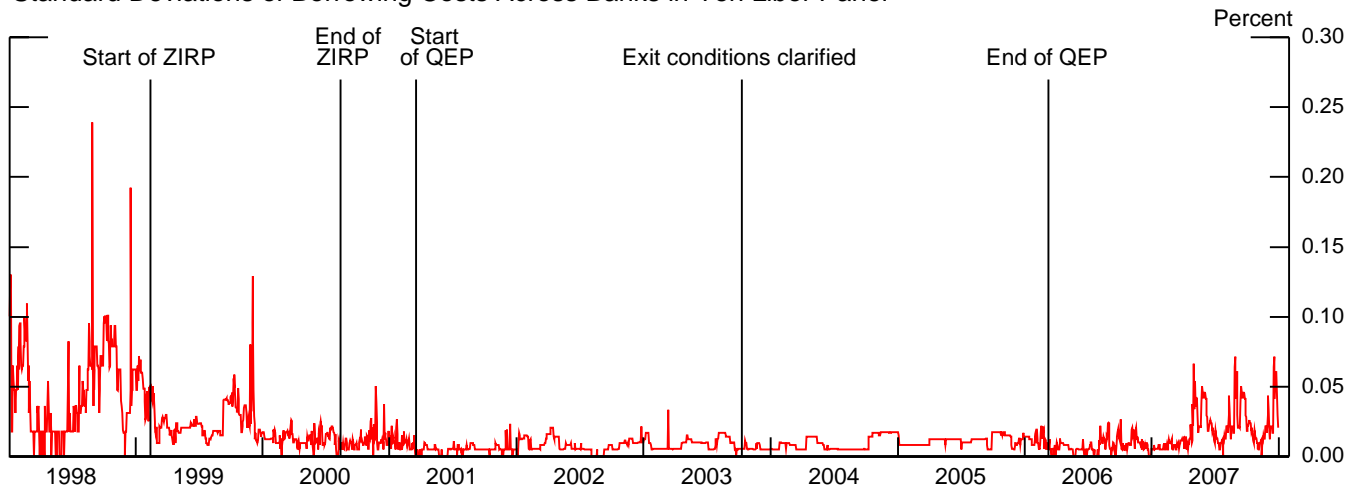
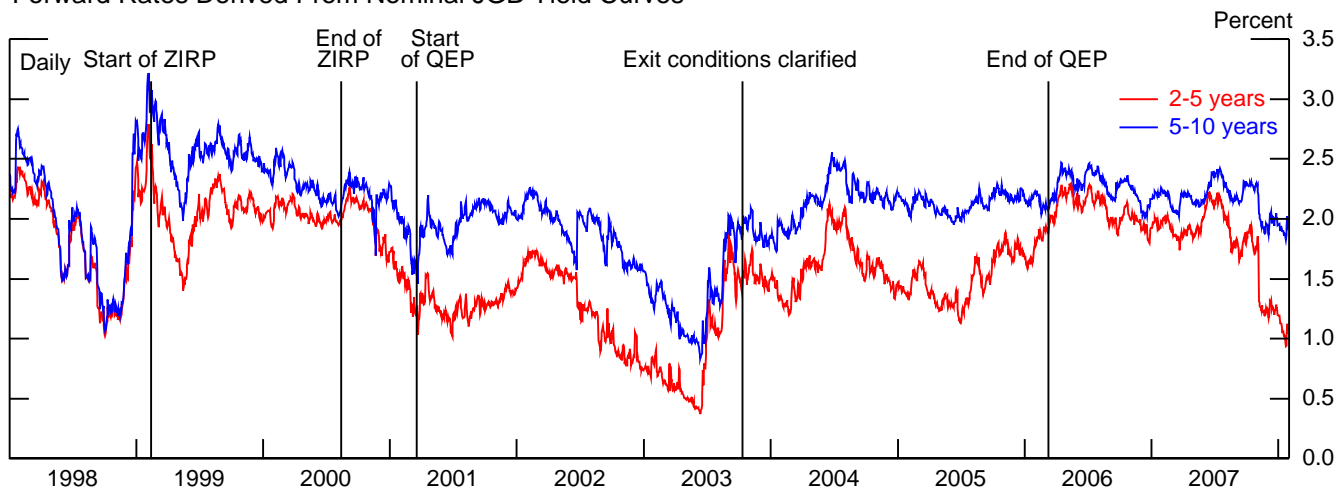


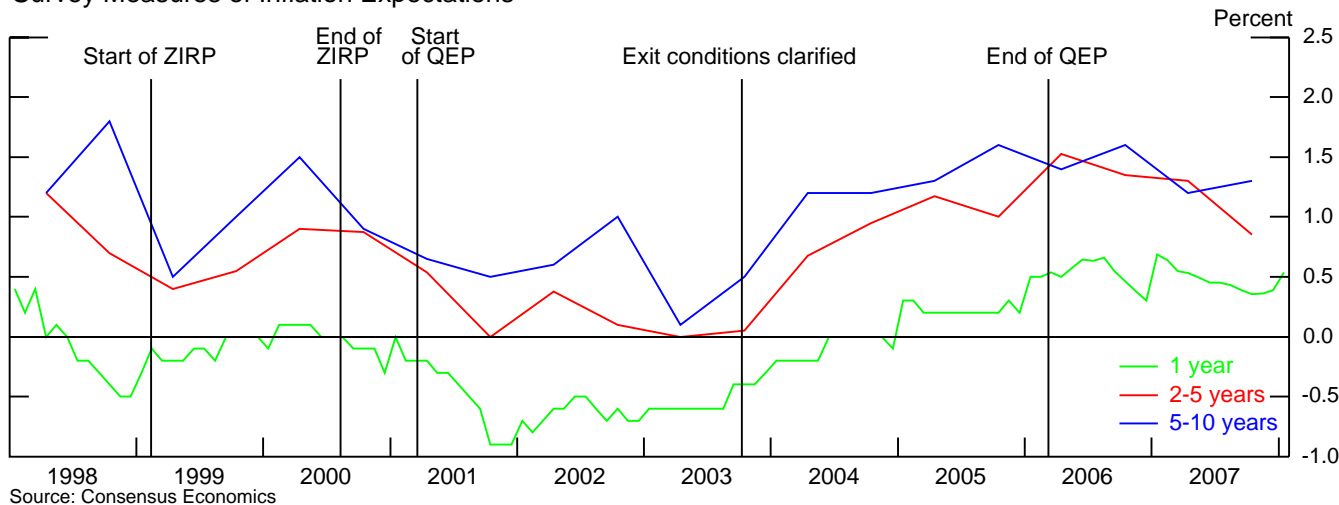
Chart 3

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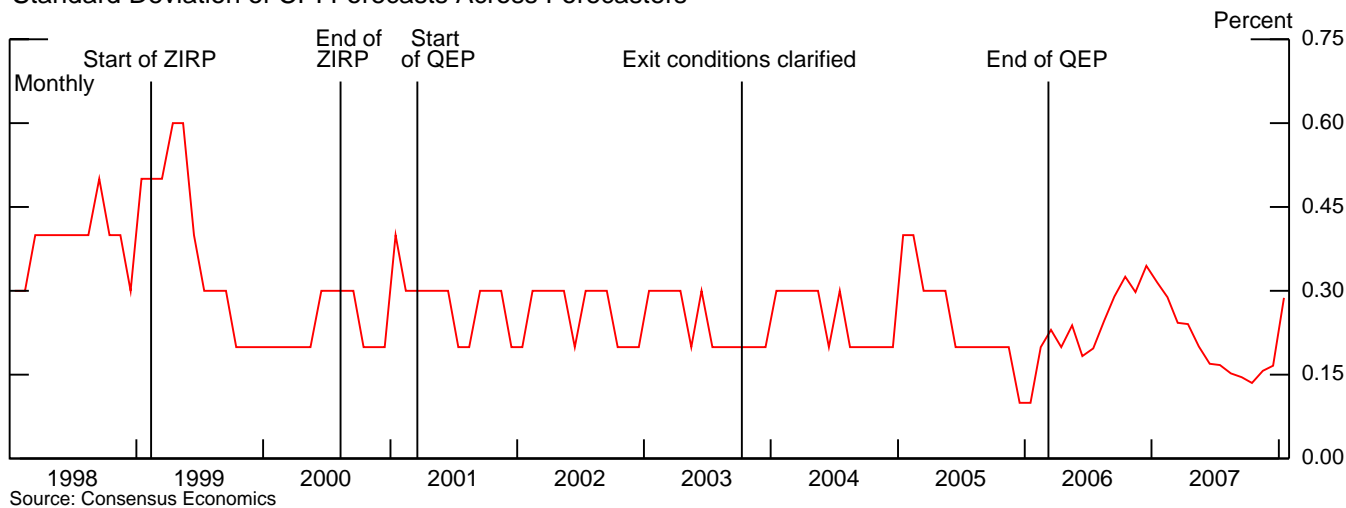
Forward Rates Derived From Nominal JGB Yield Curves



Survey Measures of Inflation Expectations



Standard Deviation of CPI Forecasts Across Forecasters



December 5, 2008

## **6. Implications of the Health of the Japanese Banking Sector for the Effectiveness of Monetary Policy**

Ricardo Correa and Sally Davies<sup>1</sup>

### **Executive Summary**

Japanese banks were very weak and, perhaps not coincidentally, bank lending declined during much of the time Japan's zero interest rate (ZIRP) and quantitative easing (QEP) policies were in place. This note examines whether banking sector weakness lessened the effectiveness of monetary policy during the ZIRP and QEP. To address this question, we survey the economic literature on bank lending in Japan during this period. Although the results from the literature are somewhat mixed, in our view, the evidence suggests that weak bank health did reduce the effects of monetary policy loosening during the ZIRP and the early years of the QEP. In addition, the literature suggests that the weakening of borrower balance sheets—i.e., borrowers became less creditworthy—also reduced the impact of monetary policy. Finally, we examine what effect the ZIRP and QEP may have had on bank health and conclude that bank profits were affected little by these policies.

### **Background on the Japanese Banking Crisis**

The Japanese banking crisis began in the 1990s, as Japanese banks struggled with a large amount of nonperforming loans (NPLs, the top left panel of the exhibit), significant loan losses, and negative profits (the middle left panel). Bank capital ratios fell as banks absorbed these losses (the bottom left panel). A blanket guarantee of 100 percent deposit insurance was put in place in 1996, after the failure of a few small depository institutions. However, financial stability was most tenuous from late 1997, beginning with the unprecedented failures of a large bank and a large securities firm, until March 1999, when the government injected tier 1 capital into the major banks by purchasing convertible preferred shares. During this period, Japanese banks experienced funding problems and paid a “Japan premium” in the London interbank market that persisted intermittently until the tier 1 capital injections in 1999.<sup>2</sup>

As can be seen from the left-hand panels in the exhibit, Japanese banks continued to struggle with NPLs and loan losses well into this decade. NPLs peaked in March 2002, and aggregate profits were negative for fiscal years 2000 through 2003. Beginning in March 2000, capital ratios declined steadily until 2003 for the major banks and 2004 for the regional banks. Thus, capital was declining during the end of the ZIRP period (which ran from February 1999 to August 2000) and the first several years of the QEP

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<sup>1</sup> Division of International Finance.

<sup>2</sup> The Japan premium went away temporarily after government injections of tier 2 capital (subordinated debt) into the major banks in March 1998, but it reappeared as concerns about bank soundness reemerged.

(which ran from March 2001 to March 2006). In addition, during the years that the ZIRP and the QEP were in place, Japanese banks absorbed considerable loan losses. Cumulative loan losses from fiscal years 1999 through 2005 totaled ¥38 trillion, which was almost 8 percent of average bank credit outstanding over the same period.

Japanese bank supervisors were slow to pressure banks to recognize and resolve their asset quality problems and took few steps during the first half of the 1990s. During this time of weak supervision (when banking supervision was undertaken by a division within the Ministry of Finance), many banks rolled over (“evergreened”) loans to troubled borrowers. The intensity of banking supervision in Japan increased steadily for quite a few years, especially after the establishment of the Financial Supervisory Agency (FSA, which later became the Financial Services Agency) in June 1998, and reached its peak with a series of special inspections of banks by the FSA to assess the adequacy of banks’ loan loss reserves in 2002 and 2003.

### **The Effect of Bank Health on Monetary Policy**

Bank lending declined for many years beginning in late 1996 and only began to rise toward the end of the QEP period (the upper right panel of the exhibit), notwithstanding the very accommodative monetary policy during the ZIRP and QEP. This decline might have resulted from very weak demand for lending. For example, if firms saw meager prospects for economic growth, they might have chosen to reduce the debt on their balance sheets rather than to borrow and invest. Additionally, many firms were left with an overhang of debt after the bursting of the bubble economy and sought to reduce that leverage.

However, the fact that corporate bonds outstanding maintained positive growth over much of the same period (the middle right panel) could suggest unmet demand for bank loans, which in turn could suggest a credit crunch.<sup>3</sup> If there were a credit crunch—i.e., if weak banks cut back on lending to creditworthy borrowers in order to conserve capital—then this could have diminished the effectiveness of expansionary monetary policy. Indeed, lending by banks that were severely capital constrained might have been virtually insensitive to accommodative monetary policy. Deteriorating firm balance sheets could also have disrupted the supply of loans and reduced monetary policy effectiveness. When land prices decline, as they did in Japan, firms may have less collateral to borrow against—i.e., firms become less creditworthy. This avenue might have a greater effect in banking systems for which lending is heavily dependent on real estate collateral, as was the case in Japan at the time.

Results from the economic literature are somewhat mixed, but overall, they suggest that bank lending and the effectiveness of monetary policy were depressed by bank and borrower weakness during the ZIRP and the early years of the QEP. The paper

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<sup>3</sup> The coincidence of growing corporate bonds outstanding and shrinking bank lending does not prove that there was unmet loan demand. For instance, Baba et al. (2005) state that the large firms capable of issuing corporate bonds in Japan did not typically borrow from banks. If so, then the graphs of bank lending and corporate bonds show credit growth for two different sets of firms, and the growth of corporate bonds would not necessarily indicate unmet loan demand.



that most directly addresses the question of how bank weakness affected monetary policy is Hosono (2006). Hosono uses bank-level data from 1975 through 1999 and regresses loan growth on bank characteristics and their interaction with the call rate, following Kashyap and Stein (2000).<sup>4</sup> The study finds that during periods of monetary expansion, the effect of monetary policy on lending is attenuated for banks with lower capital.<sup>5</sup> In other words, during periods of monetary easing, lending by banks with low capital is less sensitive to the policy rate than is lending by well capitalized banks. Assuming that this relationship continued to hold beyond the estimation period, the implication of this finding is that during periods when bank capital declined, such as from March 2000 through March 2003, monetary policy was less effective.

A number of papers find evidence that bank health in Japan is positively and significantly correlated with bank lending and firm investment. Gan (2007) uses loan-level and firm-level data and finds that bank weakness (measured by a bank's exposure to real estate in 1989, at the peak of the real estate bubble) is associated with lower lending and lower firm investment. Woo (2003) uses bank-level data and finds that bank health (measured by actual and estimated capital ratios) is associated with higher loan growth, and that this effect was stronger in 1997, when bank regulation began to be strengthened, than in earlier years. Nagahata and Sekine (2005) use firm-level data for publicly listed firms and find that capital of firms' main banks was positively and significantly related to firm investment, especially for firms that did not have access to the corporate bond market. All these results are consistent with firms facing a credit crunch that weakens the bank lending channel when bank health is declining, such as when bank capital or land prices declined.

Several papers find that the health of a Japanese firm's balance sheet is positively and significantly correlated with its access to credit or its investment. Fuchi, Muto, and Ugai (2005) find that the deterioration of firms' balance sheets due to the fall in asset prices increased firms' external finance premium and reduced their access to credit. Nagahata and Sekine find that firms invested less if they had higher debt-to-assets ratio (with assets, including real estate, adjusted to reflect their market value). These firm balance sheet effects could counteract the effects of accommodative monetary policy, weakening the lending channel when land values are declining. Alternatively, however, these observed firm balance sheet effects could reflect weakened loan demand by overleveraged borrowers.

The literature is not in complete agreement that poor health of banks and firms inhibited lending. In contrast to the articles cited above, Peek and Rosengren (2005) use loan-level data and find that weaker Japanese firms were more likely to receive bank loans, especially if the lending banks had capital ratios that were within 2 percentage points of the required minimum. In other words, Peek and Rosengren find evidence that banks—especially weaker banks—were evergreening loans to weak borrowers. However, our judgment is that this result is less likely to have persisted beyond the time

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<sup>4</sup> We refer to Japanese fiscal years, which go from April 1 through March 31. Data for the ends of fiscal years 1975 through 1999 are as of March 1976 through March 2000.

<sup>5</sup> During periods of monetary tightening, bank capital did not significantly affect the relationship between monetary policy and bank lending.

used for the estimations (which ended with 1999), because banking supervision became more stringent in Japan in the early part of this decade.

In sum, the results in the economic literature imply that during periods of increasing bank weakness in Japan, such as when bank capital or land prices were declining, bank lending and firm investment declined, inhibiting the transmission of accommodative monetary policy through the lending channel. In addition, some of these papers also find evidence consistent with a firm balance sheet effect—i.e., that weakness in firm balance sheets is also associated with reduced bank lending to these firms, which implies that bank lending and firm investment declined during periods when land values fell, and which could also have reduced the effectiveness of the lending channel of monetary policy transmission.

### **The Effect of Monetary Policy on Banks**

In this section, we briefly examine the other side of this coin—what effect did the ZIRP or QEP have on bank condition? Lower short-term interest rates, which were delivered by the ZIRP and QEP, are generally expected to boost bank profitability, other things equal, as banks transform short-term deposits into longer-term loans. However, in Japan, very low short-term rates were accompanied by very low long-term rates. Indeed, some of the actions taken under the QEP were aimed at lowering long-term rates, flattening the yield curve.

The evidence suggests that neither the ZIRP nor the QEP had much of a direct effect on bank profits. During the ZIRP and the QEP, banks' interest expenses as a fraction of total assets fell, but so did their interest income, with the end result that net interest income fell very little during these policies (the bottom right panel of the exhibit). In the four fiscal years prior to the ZIRP (FY95-FY98), net interest income of Japanese banks averaged 1.27 percent of banks' total assets. Banks' net interest income averaged 1.24 percent of total assets during the ZIRP (FY99-FY00) and 1.22 percent during the QEP (FY01-FY05).

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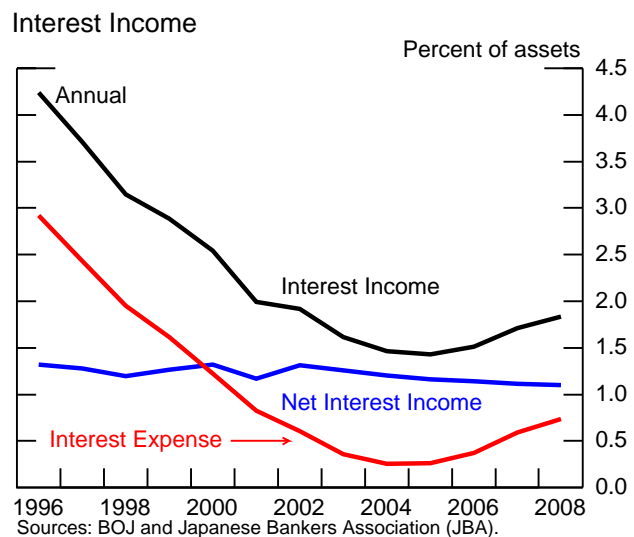
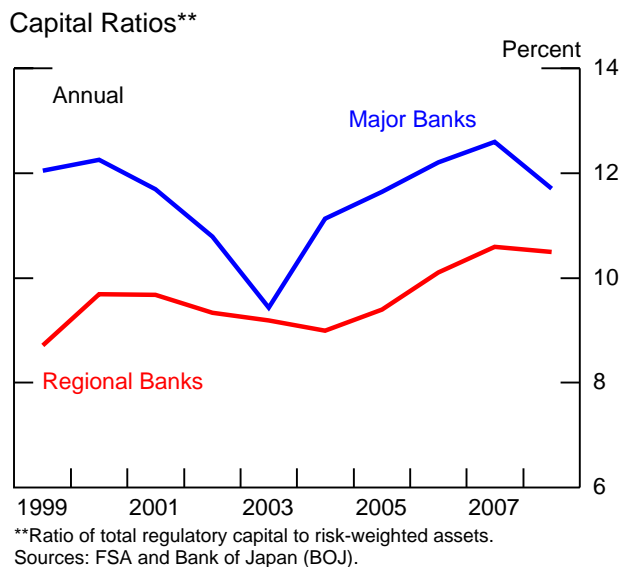
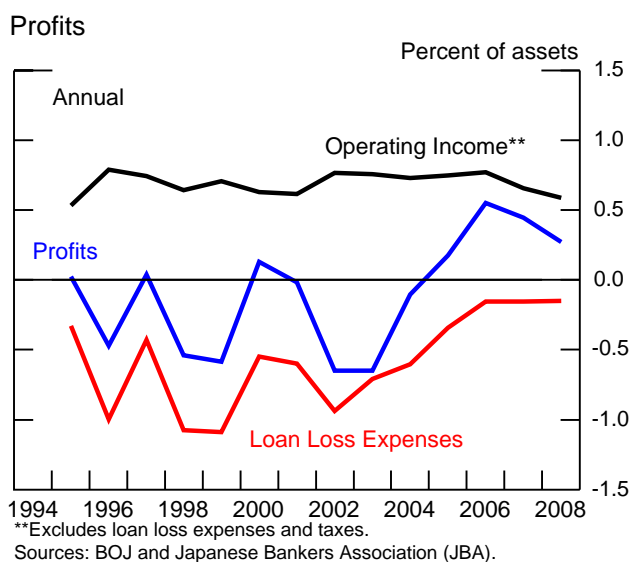
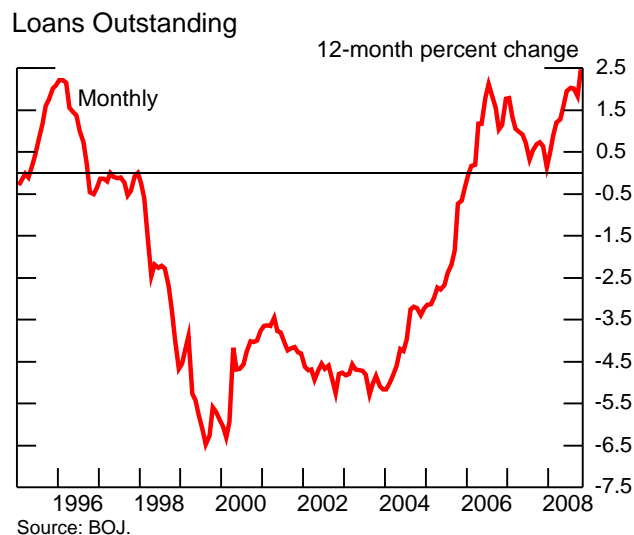
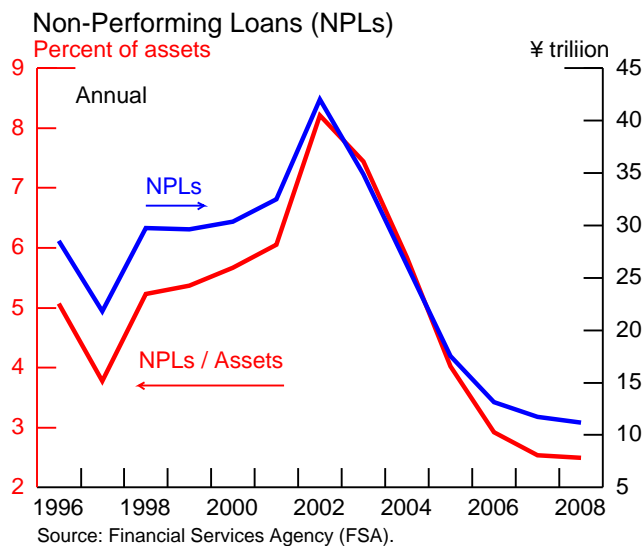
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12-05-08

### Condition of Japanese Banks\*



\* Annual data are as of March 31.

December 5, 2008

## **7. Effects of the Bank of Japan's Quantitative Easing Policy on Economic Activity**

Jane Haltmaier, Robert Martin, and Chris Gust<sup>1</sup>

### **Introduction**

From March of 2001 through March of 2006, the Bank of Japan (BOJ) supplemented its zero-interest-rate policy (ZIRP) with a policy of quantitative easing (QEP). QEP included an expansion of bank reserves and related holdings, as the BOJ significantly increased its direct purchases of Japanese government bonds (JGBs) and other securities. Japanese economic activity clearly improved during QEP. Real GDP growth averaged 1.8 percent from 2001-2007, about a percentage point higher than in the six-year period from 1995 to 2001. Growth of Japanese GDP relative to working-age population in fact compared favorably with that of the United States (top of exhibit 1). However, core inflation remained stubbornly negative throughout the period, although rising oil prices pushed headline inflation into positive territory (bottom of exhibit 1).

The question of how effective QEP was in stimulating the Japanese economy is still unsettled. There is general consensus that the policy did result in lower long-term interest rates (e.g. Kimura and Small (2004), Oda and Nagahata (2005), Ugai (2006)). However, views on the extent of QEP's contribution to economic growth as well as on exactly how it worked are more diverse. Ugai (2006), in a comprehensive literature survey, states that QEP was effective in "averting further deterioration" of the economy. Mihira et. al. (2006) find some evidence that QEP had a positive macroeconomic effect, but are unable to clearly identify the transmission mechanism. We might note that these studies typically focus on the effect of monetary policy on GDP, but there were a number of other important factors affecting the Japanese economy during this period. In particular, a surge in economic growth of Japan's major trading partners, notably China, led to a rapid expansion of Japanese exports. In addition, government spending was contracting, working against the expansionary monetary policy. This suggests that it may also be useful to look at the individual components of GDP in gauging the effects of QEP.

In this note we first provide some estimates of the effect of QEP on yields of Japanese long-term bonds, both government and corporate. We then describe some model simulations designed to gauge the potential effect of a reduction in interest rates of this size on the economy. In the second part of the note we look at changes in the major spending components of Japanese GDP to provide a more complete picture of the sources of the pickup in economic growth during the QEP period.

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<sup>1</sup> Division of International Finance.

Our main conclusions are:

- The reduction in long-term interest rates attributable to QEP might have been as large as 50 basis points, although estimates vary considerably. Our model simulations suggest that a decline in long-term rates of this size might have raised real GDP growth by about  $\frac{1}{2}$  percentage point per year on average, ceteris paribus. A second simulation that includes a proxy for easier lending conditions suggests that the effect could have been as large as  $\frac{3}{4}$  percentage point per year. This stimulus would have worked by raising consumption and private investment, and, to a lesser extent, by lowering the foreign exchange value of the yen and thus boosting net exports.
- Although QEP likely contributed to the step-up in Japanese economic growth in the 2000s, it was not the only, and quite possibly not the most important, influence on the Japanese economy during this period. Net exports played a very important role in the improvement in growth, and the stimulus appears to have come mostly as a result of robust external demand associated with a boom in Japan's major trading partners, especially in developing Asia. At the same time, contractionary Japanese fiscal policy worked in the opposite direction from QEP.

### **Effect of QEP on Long-Term Interest Rates and Economic Activity**

Consistent with a wide range of literature (Bernanke, Reinhart, and Sack (2004), Kimura and Small (2004), Oda and Nagahata (2005), and Ugai (2006)), we find that QEP had a significant effect on reducing long-term bond yields beyond what would have been expected with zero interest rates alone. We estimated a simple yield-curve regression for the 10-year JGB yield, using as explanatory variables GDP growth, inflation, and the spread between U.S. ten-year treasuries and the effective U.S. federal funds rate, as well as a dummy variable for the QEP period. We found that during QEP, the yield on the 10-year bellwether JGB rate was reduced a statistically significant 50 basis points below what the model would otherwise have predicted. This estimate is toward the high end of the range of other analysts' estimates of the effect of QEP on long-term yields, but is still not implausible. A similar regression using the long-term bank prime rate charged to corporate borrowers produced similar results, suggesting that the corporate rate largely followed the decline in government bond yields.

These results suggest that QEP could have had a significant impact on long-term yields independent of macroeconomic conditions, thereby providing a channel through which non-standard monetary policy may have boosted the Japanese economy. We used the staff's FRB/Global model to try to assess the impact such a reduction in interest rates should have had on the Japanese economy. Consistent with the estimate described above (which is of course subject to considerable uncertainty), our first model simulation assumes that quantitative easing reduced 10 year nominal JGB yields by 50 basis points

over the three year simulation horizon considered.<sup>2</sup> We assume that Japanese monetary policy was constrained by the zero bound throughout the simulation horizon.

Because the historical evolution of the economy reflects the effects of the quantitative easing that actually took place, we structure the simulation to address the question of what would have happened in the absence of such policies. Accordingly, exhibit 2 compares the actual path for key macroeconomic variables (solid lines) to an alternative in which the autonomous component of long-term JGB yields is assumed to be 50 basis points higher (dashed lines). The shock is assumed to begin in mid-2001. The persistent rise in long-term yields has a significant restraining effect on real activity. The simulation indicates that GDP growth would have been about ½ percentage point lower in 2002 and 2003 had the government not engaged in quantitative easing. Moreover, inflation would have been about ½ percentage point lower in 2003-2004 in the absence of quantitative easing. The higher real long-term interest rates implied by the alternative are consistent with a markedly stronger path for the yen. As seen in the lower right panel, the real value of the yen against the dollar would have been roughly 5 percent stronger in the absence of quantitative easing.

The foregoing simulation abstracts from any effects of quantitative easing on the ability of corporate borrowers to obtain financing. On the one hand, the financial weakness of banks and firms may have reduced the stimulus from lower interest rates described above (see note 6). On the other hand, it is plausible that quantitative easing may have helped to boost banks' liquidity and thus ease borrowing conditions for the corporate sector, even if there is no conclusive econometric evidence (including our work described above) on this point. We thus consider a second alternative simulation which assumes that QEP reduced corporate loan rates relative to comparable-maturity government bond yields by 25 basis points, as a proxy for its effect in relaxing lending constraints. This assumption is made in addition to the 50-basis-point reduction in JGB rates considered in the previous simulation.<sup>3</sup> The results of this simulation are shown in exhibit 3, where the alternative again is structured to show what would have occurred in the absence of QEP. The results indicate that real GDP growth would have been about ¾ percentage point per year lower in 2002-2003 in the absence of QEP, and inflation more than ¾ percentage point lower in 2003-2004. Thus, assuming that QEP had a modest influence on corporate borrowing conditions in addition to its effect on bond yields, the simulation results suggest that it could have played an important role in precluding a sharper contraction in Japanese activity and in forestalling a much larger decline in inflation.

### **Changes in Components of Real GDP**

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<sup>2</sup> We employ a three-year simulation horizon, which is less than the duration of the actual QEP, because the model tends to exhibit instabilities when policies are set to counterfactual paths for too long a period. The model results should be interpreted as illustrative of what might have taken place over the entirety of the QEP period.

<sup>3</sup> The choice of 25 basis points is arbitrary, but based on the view that the stimulus provided through relaxation of bank lending constraints was likely smaller than that provided by reducing JGB yields.

Between 1995-2001 and 2001-2007, the growth rate of real GDP in Japan stepped up by about 1 percentage point (table 1). As suggested by the simulations in the previous section, some of this improvement may have been a result of the QEP. This policy should have worked primarily through private investment and to a lesser extent through consumption, both of which contributed somewhat more to real GDP growth in the QEP period than in the preceding period, as shown in the third column of the table.

<b>Table 1: Contributions to real GDP Growth (percentage points)*</b>			
	<b>1995-2001</b>	<b>2001-2007</b>	<b>Change</b>
<b>GDP</b>	<b>.9</b>	<b>1.8</b>	<b>1.0</b>
<b>Domestic Demand</b>	<b>.8</b>	<b>1.1</b>	<b>.4</b>
Consumption	.5	.8	.2
Private Investment	.0	.4	.4
Government	.3	-.2	-.4
Inventory change	.0	.1	.1
<b>Net exports</b>	<b>.0</b>	<b>.7</b>	<b>.7</b>
Exports	.3	1.1	.8
Imports	-.3	-.4	-.1

Based on annual data.

However, there were other important influences on GDP growth during this period. The contribution of government spending dropped by nearly  $\frac{1}{2}$  percentage point. At the same time, the contribution of net exports to GDP growth increased from 0 in the 1995-2001 period to .7 percentage points between 2001 and 2007. The improvement was entirely on the export side, as imports made a slightly larger negative contribution in the second period. As a result of the increase in exports, the share of net exports rose from about  $\frac{1}{2}$  percent of GDP in 2001 to nearly 5 percent of GDP in 2007.

As noted above, part of the rise in net exports could have reflected the effect of the QEP in reducing the nominal exchange rate. Although a full assessment of this issue is beyond the scope of this note, we have estimated some simple export and import equations (not shown) to try to gauge the importance of external demand and exchange rates, respectively, to the sizable swing in net exports. As shown in the chart at the top of exhibit 4, the GDP growth of Japan's trading partners picked up significantly in the QEP period, which likely provided substantial stimulus to export growth. At the same time, the Japanese effective exchange rate declined in both real and nominal terms (bottom of exhibit 4), and this should have contributed to stronger exports and weaker imports.

As shown in table 2, the export equation suggests that a little more than half of the increase in the export contribution to real GDP growth between the two periods (about  $\frac{1}{2}$  percent of GDP) is attributable to the increased rate of foreign GDP growth. The faster rate of depreciation of the exchange rate in the second period is estimated to have raised the contribution of net exports to GDP growth by .2 percentage points, divided about equally between higher exports and lower imports. Some of this effect may have been a result of QEP, but exactly how much is very difficult to gauge.



In sum, even if we attribute much of the acceleration in private domestic spending and decline in the yen to QEP, and this remains uncertain, the boom in demand from Japan's trading partners most likely also played a crucial role in the acceleration of the Japanese economy during the 2000s. At the same time, the contraction in government spending appears to have played a significant role in offsetting the expansionary monetary policy.

<b>Table 2: Effects of Explanatory Variables in Export and Import Equations on Contributions to GDP Growth (percentage points)</b>			
	<b>1995-2001</b>	<b>2001-2007</b>	<b>change</b>
<b>Exports</b>	.3	1.1	.8
Foreign GDP growth	.4	.9	.5
Real Exchange Rate	.1	.2	.1
Residual	-.1	.1	.2
<b>Imports*</b>	-.3	-.4	-.1
Japanese GDP growth	-.1	-.4	-.3
Real Exchange Rate	.0	.1	.1
Residual	-.2	-.2	.0

\*A rise in imports represents a negative arithmetic contribution to GDP growth.

### **Implications for the United States**

As the United States approaches the zero lower bound, there are several important implications from the Japanese experience:

- It appears that non-standard monetary policy can affect long-term interest rates, thus creating a channel through which stimulus can be provided even when policy interest rates are at the zero lower bound.
- Although QEP may have had positive effects on economic activity, robust external demand also appears to have been very important to the recovery of the Japanese economy during this period. The United States is currently facing a much less hospitable environment for export growth due to weak economic activity abroad. Furthermore, safe haven considerations may limit the extent of dollar depreciation.
- Fiscal consolidation appears to have acted as a counterweight to expansionary monetary policy during the QEP period in Japan. Given the dismal outlook for the economies of our trading partners, fiscal support is likely even more critical for the United States in the present situation.

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December 5, 2008

## 8. Japanese Fiscal Policy: A Bridge to Nowhere?

Beth Anne Wilson<sup>1</sup>

### Executive Summary

After 1990, Japan's economy slowed sharply following decades of strong performance. In response, the Japanese government undertook substantial fiscal stimulus. The evidence suggests that Japan's fiscal policy did provide some short-term macroeconomic support, and in the absence of that stimulus, Japan likely would have experienced an even deeper economic downturn. Nevertheless, since its initial slowdown, the Japanese economy neither recovered its earlier pace of growth nor achieved sustained positive inflation. Some of the failure can be attributed to factors beyond the immediate control of the authorities, including the fallout from the previous "bubble economy," the Asian financial crisis, and population dynamics leading to a slowing of potential output growth. In addition, there were problems with the mix and implementation of the fiscal policies, including the failure to maintain fiscal stimulus on a sustained basis. Finally, and more fundamental to Japan's "lost decade," was the country's inability to quickly address weaknesses in the corporate and banking sectors. Without a pickup in the private sector, fiscal policy was essentially "a bridge to nowhere."

This note provides an overview of the Japanese fiscal effort during the past 1½ decades, briefly analyses its effectiveness, and discusses key lessons for the United States. Not surprisingly, these lessons are that in the face of deep economic disruption, fiscal stimulus is likely to be more effective if it is large and sustained, coordinated with significant monetary policy action, and implemented in tandem with policies to address underlying structural weaknesses in the economy.

### Overview of Japan's Fiscal Effort

From 1990 to 1995, Japanese real GDP growth averaged less than 1½ percent per year, a third of its pace in the previous five years. In the face of this slowing, the Japanese government began announcing fiscal stimulus plans in 1992. The increases in government spending were sizable. Government expenditure as a share of GDP rose almost 5 percentage points from 1991 to 1995 and was up an additional 2 percentage points by the end of the decade (see exhibit). In addition, revenue as a share of GDP fell 2½ percentage points from 1990 to the mid-1990s. In large part, this drop reflected a cyclical decline in revenue collection – only in 1994 did the government's fiscal stimulus packages contain a sizable tax reduction. The magnitude of the stimulus efforts, together with the impact of the recession on tax revenue, can be seen in the increase in government debt – which doubled as a share of GDP over the decade of the 1990s – and

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<sup>1</sup> Wilson: Division of International Finance. Betty Daniel of the International Finance Division also contributed to this paper.

in the cyclically adjusted budget balance – which swung from roughly 2 percent to -6 percent of potential GDP over the same period.

Japan's significant fiscal stimulus efforts were concentrated in two periods – August 1992 to September 1995 and April 1998 to October 2000. In terms of the fiscal impulse, measured here as the change in the cyclically adjusted budget balance, the initial effort began small, but over the next several years the impulse averaged 1½ percent of GDP per year. The second period's boost was somewhat smaller in magnitude and duration. In both phases of fiscal expansion, the government concentrated its expenditure effort in public investment, with a majority of the announced spending for infrastructure projects. Most of the remainder was allocated toward purchases of land and to loans to the financial and housing sectors (Muhleisen, 2000).

The government was less aggressive with tax policy until later in the decade. Explicit tax reduction was included in the April 1993 stimulus package, but the magnitude was negligible. A large policy tax reduction was included in the February 1994 stimulus package. Income taxes were reduced by 5.9 trillion yen (1.2 percent of GDP), with the anticipation that the losses in revenue would later be made up by higher value-added taxes (VAT). The expectation of higher future consumption taxes shifted consumption forward and provided short-run stimulus – output growth averaged 4½ percent at an annual rate in the two quarters preceding the VAT increase. However, the timing of the VAT tax hike in April 1997, just prior to the Asian Crisis, was unfortunate and likely exacerbated effects of the crisis. In the face of the largest decline in output since the 1950s, in 1999 the government provided tax relief in the form of temporary reductions in corporate and income taxes as part of a broader stimulus package.

After 2000, Japan's experiment with fiscal stimulus largely ended as rising levels of government indebtedness prompted the government to forego further expansions of the deficit. Notwithstanding a steep recession in 2001, the cyclically adjusted primary deficit remained roughly unchanged at a bit over 5 percent of GDP until 2005, even as the Bank of Japan was entering a novel phase of “quantitative easing” designed to boost inflation back to positive rates. As the economy started to visibly revive in 2006, a sharp cutback in government expenditures and a recovery in revenue collection caused the deficit to narrow substantially.

### **Policy Effectiveness**

Although the fiscal stimulus policy of the 1990s failed to return the growth of the Japanese economy to its previous high rate, the stimulus efforts did appear to have some positive macroeconomic effects (Bayoumi, 2000). Consumption relative to output rose over the 1990s, consistent with support from fiscal policy. As discussed above, consumption appeared particularly responsive to tax measures. Moreover, during the 1990s, the Japanese household saving rate declined on balance and interest rates remained low, suggesting that “Ricardian” considerations regarding the rising debt were not undoing the effect of the stimulus. The fiscal effort also appeared to provide some

boost to employment. The employment-to-population ratio remained relatively high through the early 1990s, with sizable gains in construction and, to a lesser extent, government employment. Accordingly, in the absence of the fiscal stimulus programs, the Japanese economy likely would have experienced an even deeper slowdown (Kuttner and Posen, 2001; Ahearne et al., 2002).

The fiscal effort appeared to have had little long-run positive impact, however. Private investment fell relative to output at the beginning of the 1990s and did not recover. Until the mid-1990s, a rise in public investment offset a fraction of this decline, but it, too, dropped off and the employment-to-population ratio began a steep and sustained decline as the fiscal impetus waned. Indeed, only after 2002 did Japanese per capita GDP resume a steady upward climb.

To some extent, flaws in the mix and implementation of the fiscal policies undermined their effectiveness. Infrastructure spending was often wasteful, politically determined, and ineffective at raising the marginal product of investment (Ihsii and Wada, 1998). Less effort was made at increasing direct transfers to individuals or firms or to strengthening Japan's relatively weak social safety net. Some evidence suggests that Japan's policies could have been better designed so as to have offered more effective stimulus (Kuttner and Posen, 2001). Finally, the impact of the fiscal stimulus was also marred by the stop-go nature of the policies, best illustrated by the ill-timed increase in consumption taxes on the eve of the Asian Crisis.

As a related point, the authorities failed to coordinate fiscal and monetary policies so as to achieve maximum impact on economic activity. During Japan's first period of fiscal stimulus, from 1992 to 1995, the Bank of Japan (BOJ) was reducing policy interest rates only slowly. Conversely, by the 2001-2006 period, when the BOJ was offering substantially greater monetary accommodation through its zero interest rates and quantitative easing, fiscal policy had retreated toward essentially a neutral stance.

Finally, and most importantly, underlying structural problems with the Japanese economy were not faced quickly enough. Investment languished as problems with corporate and bank balance sheets went unrecognized, or, at least, unaddressed, until the late 1990s. Instead, firms slowly worked down their debt burden through repayments out of profits, which constrained investment and growth in the corporate sector for years. Consumption was also weighed down by declining real estate wealth, deflation, and adverse population dynamics. By the time the financial problems were being addressed in the late 1990s and early 2000s, and the Bank of Japan was initiating its quantitative easing policy, the country's fiscal effort was spent, and debt levels made additional fiscal impetus difficult.

### **Lessons for the United States**

Despite differences in economic structure and global conditions, Japan's earlier fiscal policy experience offers some lessons for the United States today. First, given the ultimate depth and magnitude of the Japanese economic slowdown, the fiscal effort was

too small and too sporadic. While few observers at the time foresaw the decade-long slowdown to follow, in retrospect, Japan's concern with debt sustainability led policy makers to quickly reverse policy stimulus, to focus on temporary measures, and to consistently signal an imminent return to fiscal restraint.

Second, the fiscal and monetary efforts could have been better synchronized. Had the BOJ's significant monetary policy measures of the late 1990s and early 2000s been implemented in coordination with fiscal policy stimulus, they would have stood a better chance of supporting growth and preventing deflation.

Finally, as long as the underlying impediments to growth went unaddressed, both monetary and fiscal policies were unlikely to "bridge" to a recovery in private-sector performance. Quickly recognizing and dealing with the problems in the banking and corporate sector would have provided a firmer foundation for long-term growth.

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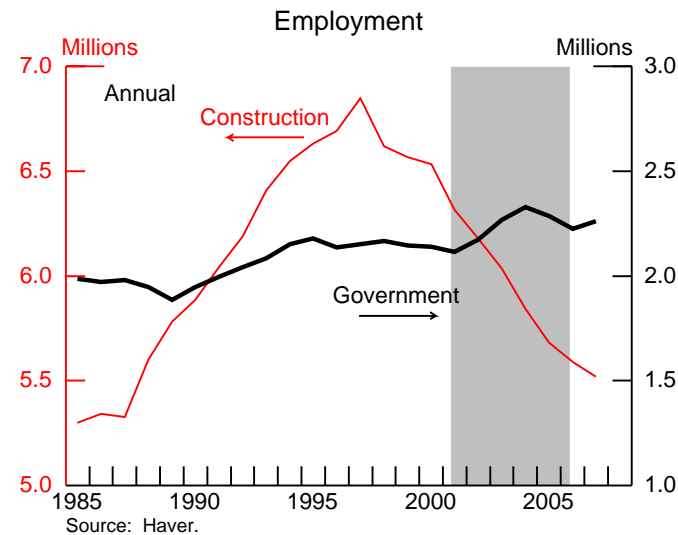
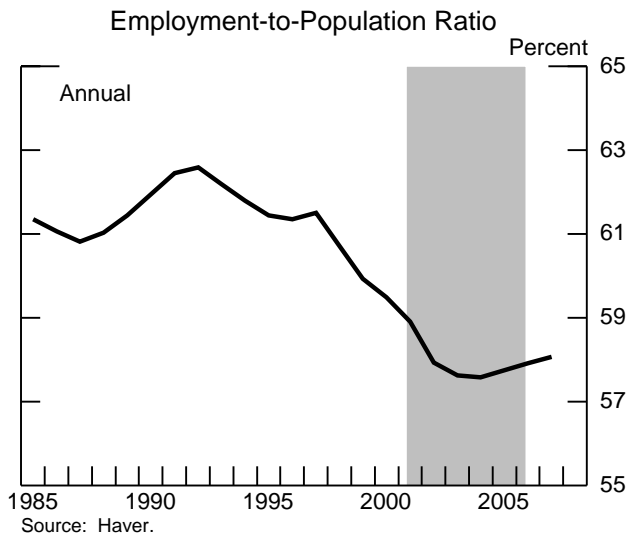
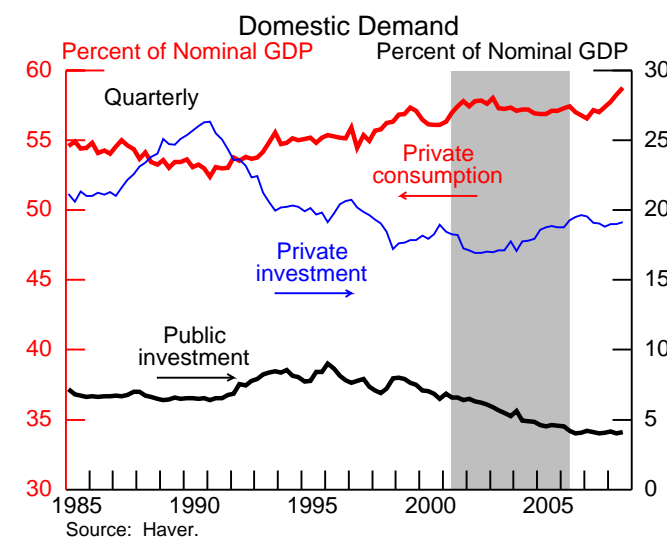
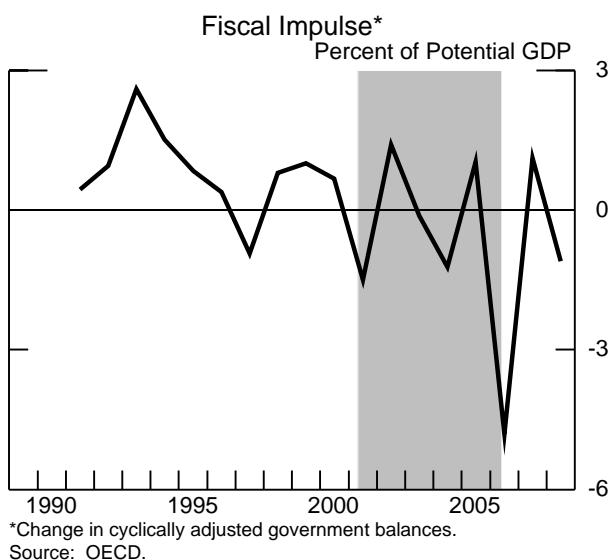
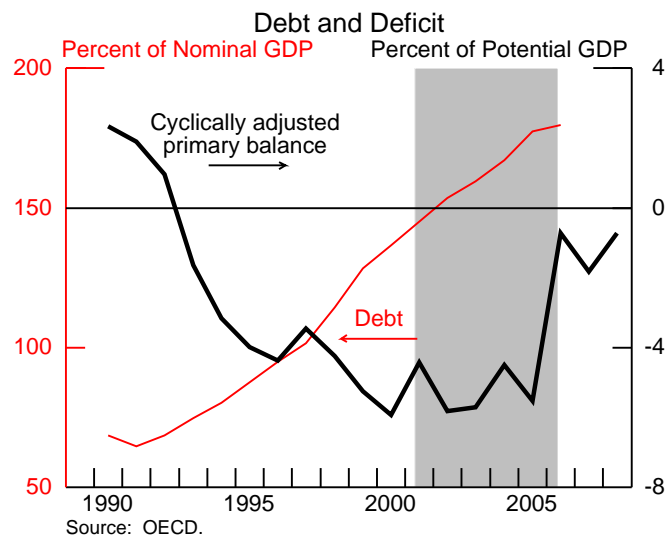
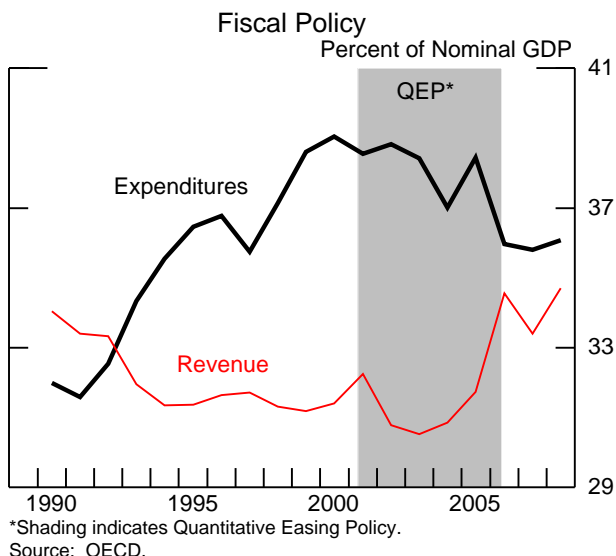
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Exhibit 1



December 5, 2008

## 9. Effects of Very Low Policy Rates on Money Market Funds

Patrick Dwyer, Patrick McCabe, Brian Mulligan, and Steve Oliner<sup>1</sup>

### Executive Summary

This note examines the likely effects of very low policy rates on money market funds (MMFs) and the potential for strains at these funds to curtail the provision of short-term financing throughout the economy. Very low effective federal funds rates (FFRs) have already reduced revenues for some MMFs, because yields on their portfolio instruments have fallen short of the fees they normally charge. Further reductions in the effective FFR would likely cause additional revenue losses, and low yields probably also would lead to some investor redemptions from MMFs. For the most part, however, we believe that strains at MMFs and the responses of fund shareholders are unlikely to cause a rapid decline in the financing that MMFs provide, even if the effective FFR falls to zero. The main exception to this general conclusion is that deeper revenue losses for MMFs that focus on Treasury repos could lead to closures of funds and a reduction in financing through repurchase agreements, although the Desk could compensate for such a decline by expanding the scale of its own repo activities if the FFR target is at or near the zero bound. Finally, we note that pressures on the MMF industry make any forecast of MMF developments more uncertain than usual.

Our conclusions draw on estimates of revenue losses at MMFs due to low yields. If the effective FFR were to stabilize at 50 basis points and the recent configuration of spreads among other money-market instruments persists, we estimate that prime MMFs would experience negligible revenue losses, but Treasury-repo and Treasury-only funds would lose about one-quarter and one-half of their revenues, respectively. The anticipated losses for prime funds would continue to be small even at a zero effective FFR. However, Treasury-repo and Treasury-only funds would experience an almost total loss of revenue at an effective FFR of either 25 basis points or zero. These projections are sensitive to our assumptions about spreads on money market instruments; in particular, if spreads were to revert to levels seen during the 2003-2004 episode of low interest rates, we would expect much more substantial industry-wide revenue losses at a zero effective FFR.

Low MMF yields may prompt investor redemptions, which would cause additional revenue losses and sales of assets by fund managers. However, investor behavior during the 2003-2004 episode and in recent weeks indicates that redemptions from most MMFs probably would not be abrupt, with the possible exception of Treasury-only and Treasury-repo funds held by institutional investors if net yields fall to zero.

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<sup>1</sup> Dwyer: Federal Reserve Bank of New York; McCabe and Oliner: Division of Research and Statistics; Mulligan: Division of Monetary Affairs.



## Current Conditions and Risks for Money Market Funds

Money market funds currently have \$3.7 trillion in assets under management (see line 1, column 1 of the table on exhibit 1). Prime funds (line 2) account for nearly half of the industry's assets and are important investors in private money-market instruments. Funds that invest exclusively in Treasury repos and short-term Treasury securities (lines 3 and 4) together account for roughly 20 percent of total money fund assets, and funds that invest in a mixture of government and agency securities (line 5) account for nearly another 20 percent. Tax-exempt funds (line 6) represent the rest of the industry.<sup>2</sup>

On average, MMFs currently earn gross yields of 1.65 percent on their portfolio assets (column 2) and pay fund shareholders *net* yields of slightly less than 1.3 percent (column 3). The difference, 0.35 percent of assets (column 4), is the average expense ratio that MMFs charge their shareholders. Annual industry revenues—fees times assets—total \$12.8 billion (column 5) and have grown 18 percent in the past year, because of increased assets under management.

Very low interest rates in money markets are reducing revenue for many MMF management firms because their revenues come from the funds' gross yields. These yields vary considerably across different types of funds, from an average of 2.3 percent for prime funds to just 0.5 percent for Treasury-repo funds. In the Treasury-repo sector, gross yields have already fallen short of fund expense ratios for funds that manage 19 percent of the sector's assets, and managers of these funds have waived a portion of their normal fees. Gross yields will probably drop further even if the effective FFR holds steady, as MMF yields typically take several weeks to adjust to changes in the effective FFR, and additional reductions in the effective FFR would likely pressure asset managers to cut revenues more deeply. Another concern is that investors might quickly redeem shares of low-yielding MMFs, forcing the funds to dispose of assets at depressed prices.

MMFs are very significant investors in some credit markets. Although prime funds have shrunk by \$290 billion since the end of August, they still held an estimated

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<sup>2</sup> This memo focuses on the mutual funds that qualify as "money market funds" under Securities and Exchange Commission Rule 2a-7, which sets credit-quality standards, maturity limits, and diversification requirements for the assets that MMFs hold. Rule 2a-7 also allows MMFs to use accounting rules that facilitate maintaining a stable net asset value (NAV). Our focus on MMFs excludes some closely related investment vehicles, including offshore money funds and so-called "enhanced-cash" funds. Dollar-denominated offshore money funds currently have about \$370 billion in assets under management, with about two-thirds of the total in funds similar to prime MMFs and most of the remainder in funds resembling Treasury-only and Treasury-repo MMFs. Offshore money funds are not regulated under Rule 2a-7 but often adhere to its standards, so the results presented below on revenue losses at low effective FFRs for prime, Treasury-only, and Treasury-repo MMFs should be broadly applicable to their offshore money-fund counterparts. Enhanced-cash funds, which include "cash-plus," "strategic-cash," and ultra-short bond funds, held roughly \$500 billion in assets in mid-2008. These funds' portfolio holdings are similar to—albeit somewhat riskier than—those of prime MMFs, but the enhanced-cash funds do not maintain stable NAVs. As a result, these funds probably would not face cost pressures due to a low effective FFR, because they could keep expense ratios above their portfolio gross yields and simply allow NAVs to decline.

39 percent of outstanding commercial paper in early December. They also have substantial investments in bank certificates of deposit, floating rate notes, and other private paper. Prime funds, Treasury-repo funds, and government and agency funds together lend \$620 billion through repurchase agreements, and tax-exempt MMFs held 18 percent of outstanding municipal securities at the end of September.<sup>3</sup> Hence, one possible risk posed by lower short-term rates is that the closure of unprofitable funds and shareholder redemptions at other MMFs could curtail the availability of short-term credit and other forms of financing in markets in which MMFs are important investors. We believe that a widespread curtailment of financing is unlikely, for several reasons described below. That said, we do have concerns about reductions in lending by MMFs in Treasury repo markets, although the Desk could compensate for such a pull-back by expanding its own repo activities if the FFR target is at or near zero.

### Projections of MMF Revenue Losses

To estimate the magnitude of MMF revenue losses over a range of effective FFRs, we project losses for each individual fund and sum those losses over all funds. The revenue loss for each fund is assumed to be the amount (if any) by which its annualized “baseline” fees exceed its predicted gross yield, multiplied by its current asset base:

$$\text{Annualized revenue loss} = \begin{cases} (\text{baseline fees} - \text{predicted gross yield}) \times \text{assets} & \text{if fees} > \text{yield} \\ 0 & \text{otherwise} \end{cases}$$

We set each fund’s baseline fees equal to its expense ratio (expressed as a percentage of assets) charged in August 2008, when the distribution of net yields suggests that no MMF was waiving fees for the purpose of maintaining a positive net yield.

Current market conditions make predictions of gross yields especially uncertain. As shown in the lower panel of exhibit 1, over the past year, average spreads to the effective FFR for different types of MMFs have been well outside their historical ranges because of concerns about credit quality, a flight to safe and liquid assets, and strains in financial markets. Because the degree to which these influences will continue to affect spreads is difficult to predict, we project losses for each MMF using its average gross-yield spreads to the effective FFR for two sample periods: (i) the past 52 weeks (ending December 2, 2008) and (ii) July 2003 to June 2004, the previous period when the FFR target was 1 percent.

Estimated revenue losses are shown in exhibit 2. Each panel shows, as a function of the effective FFR, projected MMF revenue losses as a percentage of baseline revenues. The black line in each panel depicts the estimated revenue loss given the average gross-yield spread over the effective rate for the past 52 weeks, while the red

<sup>3</sup> Investment Company Institute, *Trends in Mutual Fund Investing, November 2008*; Federal Reserve, *Flow of Funds Accounts of the United States, Second Quarter 2008*; Federal Reserve, *Commercial Paper Rates and Outstanding*; iMoneyNet.

dashed line presents the estimated revenue loss given the average spread from July 2003 to June 2004.

As shown in the upper left panel, if the effective FFR were to stabilize at 50 basis points and the past year's average spreads were to persist, we would anticipate that the MMF industry would have to reduce shareholder expenses—which represent the funds' revenues—by 7 percent to keep fees from exceeding gross yields. At effective rates of 25 basis points and zero, expected losses would climb to 17 percent and 22 percent of revenues respectively. Projected losses, especially at low effective rates, are sensitive to the sample period used to estimate average spreads. Based on spreads in the 2003-2004 period, which were lower than recent spreads for most MMFs, expected industry losses at a zero effective FFR would be 66 percent of revenue—nearly triple those derived using the past year's spreads.

### **Risk of a Curtailment in the Availability of Financing**

Because MMFs are important providers of credit and repo finance for businesses, financial institutions, and state and local governments, serious strains on these funds could conceivably reduce the availability of financing for important sectors of the economy. We assess this risk by examining the expected revenue losses for each type of fund.

For prime funds, as shown in the upper right panel of exhibit 2, projections based on the unusually wide spreads over the past year imply very small revenue losses even at an effective FFR of zero. The losses, however, would be much larger if we instead used the spreads that prevailed from 2003 to 2004. For government and agency MMFs and tax-exempt MMFs (the middle panels), the results are qualitatively similar to those for prime funds—the projected revenue losses under the recent configuration of spreads are relatively small, but losses would be considerably larger if spreads returned to 2003-2004 levels.<sup>4</sup>

The picture for Treasury-repo and Treasury-only funds (the lower panels) is just the opposite: Unusually low recent spreads for these funds put them at risk of major revenue declines. Assuming that these recent spreads persist, we estimate that Treasury-repo and Treasury-only funds would lose 26 percent and 43 percent of revenue, respectively, at an effective FFR of 50 basis points. Losses for these funds would jump to 81 percent and 88 percent, respectively, at an effective FFR of 25 basis points, and at a zero effective rate, their revenues would be almost completely wiped out. These estimates are based on the assumption that gross yields will not fall below zero, but gross yields for Treasury-repo and Treasury-only funds over the past year have averaged about  $\frac{1}{4}$  percentage point below the effective FFR (see column 6 of the table). Thus, a forecast

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<sup>4</sup> For tax-exempt funds, we forecast gross yields using spreads between these yields and 65 percent of the effective FFR, based on the assumption that pricing for short-term tax-exempt securities reflects a marginal tax rate of 35 percent. In computing average spreads for these funds for the past-year sample, we excluded observations for weeks ending in September and October 2008, because the spike in short-term tax-exempt rates in those months appears to have been short-lived.

that uses recent spreads would predict, at a zero effective rate, negative gross yields and revenue losses for these funds in excess of 100 percent (fund sponsors would have to *pay* to maintain net yields of zero). The outlook for Treasury-repo and Treasury-only funds would improve somewhat if spreads were to revert to their 2003-2004 levels; in that case, revenue losses for both types of funds would be less than 10 percent at an effective FFR of 50 basis points and would be roughly 30 percent at an effective FFR of 25 basis points. But these funds would still lose virtually all revenue at an effective FFR of zero.

Large revenue losses for Treasury-only funds likely would not be a significant concern for policymakers, as robust demand for safe and liquid assets by other investors would cushion any reduction in MMF holdings of Treasury securities. However, the very substantial predicted revenue losses for Treasury-repo funds raise concerns that the closure of many of these funds would reduce the availability of financing through Treasury repurchase agreements.

Several factors ameliorate the risk that strains at MMFs might curtail the provision of short-term financing to other economic sectors.

- First, firms that manage MMFs historically have earned substantial returns from this activity and probably would tolerate revenue losses for a while. Interviews with MMF managers confirm their willingness to continue operating funds despite considerable revenue losses, although several have suggested that they might begin shutting down Treasury-only and Treasury-repo funds after six months to one year in the current interest-rate environment.
- Second, there may be scope for MMF managers to offset some revenue losses from the waiver of asset-based fees by charging account-based and transaction-based fees that are not limited by gross yields. Several large mutual fund families already impose such fees, such as low-balance and account-maintenance fees.<sup>5</sup>
- Third, while spreads on commercial paper and short-term tax-exempt securities may narrow in coming months, they are less likely to do so in an economic climate in which the FOMC deems it necessary to maintain a very low effective FFR. Moreover, yields on instruments for which MMFs are the only (or dominant) investors would probably fall only to levels that leave those instruments profitable for MMFs to hold.
- Fourth, as noted above, if the FFR target is at or near zero, the FOMC could compensate for reductions in the supply of repo financing caused by strains at Treasury-repo MMFs by expanding the Desk's repo activities.

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<sup>5</sup> To be sure, MMFs face legal hurdles that would prevent them from charging some types of fees on a per-account basis. Moreover, asset managers in interviews have mostly rejected the idea of using account-based fees to offset any reductions in asset-based fees, out of concern that shareholders would view new fees as onerous. However, faced with a choice between charging such fees and liquidating a fund, MMF managers may reconsider.

- Fifth, sudden, large-scale redemptions, which might force MMFs to dispose of assets quickly, are unlikely for most funds. Amid heightened concerns about the credit risk and liquidity of other types of investments, low net yields are probably less important than usual for MMF investors. Indeed, Treasury-repo funds, which already pay net yields averaging just 26 basis points (line 3 of the table), have attracted net inflows of 3 percent of assets in the past three weeks. Retail investors in the past have responded only slowly to differences in yields for MMFs and substitutes such as bank deposits. Institutional investors respond more quickly to differences in yields, and one potential concern is that a further decline in yields on Treasury-repo and Treasury-only MMFs may prompt these investors to move money quickly from MMFs to FDIC-insured non-interest-bearing transactions accounts. The MMFs in question hold highly liquid assets, which would limit the risk that such outflows would be disruptive.<sup>6</sup>

A more disturbing—but very unlikely—possibility is that an MMF might “break the buck” (that is, suffer a capital loss of more than one-half percent of assets) because a fund manager chose to collect fees that exceeded an MMF’s gross yield for an extended period. Such a choice appears improbable, as it would cause considerable damage to the manager’s reputation. Managers will have some time to respond to low yields, and in extreme cases would probably either liquidate or sell a fund, but not let its NAV decline.

### **Lessons from the 2003-2004 Episode of Low Short-term Interest Rates**

During the period from July 2003 to June 2004, when the FOMC maintained an FFR target of 1 percent, 65 percent of MMFs waived some fees.<sup>7</sup> A regression analysis for this period indicates that funds, on average, cut fees more than one-for-one with their projected shortfalls of gross yields relative to baseline expenses. Indeed, MMF managers have told us in interviews that, during the 2003-2004 episode, they usually waived fees to maintain net yields of 5 or 10 basis points, and some managers are doing so again. To the extent that managers continue to maintain such *positive* net-yield targets, our revenue-loss projections will *understate* actual losses, as we assume that fees are waived only to maintain a net yield of zero.

While investor redemptions from both retail and institutional MMFs reduced assets under management in the industry by about 15 percent from mid-2003 to mid-2005, the redemptions were neither sudden nor precipitous (exhibit 3, upper panel). This experience provides some support for our view that any outflows prompted by further declines in MMF yields are unlikely to be abrupt for the industry as a whole.

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<sup>6</sup> In addition, investors’ concerns about strains at MMFs appear to have been allayed by the insurance provided by the Treasury’s Temporary Guarantee Program for Money Market Funds and by liquidity support for money-market instruments provided by several of the Federal Reserve’s new liquidity facilities. These programs would be expected to reduce the likelihood of sudden, precipitous outflows from MMFs.

<sup>7</sup> The bulk of these funds had already been waiving some fees in previous years when the FFR target was well above 1 percent. Indeed, MMF managers commonly charge fees lower than their prospectuses allow to maintain net yields that are attractive to investors.

In 2005, as the previous low-rate episode was ending, the number of MMFs in operation fell from 943 to 871, the largest annual decline on record. But the number of MMFs has trended down since it reached a peak of 1045 in 1999, and the decline has not been disruptive—indeed, since 1999, industry assets under management have more than doubled. Moreover, with nearly 800 MMFs still in operation in an industry characterized by substantial economies of scale, some additional consolidation might be a positive development.

### **Uneven Effects Across MMF Sponsors**

The lower panel of exhibit 3 shows distributions of predicted revenue losses across the 132 MMF sponsors, including 47 “small” sponsors that manage less than \$1 billion in assets and 11 “large” sponsors that manage more than \$100 billion. If the effective FFR were to stabilize at 50 basis points, the average gross-yield spreads observed over the past year imply that the vast majority of sponsors would lose less than 20 percent of their MMF revenue (the solid blue bars in the left panel). Only five sponsors would lose more than 40 percent—of these, four are small and none large. At an effective rate of zero (the solid blue bars in the right panel), 19 of the 132 sponsors would suffer revenue losses greater than 40 percent, including eight that would lose more than 80 percent (five of those eight are small and none large). However, if spreads reverted to levels seen in 2003-2004, 52 sponsors (28 small, none large) would have revenue losses exceeding 80 percent at an effective FFR of zero.

Variation in the expected losses among sponsors reflects differences in their sizes and in the types of funds they offer. As indicated above, smaller fund families would be hit hardest, mainly because they tend to offer retail MMFs with higher expenses. Fund managers with relatively large Treasury-repo and Treasury-only offerings also would be disproportionately hurt. Asset managers whose MMFs are sold by third-party brokers may face especially difficult challenges, as expense ratios for their funds include fees of as much as 1 percent of assets to compensate the brokers. These fees cannot be easily waived, although several MMF managers have told us that they have negotiated some reductions in such fees to help keep expenses below gross yields.

MMF sponsors that choose to extend their funds’ participation in the Treasury’s Temporary Guarantee Program through the end of April 2009 would pay the 4-basis-point (annualized) premium out of gross yields, so these premium payments would increase our revenue-loss estimates. For example, industry-wide participation in the program would raise estimated revenue losses at a zero effective FFR (under the current configuration of spreads) from 22 percent to 26 percent. Sponsors of MMFs with near-zero gross yields would have to pay premiums out of pocket; hence, very low interest rates will likely be a factor weighing against continued participation in the program by some Treasury-only and Treasury-repo funds.

### **Uncertainty Amid Recent Strains in the MMF Industry**

Our primary conclusion is that very low short-term policy rates will lead to large revenue losses for some MMFs, but that substantial spillovers to the rest of the economy are unlikely. That said, recent strains in the MMF industry make any forecast of MMF developments more uncertain than usual. Prime MMFs are still recovering from the massive net redemptions that followed the mid-September news that the Reserve Primary fund had broken the buck. Many asset management firms have recently subsidized their prime MMFs to maintain stable NAVs, and these heightened costs and capital risks may have reduced managers' willingness to endure the losses associated with very low interest rates, particularly because many management firms have recently experienced large revenue losses as assets have declined in non-MMF product lines. MMF managers express concerns about elevated risks of large-scale MMF redemptions because investors who have quickly shifted assets into Treasury-only, Treasury-repo, and government and agency MMFs may reverse course. We believe that these concerns warrant careful monitoring but that the risk of sudden, disruptive spillover effects from strains at MMFs remains low.

## Exhibit 1 Money Market Funds and Low Interest Rates

Summary statistics for money market funds

Type of fund	Current data (week ending December 2, 2008)			Data for week ending August 26, 2008		Average gross-yield premium over effective FFR (ppts.) <sup>1</sup>	
	Assets under management (\$bill)	Average gross yield (pct.)	Average net yield (pct.)	Average expense ratio (ppts.)	Annual revenue (\$bill) <sup>2</sup>	November 2007 - November 2008 <sup>3</sup>	July 2003- June 2004
		(1)	(2)	(3)	(4)	(5)	(6)
1. All MMFs	3656.8	1.65	1.29	0.35	12.80	0.51	0.08
2. Prime	1690.5	2.26	1.87	0.37	6.16	1.01	0.12
3. Treasury-repo	342.3	0.53	0.26	0.31	1.07	-0.19	0.03
4. Treasury-only	412.3	0.77	0.45	0.31	1.29	-0.26	-0.02
5. Government and agency	718.2	1.50	1.15	0.33	2.36	0.52	0.08
6. Tax-exempt	493.6	1.30	0.89	0.39	1.93	0.72	0.38

Source: Staff calculations based on iMoneyNet data.

Notes. Averages are weighted by assets.

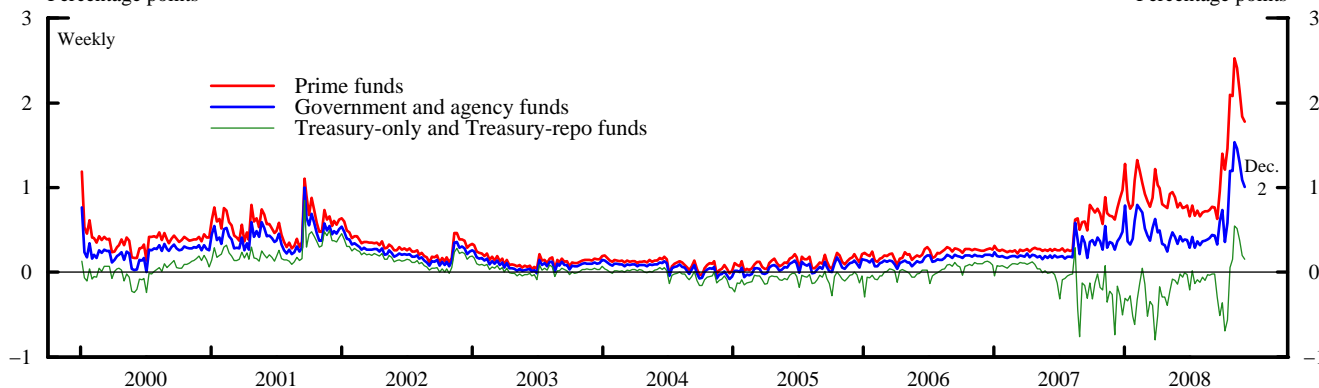
1. Gross-yield premium for tax-exempt funds is gross yield less 65 percent of the effective federal funds rate.

2. Based on current assets (column 1) and expense ratios from August 26, 2008 (column 4).

3. Sample period for tax-exempt funds excludes weeks ending in September and October 2008.

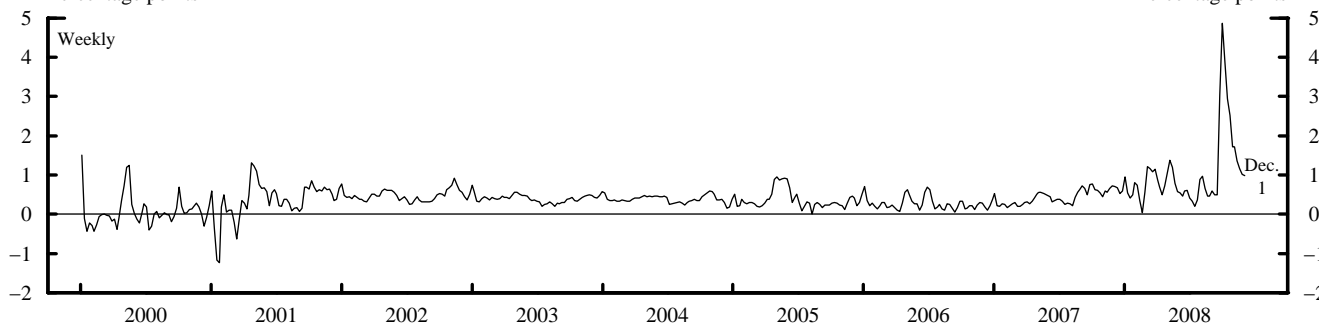
Taxable MMF Gross Yields Less Effective FFR

Percentage points



Tax-exempt MMF Gross Yield Less 65 Percent of Effective FFR

Percentage points

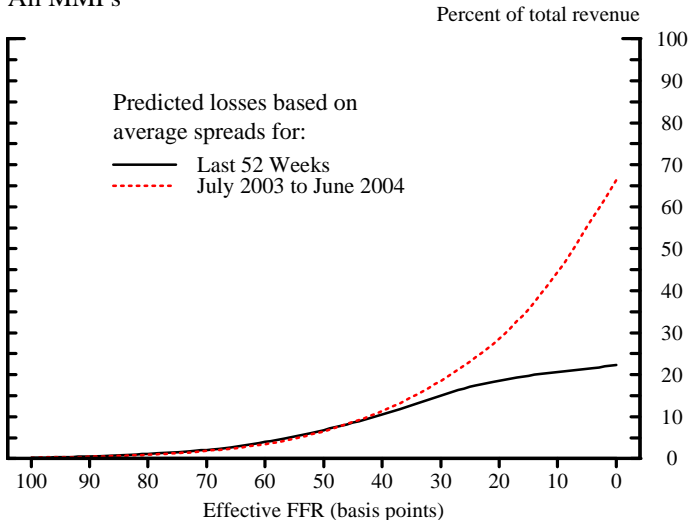


Source: Staff calculations based on iMoneyNet data.

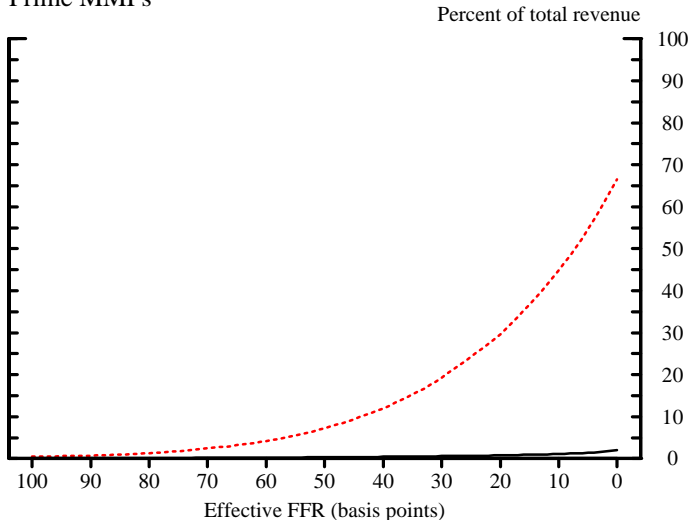


## Exhibit 2 Estimated MMF Revenue Losses and the Effective Federal Funds Rate

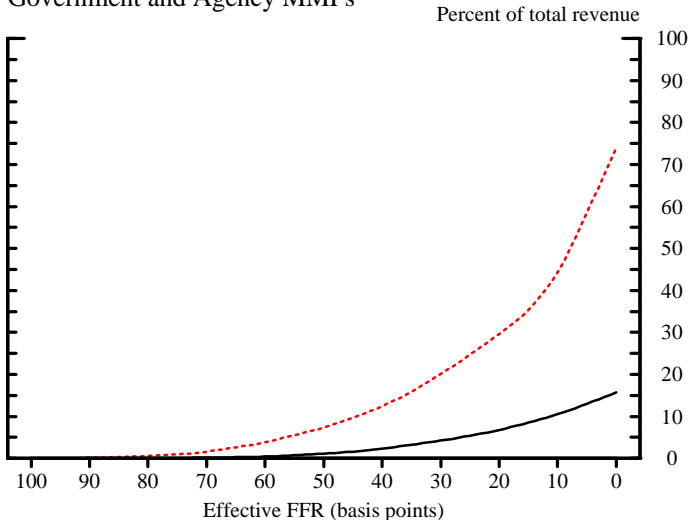
All MMFs



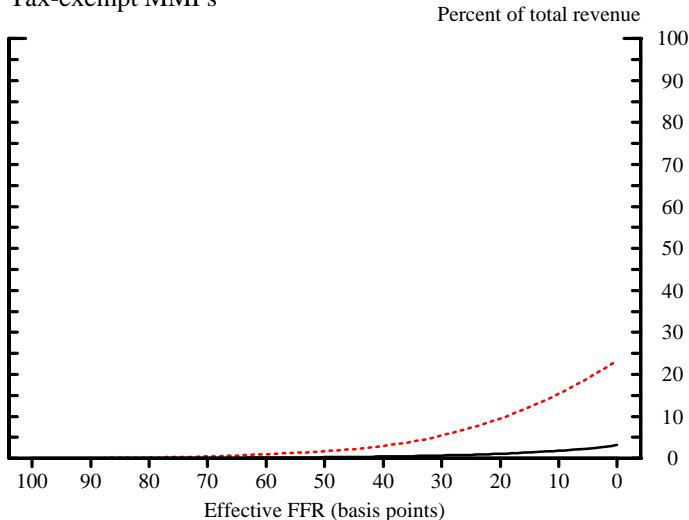
Prime MMFs



Government and Agency MMFs

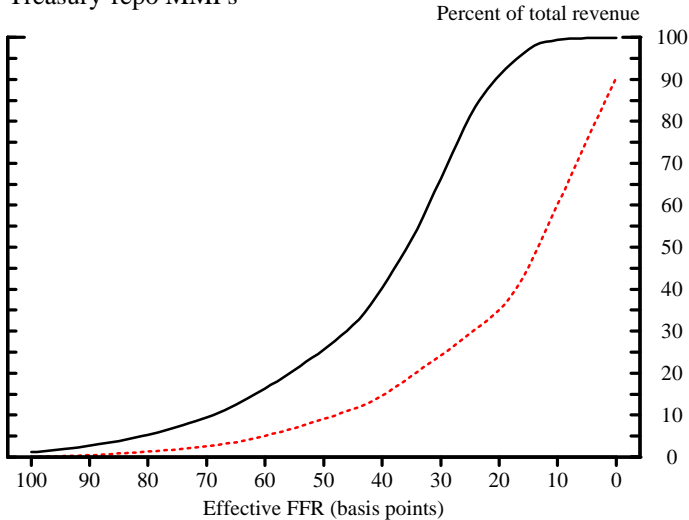


Tax-exempt MMFs

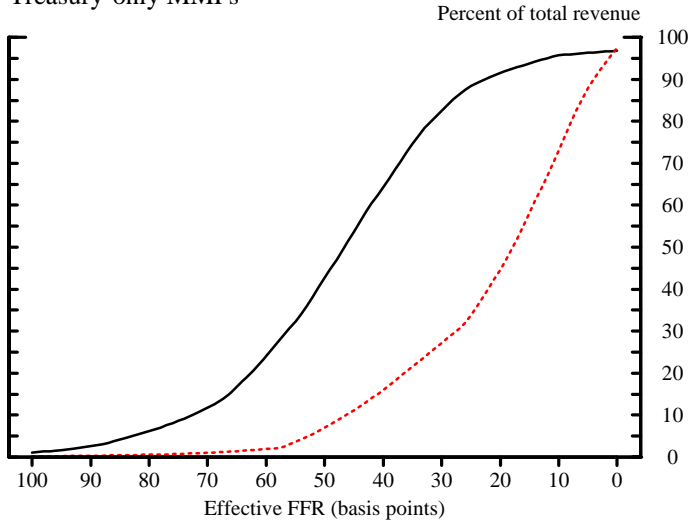


Note. Solid line represents predicted losses based on average spreads for the last 52 weeks, excluding weeks ending in September and October 2008.

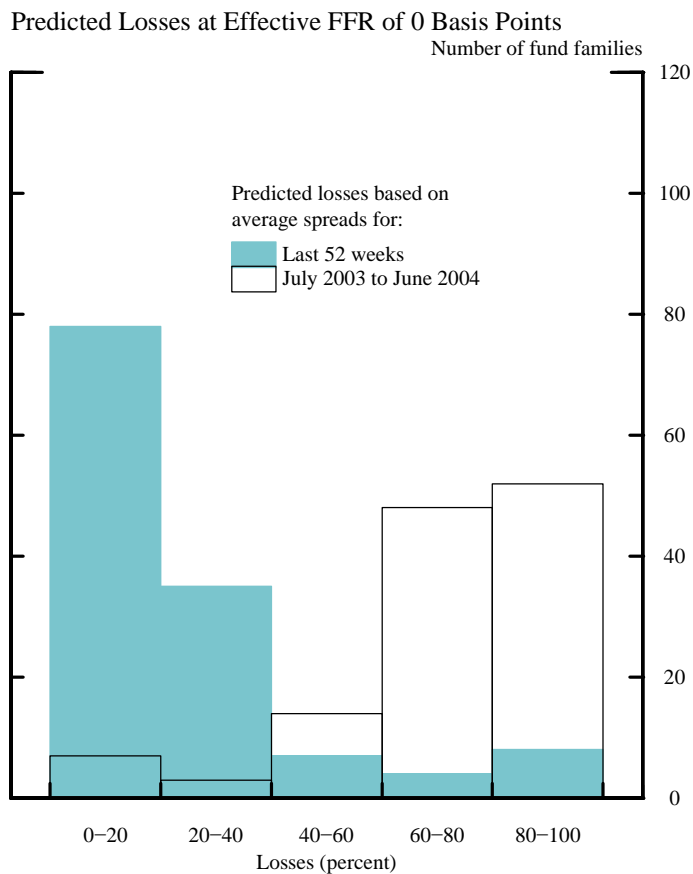
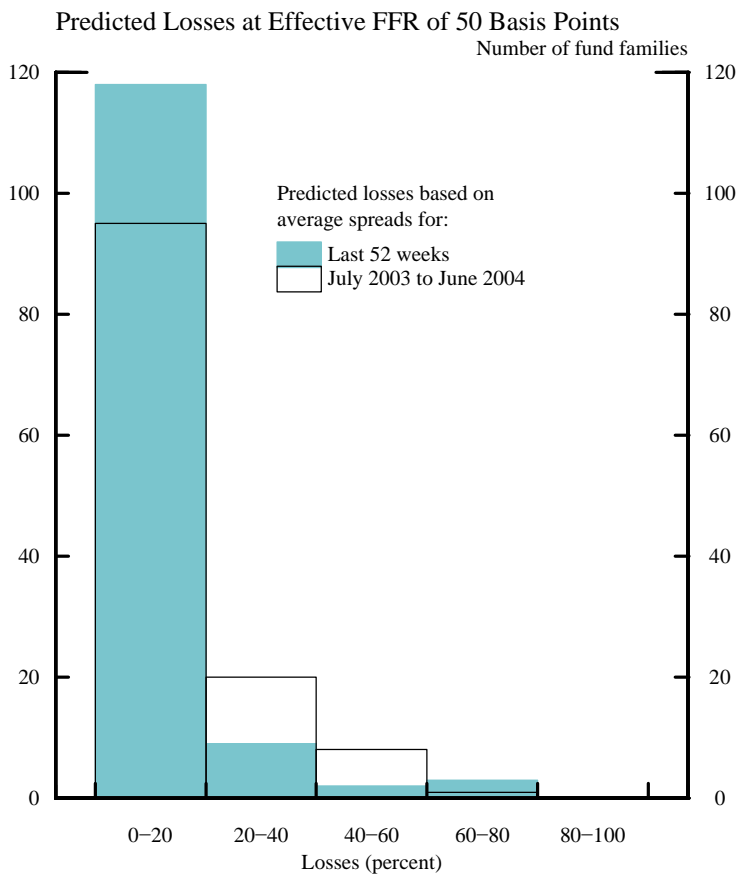
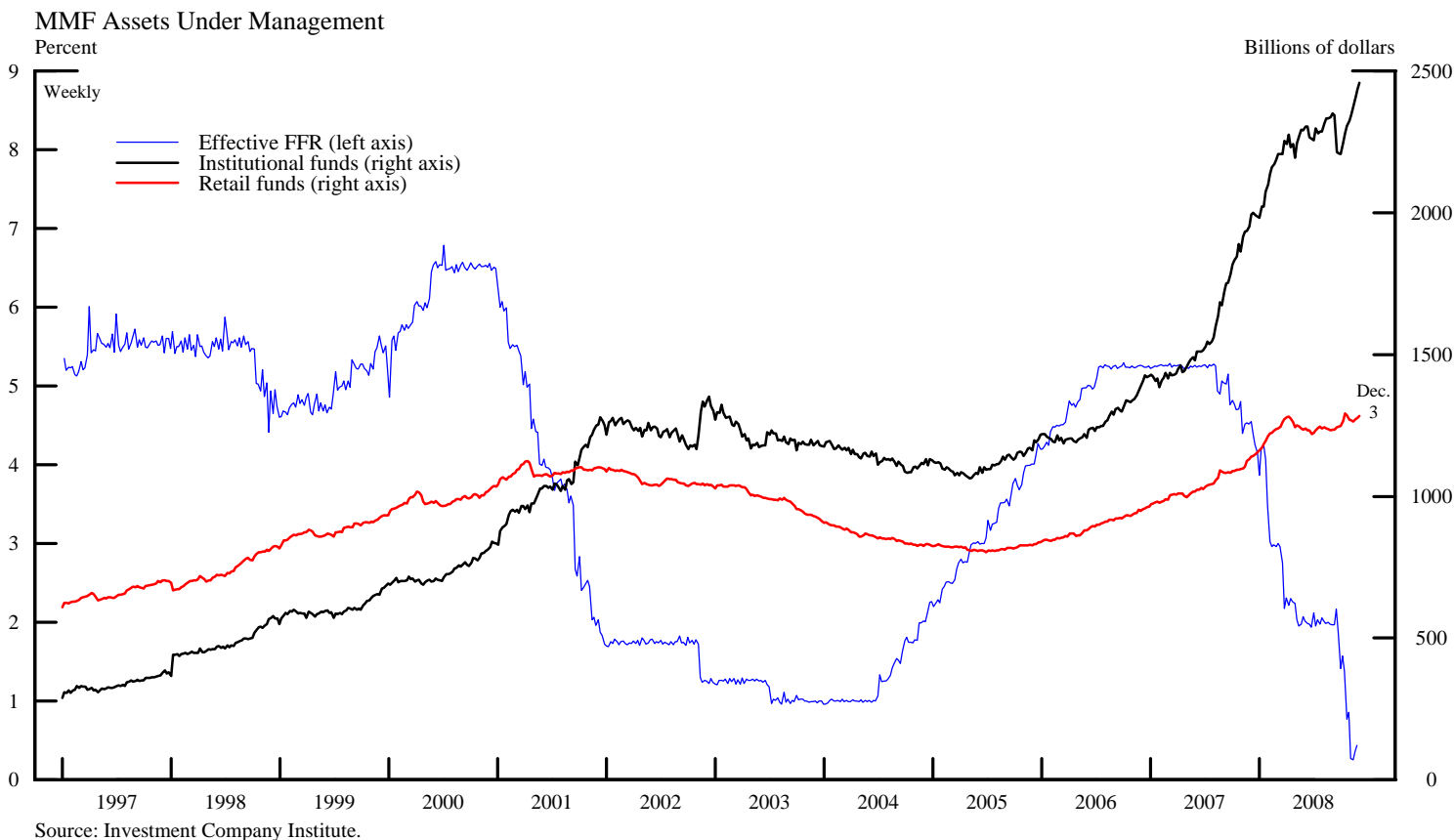
Treasury-repo MMFs



Treasury-only MMFs



### Exhibit 3 Money Market Funds and Low Interest Rates



December 5, 2008

## 10. Effects of Very Low Interest Rates on the Profitability of Commercial Banks and Other Financial Institutions

William English, Donald Morgan, Skander Van den Heuvel and Egon Zakrajšek<sup>1</sup>

### Executive summary

Conventional wisdom holds that financial firms—especially depository institutions—benefit from a steep yield curve, because their primary function is to intermediate funds across maturities by providing relatively short-dated claims to investors while extending longer-term loans to borrowers. According to this view, a steepening of the yield curve should increase financial firms' net interest margins and, all else equal, boost the equity prices of such firms. However, financial institutions may hedge this exposure to interest rate changes, or the effects of changes in rates on net interest margins may be offset by changes in the noninterest components of firms' income or expense. Indeed, the empirical literature offers little consensus regarding the effects of changes in interest rates on the profits of financial institutions.<sup>2</sup>

In this note, we examine the effects of unanticipated changes in short-term interest rates on the behavior of stock returns of financial institutions (commercial banks, insurance carriers, and security brokers and dealers). In addition, we consider whether these effects change in an environment of very low policy interest rates, a situation in which the pricing of some bank assets and liabilities may be influenced by the zero bound on nominal interest rates. Specifically, we adopt the empirical methodology of Bernanke and Kuttner (2005), who analyze the reaction of the broad stock market to changes in the stance of monetary policy.<sup>3</sup> We, in contrast, analyze *firm-specific* stock returns in an environment of very low interest rates—namely, the 2003-04 period when the target funds rate was at 1 percent. By exploiting firm-specific stock returns, we are able to

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<sup>1</sup> English and Zakrajšek: Division of Monetary Affairs; Morgan: Research Department, Federal Reserve Bank of New York; Van den Heuvel: Division of Research and Statistics. Robert Kurtzman provided excellent research assistance.

<sup>2</sup> Empirical research using equity price data has generally found that bank stock returns are negatively related to unpredictable changes interest rates—typically derived from an auxiliary econometric model—indicating that bank stock prices tend to fall when longer-term interest rates rise unexpectedly; see, for example, Flannery, M. J. and C. M. James, 1984. “The Effect of Interest Rate Changes on the Common Stock Returns of Financial Institutions,” *Journal of Finance*, 39(4), pp. 1141-1153. In contrast, analysis that looks at the relationship between banks' net interest margins (net interest income as a percentage of interest-earnings assets) and interest rates has generally found little evidence that net interest margins respond systematically to changes in short-term rates or the slope of the term structure; see, for example, English, W. B., 2002. “Interest Rate Risk and Bank Net Interest Margins,” *BIS Quarterly Review*, December, pp. 67-82.

<sup>3</sup> See Bernanke, B. S. and K. N. Kuttner, 2005. “What Explains the Stock Market's Reaction to Federal Reserve Policy?” *Journal of Finance*, 60(3), pp. 1221-1257.

identify more precisely the average effect of unanticipated interest rate changes on the equity valuations of financial institutions. Our principal findings are as follows:

- Equity prices of financial institutions increase in response to an unexpected policy easing. For example, a 25-basis-point surprise reduction in the target funds rate boosts, on average, stock prices of commercial banks almost 0.7 percent; stock prices of insurance companies about 0.6 percent; and stock prices of investment banks about 1.3 percent.
- In contrast to the conventional wisdom, stock prices of financial firms also increase in response to FOMC communication that leads investors to anticipate a flatter path for policy in the medium term. The effect on financial stock returns of communication about the future path for policy was especially large during the 2003-04 period of very low interest rates. During that period, communication leading to a 25-basis-point downward revision in medium-term policy expectations resulted, on average, in a 1.5 percent gain in financial share values.
- Abnormal stock returns of financial firms—that is, returns once their usual reactions to the market return and Fama-French factors have been removed—appear to be unrelated to unexpected changes in interest rates. This result suggests that unexpected changes in the stance of monetary policy do not influence financial firms' profits directly, but rather through their effects on broader financial and economic conditions, including the equity risk premium, future profit opportunities, and asset quality.
- To demonstrate the size of effects on stock prices that the Committee's decisions could have, we consider a hypothetical example in which the Committee at its December meeting chooses to lower the target funds rate by 75 basis points, to 25 basis points, and through the accompanying statement indicates its intention to keep the target rate at that level for an extended period of time. Our estimates suggest that in this hypothetical case, the stock prices of financial firms would rise between 2.7 and 3.2 percent and those of nonfinancial firms would increase about 3.8 percent.

### **The empirical framework**

To obtain exogenous variation in short-term interest rates, we analyze the reaction of firm-specific stock returns to unexpected changes in the federal funds target rate on the day of an FOMC announcement—that is, policy actions associated with regularly scheduled FOMC meetings as well as any intermeeting policy moves. Following standard practice, we measure the *target* surprise associated with a specific policy action using the change in the rate on federal funds futures contracts expiring before the subsequent FOMC meeting. Aside from being surprised by the immediate *level* of the funds rate, market participants may also be surprised by indications regarding the path of monetary policy going forward, induced, for example, by the wording of the statement accompanying the policy decision. We estimate such a *path* surprise as the component of the change in the year-ahead expected federal funds rate implied by Eurodollar futures quotes (the ED4 contract) that is not explained by the associated target surprise.

Exhibit 1 depicts the behavior of the target funds rate (top panel), the associated target surprises (middle panel), and the path surprises (bottom panel) since February 1994, when the FOMC began making explicit policy announcements. As indicated by the thin red bars in the middle panel, the largest target surprises are associated with intermeeting policy actions. By contrast, the magnitude of a typical path surprise (bottom panel) does not differ systematically between regularly scheduled FOMC meetings and intermeeting policy moves.

The shaded yellow area in each panel corresponds to the 2003-04 period, during which the target funds rate was kept at 1 percent for a prolonged period—the low interest rate environment according to our definition. As evidenced by the virtual absence of any target surprise of an economically meaningful magnitude, the Committee's communication efforts during that period clearly resulted in little uncertainty regarding policy actions at the FOMC meetings. Nevertheless, as indicated by the considerable variation in path surprises, market participants were surprised by the associated FOMC communication, which led them on a number of occasions to revise significantly their expected path for policy during that period.

To obtain a set of benchmark results, we first estimate the following panel stock return regression:

$$R_{it} = \theta_1 \Delta ff_t^u + \theta_2 \Delta ED4_t^u + \theta_3 \Delta ff_t^e + \eta_i + \varepsilon_{it}; \quad (1)$$

where  $R_{it}$  denotes the daily (total) stock return of firm  $i$  on the day of an FOMC announcement;  $\Delta ff_t^u$  denotes the target surprise—that is, the unexpected portion of the change in the target rate;  $\Delta ED4_t^u$  denotes the path surprise—that is, the change in the year-ahead expected funds rate that is not explained by the associated target surprise;  $\Delta ff_t^e$  denotes the expected portion of the change in the target funds rate;  $\eta_i$  is a firm fixed effect; and  $\varepsilon_{it}$  is a zero-mean error term. Our panel data set consists of all nonfarm publicly traded firms covered by the Center for Research in Security Prices (CRSP) that had a minimum of 252 trading days of returns between January 1, 1994 and June 30, 2008.<sup>4</sup> We consider three categories of financial firms based on 4-digit Standard Industrial Classification (SIC) codes: (1) commercial banks and bank holding companies (807 firms); (2) insurance carriers (280 firms); and (3) security brokers and dealers—that is, investment banks (96 firms). As a robustness check of our results, we also estimate our return regressions on the panel of 9,184 nonfinancial firms. In the time dimension, our sample spans 121 policy actions, including five intermeeting policy moves.<sup>5</sup> We estimate equation 1 by OLS, thus the coefficients  $\theta_1$  and  $\theta_2$  measure the average effect of target and path surprises on stock returns, respectively. The coefficient  $\theta_3$  measures

<sup>4</sup> To ensure that our results were not driven by a small number of extreme observations, we dropped from our sample all observations with absolute daily return in excess of 25 percent.

<sup>5</sup> Following Bernanke and Kuttner (2005), we omitted the intermeeting 50 basis points cut in the target funds rate on September 17, 2001.

the average effect of the expected change in the target funds rate, which under the efficient markets hypothesis, should be equal to zero.<sup>6</sup>

### **Benchmark results**

Table 1 contains the results from the estimation of equation 1 for our four categories of firms. Consistent with the efficient markets hypothesis, the effect on stock returns of the expected change in target funds rate ( $\Delta ff_t^e$ ) is statistically and economically indistinguishable from zero for each sector. The estimated effect of target surprises ( $\Delta ff_t^u$ ) implies that a 25-basis-point surprise cut in the target funds rate, on average, boosts stock prices of commercial banks almost 0.7 percent, those of insurance companies 0.6 percent, and those of investment banks about 1.3 percent. As a comparison, stock prices of nonfinancial firms rise about 1.1 percent, on average, in response to a 25-basis-point unanticipated reduction in the funds rate target.<sup>7</sup>

Turning to FOMC communication, the estimated effect of path surprises ( $\Delta ED4_t^u$ ) implies that an unexpected 25-basis-point downward shift in the expected funds rate at a one-year horizon boosts equity valuations of commercial banks about 0.4 percent, those of insurance companies and investment banks almost 0.5 percent, and those of nonfinancial firms almost 0.7 percent; those effects, although economically significant, are statistically significant only at the 10 percent level and not even at that level for investment banks. All told, our benchmark results indicate that stock prices of both financial and nonfinancial firms generally benefit from unanticipated reductions in the target funds rate as well as from FOMC communication that results in a flatter trajectory of the expected path for monetary policy.

### **Stock returns and monetary policy surprises in a low interest rate environment**

In this section, we examine whether the effects of monetary policy surprises on stock returns of financial institutions are different in an environment of very low policy rates. For example, approaching the zero bound on nominal interest rates is likely to increase concerns about the risk of a prolonged deflationary spiral with its attendant consequences for the health of borrowers' balance sheets. In addition, when rates fall to very low levels, the ability of banks to recover costs and profit from their deposit base by

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<sup>6</sup> Statistical inference about the estimated coefficients is an important issue in such panel-data return regressions because the explanatory variables do not differ across firms and the error terms are likely to exhibit significant cross-sectional—that is, spatial—correlation. Accordingly, we use the methodology developed by Driscoll and Kraay (1998) to compute standard errors that are robust to the presence of arbitrary cross-sectional dependence in the error term; see Driscoll, J. C. and A. Kraay, 1998. "Consistent Covariance Matrix Estimation with Spatially Dependent Data." *The Review of Economics and Statistics*, 80(4), pp. 549-560.

<sup>7</sup> The magnitude of these effects is broadly in line with those reported by Bernanke and Kuttner (2005). The differences reflect, in part, different sample periods and, more importantly, the fact that Bernanke and Kuttner use value-weighted portfolio returns, which give more weight to large firms. Consistent with their findings, we find that stock returns of large banking institutions respond more strongly to monetary policy surprises than those of smaller commercial banks.

offering deposit rates that are set below market rates is likely to become impaired because customers will not accept negative nominal interest rates.

To examine this question empirically, we estimate a variant of equation 1 in which we allow the coefficients on policy surprises to differ across two interest rate regimes: a “low” interest rate environment and a “normal” interest rate environment. Formally,

$$R_{it} = \theta_1^{norm} I(ff_{t-1} > 1) \Delta ff_t^u + \theta_2^{norm} I(ff_{t-1} > 1) \Delta ED4_t^u + \theta_1^{low} I(ff_{t-1} \leq 1) \Delta ff_t^u + \theta_2^{low} I(ff_{t-1} \leq 1) \Delta ED4_t^u + \eta_i + \varepsilon_{it}; \quad (2)$$

where  $I(ff_{t-1} \leq 1)$  is an indicator function that equals one when the target federal funds target is at (or below) 1 percent on the day immediately preceding an FOMC announcement—the “low” interest rate environment—and zero otherwise. Conversely, the indicator function  $I(ff_{t-1} > 1)$  identifies a period in which the target rate was strictly above 1 percent, the “normal” interest rate environment. Using this definition, the low interest rate environment (the shaded yellow vertical bars in Exhibit 1) covers the period from August 12, 2003, to June 30, 2004, for a total of eight regularly scheduled FOMC meetings.

Results of this exercise are reported in Table 2. Because there was no significant variation in target surprises during the period in which the target rate was kept at 1 percent (see middle panel of Exhibit 1), the effect of target surprises on stock returns in that regime is estimated very imprecisely. In contrast, communication about the future path of monetary policy—as captured by path surprises—is estimated to have had an economically large and statistically significant effect on the stock prices of both financial and nonfinancial firms during that period. For example, in the low interest rate environment, a downward revision of 25 basis points in year-ahead policy expectations is estimated to boost the stock prices of financial institutions between 1.3 and 1.5 percent, depending on the sector. In addition to being economically large, the effect of path surprises on stock returns in the low interest rate environment is statistically significantly different from that in the normal interest rate environment. Indeed, according to our estimates, it appears that path surprises had virtually no effect on the stock returns of financial firms outside the period of very low policy rates. This finding, however, is not specific to financial firms. As evidenced by the entries in the last column of the table, the same pattern holds for nonfinancial firms, a sector where we actually find the largest impact (in absolute value) of path surprises on stock returns in the low interest rate environment.

What could account for the heightened importance of FOMC communication during the 2003-04 period of low policy rates? One possibility is that investors were especially concerned about the risk of deflation and the economy falling into a liquidity trap, resulting in a protracted period of economic weakness. Against this backdrop, the Committee’s communication efforts, including an indication that the funds rate will be maintained at 1 percent for a prolonged period, may have helped assuage investors’

concerns about the possibility of an especially adverse macroeconomic outcome, thereby giving a larger-than-usual boost to stock prices.

The fact that the stock prices of both financial and nonfinancial firms display heightened sensitivity to FOMC communication in the low interest rate environment strongly suggests that this is a market-wide phenomenon. We test this hypothesis by examining the responses of abnormal stock returns to monetary policy surprises. In particular, we estimate abnormal stock returns for each firm by regressing its daily excess return on the market excess return and the two Fama-French factors, corresponding to size (SMB) and book-to-market (HML).<sup>8</sup> Abnormal returns are defined as the residuals from this regression—that is, by construction, the part of the return that is not accounted for by its usual co-movement with the aggregate risk factors. We then estimate equation 2 using abnormal returns instead of returns as the dependent variable.

The results of this exercise are presented in Table 3. As evidenced by the entries in the table, there is little systematic evidence that monetary policy surprises lead to significant abnormal returns for either financial or nonfinancial firms. We interpret these results as indicating that the reactions of financial stock prices to monetary policy surprises in both the low and normal interest rate environments are in line with their usual response to measures of aggregate risks. In this sense, there is nothing special about the way equity prices of financial institutions react to unanticipated changes in interest rates. That is, unexpected changes in the stance of monetary policy influence financial firms' equity valuations through their effects on broader financial and economic conditions, including the equity risk premium, future profit opportunities, and asset quality.

To evaluate the potential size of the effects of target and path surprises on equity prices, we consider a hypothetical scenario. In this scenario, the Committee lowers its target for the federal funds rate by 75 basis points at the December meeting and through the accompanying statement indicates its intention to keep the target rate at 25 basis points for an extended period of time. Such policy action would entail a negative target surprise of about 15 basis points, which by itself would increase stock prices of financial firms between 0.3 and 0.8 percent—depending on the sector—and those of nonfinancial firms about 0.6 percent.<sup>9</sup> According to Eurodollar futures quotes, investors currently anticipate that the funds rate will be about 75 basis points in November 2009. Assuming

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<sup>8</sup> Our estimates of abnormal returns are based on the standard Fama-French 3-factor model:

$$(R_{it} - i_t^T) = \beta_i^0 + \beta_i^M (R_t^M - i_t^T) + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \varepsilon_{it};$$

where  $i_t^T$  is the risk-free rate (daily one-month Treasury yield),  $R_t^M$  is the value-weighted total market return from CRSP, and  $SMB_t$  and  $HML_t$  are the Fama-French “small minus big cap” and “high minus low book-to-market” risk factors. We estimate the firm-specific “betas” using all trading days (not just days of FOMC meetings or intermeeting policy moves) over our sample period.

<sup>9</sup> Because the effect of target surprises on stock returns in the low interest rate environment is estimated very imprecisely and, in fact, is statistically indistinguishable from the effect in the normal interest rate environment (see Table 2), the results discussed in this paragraph are based on the specification of equation 2 in which the coefficient on the target surprise is not allowed to vary between the low and normal interest rate environments; the resulting estimates of the effects of target and path surprises are very similar to those reported in Tables 1 and 2, respectively.



that the FOMC statement lowers the year-ahead expected funds rate to 25 basis points—implying a negative path surprise of about 45 basis points—our estimates suggest that stock prices of financial firms would likely rise an additional 2.4 percent and those of nonfinancial firms would increase an additional 3.2 percent, yielding a total gain of between 2.7 and 3.2 percent for financial firms and about 3.8 percent for nonfinancial firms.

The increases in equity valuations in this hypothetical scenario are, of course, averages across the firms in our sample. In practice, some firms' stock prices would rise by more and other firms' would rise by less, or even decline, depending on the activities and exposures of the particular institutions. In addition, our sample of commercial banks and bank holding companies—which accounts for the bulk of industry assets—consists of publicly traded firms that are listed on major stock exchanges and excludes most smaller community-based banks. To the extent that these smaller institutions have a relatively high fraction of their loan portfolios priced relative to the prime rate—which tends to move in lockstep with the target federal funds rate—they may be more likely to experience a reduction in profitability as a result of a further reduction in the target funds rate.<sup>10</sup>

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<sup>10</sup> The pass-through of the changes in the target federal funds rate to business and household borrowing rates is discussed in note 13 of this package, “The federal funds rate target and business and household borrowing rates.”

Table 1. Reaction of Stock Returns to Changes in the Stance of Monetary Policy

Interest Rate Change	Sector			
	Commercial Banks	Insurance Carriers	Investment Banks	Nonfinancial Firms
Target Surprise	<b>-2.70</b> [3.02]	<b>-2.30</b> [2.09]	<b>-5.25</b> [2.32]	<b>-4.28</b> [2.66]
Path Surprise	-1.64 [1.78]	-1.89 [1.70]	-1.83 [0.80]	-2.67 [1.81]
Expected Change in Funds Rate Target	-0.04 [0.10]	0.29 [0.51]	-0.23 [0.19]	0.30 [0.54]
$R^2$	0.012	0.006	0.015	0.009
No. of observations	54,183	16,326	4,818	531,258
No. of firms	807	280	96	9,184

Notes: Sample period: 121 policy actions between February 1994 and June 2008. Dependent variable is the firm-specific daily stock return on the day of the policy action. All specifications include firm fixed effects and are estimated by OLS. Absolute  $t$ -statistics based on standard errors that are robust to arbitrary cross-sectional dependence in the error term are reported in brackets. Coefficient estimates highlighted in bold are statistically different from zero at the 5 percent significance level.

Table 2. Reaction of Stock Returns to Changes in the Stance of Monetary Policy in a Low Interest Rate Environment

Interest Rate Surprise	Interest Rate Environment	Sector			
		Commercial Banks	Insurance Carriers	Investment Banks	Nonfinancial Firms
Target Surprise	Normal	<b>-2.72</b> [3.27]	<b>-2.18</b> [2.11]	<b>-5.32</b> [2.52]	<b>-4.17</b> [2.58]
	Low	12.2 [0.77]	20.1 [1.01]	13.1 [0.15]	-1.03 [0.02]
Path Surprise	Normal	-0.90 [0.87]	-1.01 [0.78]	-1.36 [0.53]	-1.69 [1.04]
	Low	<b>-5.30</b> [3.94]	<b>-5.94</b> [4.90]	<b>-5.48</b> [2.14]	<b>-7.19</b> [4.20]
<i>Differential effects:</i>					
Target Surprise: (Low – Normal)		15.0 [0.94]	22.2 [1.12]	18.4 [0.21]	3.14 [0.07]
Path Surprise: (Low – Normal)		<b>-4.41</b> [2.62]	<b>-4.93</b> [2.82]	-4.12 [1.14]	<b>-5.49</b> [2.33]
$R^2$		0.014	0.007	0.016	0.009
No. of observations		54,183	16,326	4,818	531,258
No. of firms		807	280	96	9,184

Notes: Sample period: 121 policy actions between February 1994 and June 2008. Dependent variable is the firm-specific daily stock return on the day of the policy action. All specifications include firm fixed effects and are estimated by OLS. Absolute  $t$ -statistics based on standard errors that are robust to arbitrary cross-sectional dependence in the error term are reported in brackets. Coefficient estimates highlighted in bold are statistically different from zero at the 5 percent significance level.

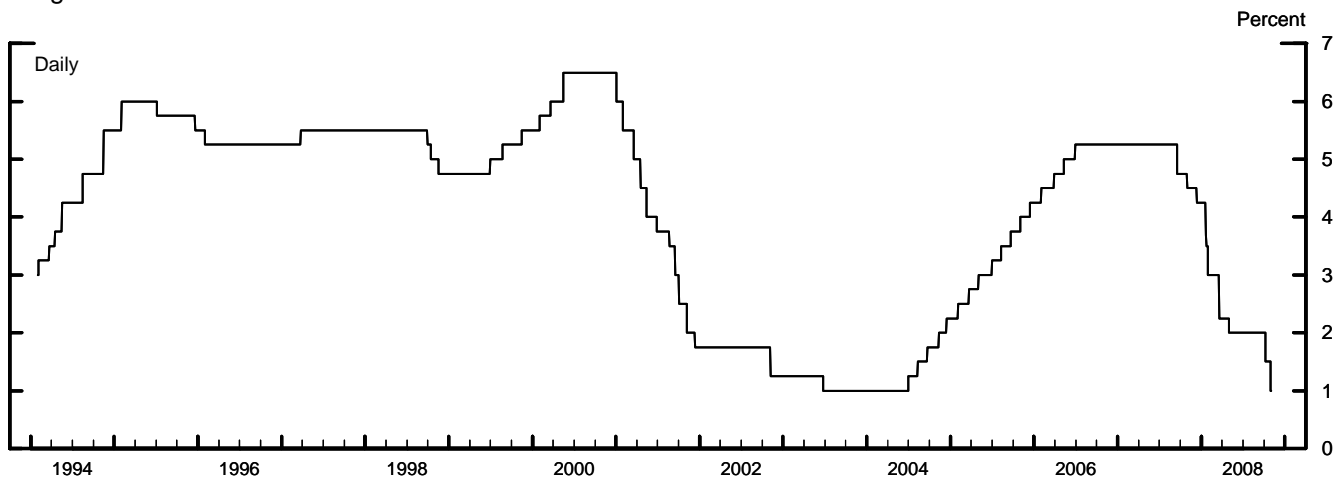
Table 3. Reaction of Abnormal Stock Returns to Changes in the Stance of Monetary Policy in a Low Interest Rate Environment

Interest Rate Surprise	Interest Rate Environment	Sector			
		Commercial Banks	Insurance Carriers	Investment Banks	Nonfinancial Firms
Target Surprise	Normal	<b>-1.12</b> [2.13]	-0.14 [0.28]	-1.23 [1.50]	-0.52 [1.11]
	Low	12.5 [1.06]	17.5 [0.94]	-0.23 [0.00]	-1.98 [0.24]
Path Surprise	Normal	0.02 [0.03]	-0.36 [0.67]	-0.43 [0.26]	<b>-0.94</b> [2.38]
	Low	-0.97 [0.87]	-0.04 [0.06]	2.58 [1.21]	0.01 [0.01]
<i>Differential effects:</i>					
Target Surprise: (Low – Normal)		13.6 [1.16]	17.7 [0.95]	1.00 [0.02]	-1.46 [0.17]
Path Surprise: (Low – Normal)		-0.99 [0.81]	-0.32 [0.39]	2.15 [0.79]	0.94 [1.59]
$R^2$		0.002	0.000	0.001	0.000
No. of observations		54,183	16,326	4,818	531,258
No. of firms		807	280	96	9,184

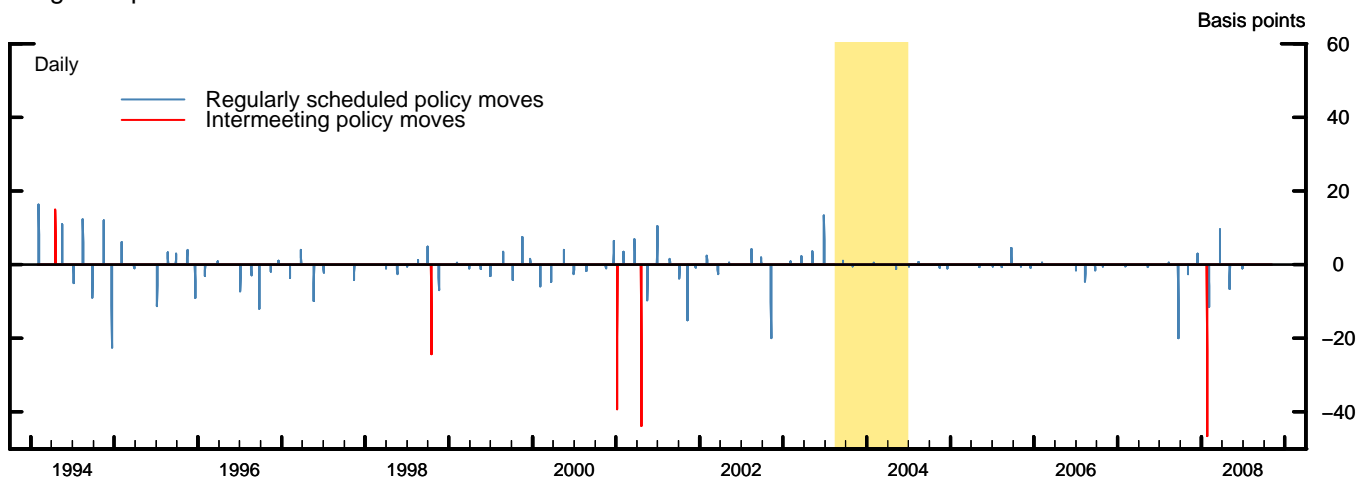
Notes: Sample period: 121 policy actions between February 1994 and June 2008. Dependent variable is the firm-specific daily abnormal stock return on the day of the policy action. Abnormal stock returns are estimated using the Fama-French 3-factor model (see text for details). All specifications include firm fixed effects and are estimated by OLS. Absolute  $t$ -statistics based on standard errors that are robust to arbitrary cross-sectional dependence in the error term are reported in brackets. Coefficient estimates highlighted in bold are statistically different from zero at the 5 percent significance level.

### Monetary Policy Actions and Surprises

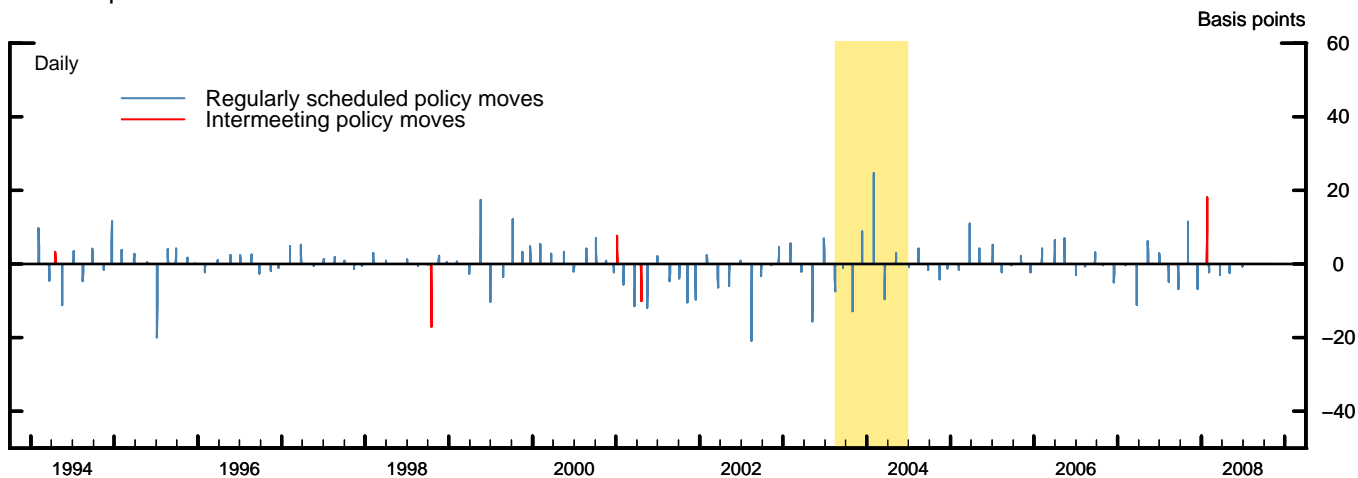
Target federal funds rate



Target surprises



Path surprises



December 5, 2008

## 11. Treasury Market Functioning and the Zero Bound<sup>1</sup>

Kenneth Garbade, Frank Keane, Jennifer Roush<sup>2</sup>

### Executive Summary

This memo examines the likely effects of very low interest rates on Treasury market functioning. General collateral rates in the repo markets have already been very low for some time and functioning in repo, cash, and derivative Treasury markets has deteriorated as a consequence. A further decline in interest rates would likely exacerbate already poor conditions.

The securities lending and repo markets are used by dealers, banks, and other leveraged investors to finance long and short cash market positions in Treasury securities. They are also used by money market funds and other cash investors to earn interest on cash balances and to earn fee income from lending securities. Disruptions in these financing markets has degraded liquidity in Treasury cash markets and may increase the cost of Treasury issuance (because investors generally demand higher yields on less liquid securities) at a time when government borrowing needs have increased and are expected to expand substantially. More broadly, investors depend on the Treasury market to price and hedge positions in other fixed income markets. Thus reduced liquidity and increased volatility in the Treasury markets affects investors' ability to predictably engage in other interest rate markets and could dampen lending behavior more generally. Dealer hedging of interest rate risk associated with large un-margined fails and increased related capital charges may limit already scarce balance sheet capacity.

### Current Interest Rate Environment

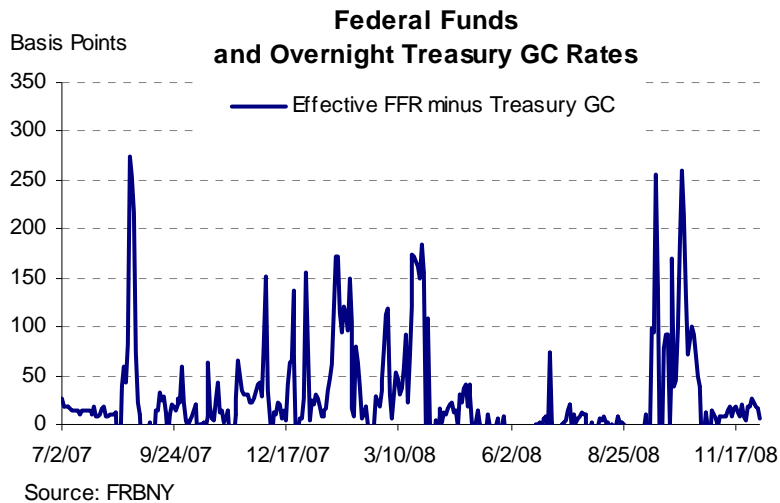
The level of the overnight general collateral Treasury repo rate ("Treasury GC") is more important for Treasury market functioning than either the target or the effective fed funds rate. Historically, distinguishing among the three rates mattered little because the rates traded in close proximity to each other. However, in times of financial market stress, such as after the Lehman bankruptcy and the subsequent "breaking of the buck" at the Reserve Fund money market fund, demand for safety from short-term investors

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<sup>1</sup> This note draws on work by Michael Fleming and Kenneth Garbade, "When the Back Office Moved to the Front Burner: Settlement Fails in the Treasury Market After September 11," *Federal Reserve Bank of New York Policy Review* (November 2002) and "The Repurchase Agreement Refined: GCF Repo,," *Federal Reserve Bank of New York Current Issues in Economics and Finance* (June 2003) and Michael Fleming, memo, "The Repo Market and the Zero Bound, March 24, 2003."

<sup>2</sup> Fleming and Garbade: FRBNY Research; Keane: FRBNY Markets Group; Roush: Division of Monetary Affairs.

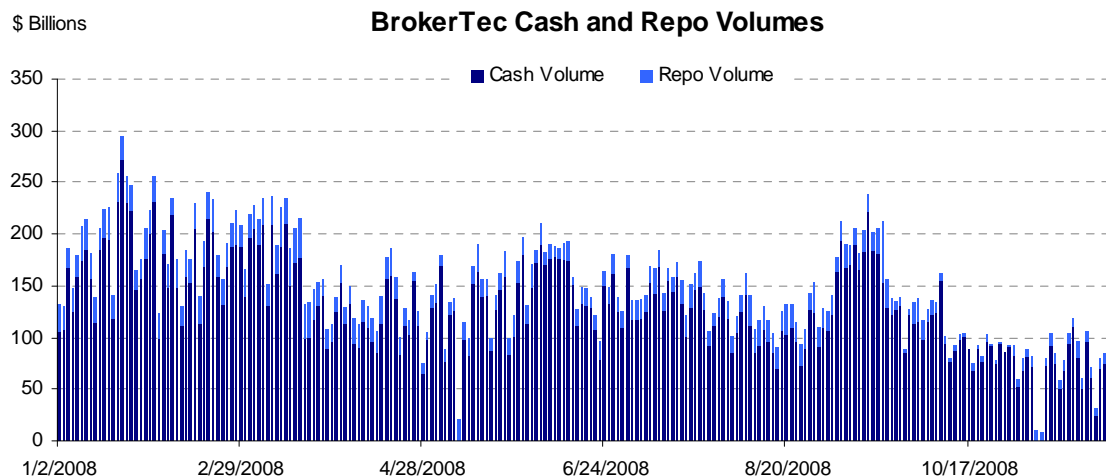
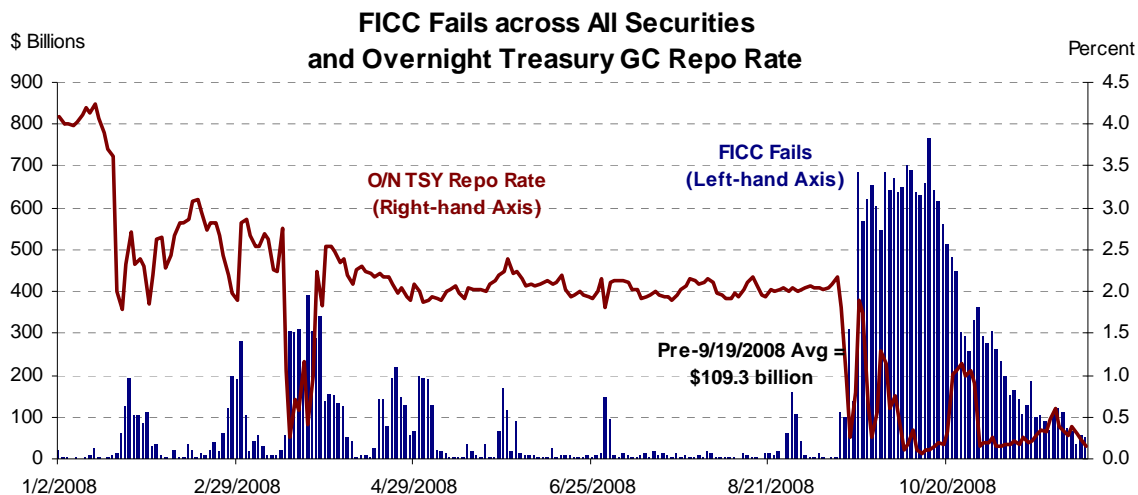
surged. In this instance, the Treasury GC rate traded below 25 basis points for an extended period even while the effective funds rate was around 1.0 percent and the target funds rate was at 1.50 percent. The spread between Treasury GC and the effective funds rate has narrowed recently, but the period from mid-September through mid-October period demonstrated that the two rates can diverge for a sustained period.



The recent experience provides a good indication of the potential for near-zero interest rates to disrupt Treasury repo, securities lending, and cash market functioning. In particular, the unusually low Treasury GC rate set the stage for an unprecedented volume of settlement fails. Chronic and persistent fails occur in an issue when the special collateral repo rate for the security is near zero for a prolonged interval of time thereby providing little economic incentive for sellers to borrow the security to cure their settlement fails.<sup>3</sup> Because special collateral repo rates are bounded from above by the GC rate, the recent low level of the GC rate has compressed specials rates to near zero and created an environment conducive to widespread fails in a large number of issues. In recent weeks, some trades on nearly all Treasury issues have failed to settle on the originally scheduled settlement dates. Trades in some issues have failed for weeks. As a result of the widespread and persistent settlement fails, dealers and others have become reluctant to enter into transactions in Treasury securities, including outright purchases and sales as well as borrowing and lending money and securities on repurchase agreements.

The first chart below shows the relationship between low Treasury GC rates and increased settlement fails. The second chart documents the concomitant decline in transaction volumes in the cash and repo markets. The decline in trading volume is particularly remarkable given the recent increase in the pace of Treasury issuance, which would be expected to stimulate higher trading volumes.

<sup>3</sup> As rates approach zero participants become indifferent between failing to make delivery and making delivery because the current market fails penalty rate is equivalent to an interest free loan or a repo rate of zero.



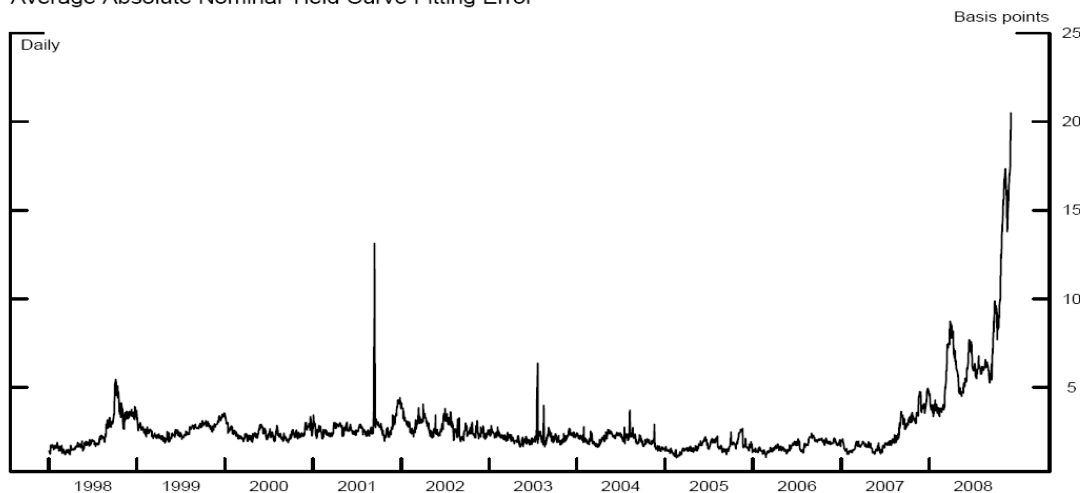
The deterioration in repo market liquidity has also led to significant price dispersion among similar maturity securities in the Treasury market. Under normal market conditions, such price differences are relatively small as arbitrageurs borrow securities to execute relative value trades, buying undervalued securities and selling overvalued securities short. However, this type of trading has reportedly been increasingly limited by poor functioning in repo markets (as well as other factors), leading to sharply higher fitting errors in models of the yield curve.<sup>4</sup> As shown below, fitting errors from the Board’s yield curve have surged since mid-September from already elevated levels. This fragmentation of relative value relationships is important because it

<sup>4</sup> There have also been reports that increased settlement fails in cash markets have raised concerns for futures and options market participants, as “futures basis trading” is one example of reduced relative value trading due to increased clearance risk in secondary cash markets, and futures basis trading ultimately involves trading in off-the-run Treasuries in secondary markets to satisfy contract obligations.



impairs the use of fitted yield curves for identifying forward interest rates and breakeven rates of inflation.

Average Absolute Nominal Yield Curve Fitting Error



Note. Calculated from securities with two to ten years until maturity, excluding on-the-run and first off-the-run securities.  
Updated: December 4, 2008

Finally, problems entering, financing, and exiting short Treasury positions are believed to have reduced the ability of market participants to hedge the interest rate risk associated with positions in non-Treasury securities, including mortgage-backed securities, and may have contributed to the widening of interest rate spreads for such securities.

### Interest Rates Near Zero

Recall that the crucial rate, for purposes of assessing the functioning of the Treasury market, is the Treasury general collateral rate, not the target funds rate. To the extent market participants are anxious about unsecured exposures and exposures secured with less liquid securities, we can expect a relatively wide spread between the target rate and the Treasury GC rate. Conversely, the spread will be tighter if market participants are more confident about such exposures.

Given the existing institutional arrangements (including the lack of a Treasury securities lending facility and the current market convention on settlement fails), we would anticipate that a Treasury GC repo rate of zero (or anything close to zero) would provide a fertile environment for major market dysfunction, including widespread, massive settlement fails on cash, repo, and securities lending trades. This would likely lead market participants to pull away from market making and related arbitrage activities, resulting in significant fragmentation of the yield curve on both an issue-by-issue and sector-by-sector basis. In addition, Treasury would have to expand its efforts to pull investors into the primary market, through direct auction participation, in order to insure against auction failure.

On the other hand, market functions are likely to continue at an acceptable level at a Treasury GC rate of 50 basis points (although there is no guarantee that a fed funds target rate of 50 basis points will be accompanied by a Treasury GC rate of 50 basis points). The biggest risk if the Treasury GC rate is 50 basis points would arise if investors come to feel at some point that the Fed is likely to tighten in the near future, with leveraged investors concurrently holding a large quantity of long-term securities. They may then want to aggressively short Treasury issues as hedge, leading to widespread, massive settlement fails. (This is essentially what happened in June 2003.)

Between 50 basis points and zero, it seems reasonable to posit a more or less steady degradation of market functionality. Limited experience to date does not allow the ready identification of any obvious discontinuities.

### **Potential Impact of Recent Market Practice Recommendations**

Settlement fails occur primarily because of the market convention that a failing seller can deliver securities after the originally scheduled settlement date at the original invoice price and without any additional penalty. This treatment results in an interest free loan to the purchaser for the duration of a settlement fail, an implicit fail penalty to the seller which becomes costless when rates hit zero. The imposition of an *explicit penalty fee* on delivery failures could restore the incentive to borrow securities to accomplish delivery even when the special collateral repo rate is near or below zero.

On November 12, 2008 the Treasury Market Practices Group (“TMPG”) announced four new market practice recommendations, which included; (1) introduction of a fails penalty rate, (2) broad-based margining of fails, (3) encouragement of more active attempts to cash settle fails after five days, and (4) creation of a tool to cure round-robin fails.<sup>5</sup> The TMPG also recommended discussing with Treasury officials the development of a securities lending facility. (<http://www.ny.frb.org/tmpg/PR081112.pdf>)

If the first recommendation is implemented, dealers would have an incentive to borrow securities to cure settlement fails even if special collateral repo rates fell below zero. The TMPG is currently working intensively with Securities Industry and Financial Markets Association and other market participants to analyze legal and operational issues associated with making the November 12 recommendations a reality. The participants are committed to publishing an implementation timeline by January 5, 2009 although when the TMPG recommendations will become operational remains unclear. And unforeseen developments could arise that would block implementation of some or all of these market practice recommendations.

The current TMPG initiatives are unlikely to be implemented before mid-2009, and may not be implemented until some time in 2010. They involve coordinated changes in back office systems that are extraordinarily complex and have been built up over several decades. Changing a single system would not be cheap or easy; coordinated

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<sup>5</sup> Round-robin settlement fails are settlement fail chains that can be collapsed with sufficient information across various clearing platforms that operate independently in the OTC Treasury market.

change will be tougher and more expensive. In the meantime, having now experienced two episodes of chronic fails (one in 2003 involving a single security, the other in the past few months involving virtually every Treasury security), it would be important to have other options to address the problems of persistent fails and unusually expensive single issues. The snap reopenings in October 2008 directed at four issues that exhibited these symptoms were widely viewed by market participants as having been ineffective and in some ways even counterproductive. An alternative way to address problems caused by massive settlement fails, either at the zero bound or from another cause, would be for Treasury to gain statutory authority to lend new temporary supply of Treasury securities. The recent TMP recommendations included support for this development, but it would require Congressional action to become a reality.

### **A More In-depth Discussion of the Repo Markets**<sup>6</sup>

Most market participants borrow and lend money and Treasury securities through repurchase agreements. A participant executing an RP sells securities (typically for same-day settlement) and simultaneously agrees to repurchase the same securities from the buyer at a higher price on a future date. The transaction is tantamount to borrowing money using securities as collateral, where the proceeds of the initial sale is the principal amount of the borrowing and the excess of the repurchase price over the sale price is the interest paid on the borrowing. The counterparty to the transaction executes a reverse RP, borrowing (or “reversing in”) securities against lending money.

There are two types of RPs. A *general collateral* RP is an RP in which the lender of funds is willing to accept any of a variety of Treasury securities as collateral. The lender is concerned primarily with earning interest on its money and having possession of securities that can be sold quickly in the event of a default by the borrower. A *special collateral* repo is an RP in which the lender of funds wants to borrow a particular security. It is, consequently, a device for borrowing and lending securities rather than borrowing and lending money. The rate on a special collateral RP is commonly called a “specials” rate. The owner of a security may be induced to lend the security if a dealer offers the owner an opportunity to borrow money at a specials rate below which the owner can re-lend the same funds on a general collateral reverse repo. If the demand to borrow is particularly strong, or if the supply of the security available for lending is limited, the specials rate for the security may be materially below the general collateral rate; the security is then said to be “on special.”

#### ***GC Repo Market***

General collateral RPs provide a safe and low-cost way for mutual funds, depository institutions, and others to lend out surplus cash on a short-term basis, and they simultaneously provide dealers, hedge funds, and others a way to finance long positions and thereby support their market-making, risk-management, and speculative activities.

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<sup>6</sup> Much of this section reflects repo market discussion by Michael Fleming in 2003 note.

At a fed funds rate of 25 basis points, or even 12.5 basis points, the GC repo market might very well keep operating. Long positions would still need to be financed and lenders might still prefer to lend money on a secured rather than an unsecured basis. But were the funds rate and short-term market rates in general to fall closer towards zero, the incentives institutions now have to continue lending in the GC repo market could erode to the point that they may prefer to maintain higher balances on deposit with their clearing banks, and banks themselves could prefer to hold risk-free excess reserves rather than lend to dealers and others in need of financing. The distinction between a GC repo market and a specials market would also become blurred, and the kinds of persistent and widespread settlement failures that occasionally mark the repo specials market could begin to occur more generally (as noted in the following section, we did begin to observe such widespread breakdown in market function in recent months).

### ***Repo Specials***

The largest impact of a near-zero fed funds rate could stem from the compression of special collateral repo rates towards zero. Near-zero specials rates can be expected to lead to increased, persistent, and widespread settlement fails, which in turn could limit activity in the secondary market for outright transactions, and ultimately increase issuer financing costs. Such reduced activity would likely be accompanied by a curtailment of dealers' positions, long or short, leading to reduced financing demand for long or short positions.

Chronic and widespread settlement fails have the potential to affect the functioning of the markets for outright transactions. A chronic fail increases the risk of loss in the case of counterparty insolvency.<sup>7</sup> The prospect of loss will lead market participants to devote resources to monitoring such risks and could lead them to limit their secondary market trading. Concerns that settlement problems could affect secondary market liquidity led Treasury officials to sell 10-year notes on an unscheduled basis after September 11, 2001, and more recently (on October 8, 2008) to reopen four notes in snap offerings.

While the aggregate size of fails reached record levels earlier this fall, it was the widespread nature of the fails; with between 100 and 200 issues failing on any given day, that was most striking. Part of the reason for such widespread fails seems to have been the low Treasury GC rate and the resulting compression of special rates. Another factor was the pullback of securities lenders, who normally arbitrage the rate spread between the specials repo market and other wholesale repo markets, because of heightened counterparty credit concerns and market volatility on the reinvestment side of the business. More recently, fails have subsided significantly. On November 14, 2008, aggregate FICC fails were about \$110 billion, the lowest since September 19, 2008 and roughly equal to average levels for the year.

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<sup>7</sup> This risk is significantly mitigated by mark-to-market conventions (such as those followed by the Fixed Income Clearing Corporation).

As we have seen, a fed funds rates below 50 basis points has been associated with increased settlement fails for virtually all Treasury issues. Specials rates are sometimes observed to be close to zero for certain securities, showing that some dealers are willing to go to the trouble of borrowing securities when the incentive to do so appears exceedingly small.<sup>8</sup> A fed funds rate of 50 basis points might therefore provide sufficient margin for those who are short to borrow and for those who are long to lend.

However, recent experience shows there is a risk of a sharp divergence between Treasury GC rates and the effective federal funds rate (and short-term funding rates in general), with the Treasury GC rate falling substantially below other wholesale funding rates during episodes of flight to safety (for example, at year-end or in response to elevated stock market volatility). At a 50 basis point target, a divergence smaller than what has been observed this fall would be sufficient to severely disrupt specials trading and cash markets, and such disruption might be more persistent than that observed this fall with the target rate at 1.50 and 1.00 percent.

At a fed funds rate of zero, if the TMPG initiatives have not been enacted, there would be no incentive to make delivery and fails could be expected to increase considerably and persist. Securities lending would likely cease and cash trading volumes decline further, as Treasuries became a “long only” market, with market makers unwilling to sell securities they did not already have in inventory.

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<sup>8</sup> Similarly, dealers will often borrow securities from the Federal Reserve at a fee close to the GC rate in order to avoid failing, even though the incentive to do so appears small. Both of these cases may be explained by a dealer not wanting to fail for reputational and/or other reasons.

December 5, 2008

## **12. Potential Effects of Very Low Policy Rates on Federal Funds & Other Money Markets<sup>1</sup>**

David Bowman, Chris Burke, Seth Carpenter, Susan Foley, Todd Keister<sup>2</sup>

### **Executive Summary**

The possibility that further cuts in the target federal funds rate might be necessary to foster satisfactory economic performance has raised questions about how money markets would operate in an environment of very low short-term interest rates and in the aftermath of such a period. This note considers the possible effects of very low short-term interest rates on several aspects of money market functioning. Given the low levels of opportunity costs, activity in various money markets seems likely to decline further, and liquidity could well diminish. Investors may choose to hold larger balances in transaction accounts than previously. Depository institutions' daylight overdrafts may continue to decline. The infrastructure supporting money market activity—for example, the number of active money market brokers and the experience level of federal funds traders and reserve managers—could be eroded temporarily during a period of very low interest rates and may take some time to recover after rates are no longer low.

### **The Federal Funds Market**

As a result of the very high level of reserve balances, the effective fed funds rate has been significantly below target in recent weeks. The federal funds rate was around 22 basis points at the end of October, climbed to around 55 basis points in late November, and began to decline again in December with the anticipation of additional monetary policy easing. In principle, the payment of interest on excess balances should provide a floor to the federal funds rate, but in practice, several large lenders in the market are not eligible to receive this interest, and the arbitrage from the market rate to the excess rate has been incomplete.

The extraordinarily high level of balances and the payment of interest on excess balances have together led to a decline in the daily volume of overnight brokered federal funds transactions. Brokered volume, which averaged \$100 billion in the twelve months before the credit crunch began in August 2007, grew to an average of \$120 billion in the nine months after. In September 2008, however, the amount of reserve balances provided through the various Federal Reserve liquidity facilities exceeded the Desk's ability to drain balances, and the level of balances outstanding soared. In early October, the Federal Reserve began to pay interest on required and excess reserve balances. As a

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<sup>1</sup> This note borrows heavily from the 06-18-2003 memo, "Some Potential Financial Sector Implications of Very Low Short-Term Interest Rates" by James Clouse (Board), Spence Hilton (FRBNY), and Ken Kuttner (FRBNY).

<sup>2</sup> Division of International Finance, Markets-FRBNY, Division of Monetary Affairs, Division of Reserve Bank Operations and Payment Systems, and Research-FRBNY, with appreciable help from Spence Hilton.

result of these two developments, average daily brokered volume decreased back to \$100 billion in mid-October and slid a bit more through early December. The composition of daily trading has also changed. A larger proportion of brokered transactions now reflects selling by institutions that cannot earn interest on balances, in particular the GSEs, for two reasons. First, the GSEs cannot earn interest by leaving funds in their account at the Federal Reserve and thus have an incentive to sell funds for any positive return. Second, some GSEs have become reluctant to engage in term lending of federal funds and appear to have shifted these funds into the overnight market. As a result, the fraction of lending in the overnight federal funds market that comes from GSEs has increased from 35 percent in July 2008 to 56 percent in November.

A further reduction in the target federal funds rate would likely reinforce the previously discussed trends. Volume in the market could continue to decline, however, it is unclear at what market rate there would be an especially sharp decline. As noted, above, trading volume has declined from its peak, but has not collapsed. In the case of Japan, discussed in section 4, the money market only disappeared when the policy and market rates were essentially at zero. In the Japanese experience, the market recovered after overnight rates rose, but the recovery took time and was incomplete.

Some market participants have speculated about the possibility of negative rates in the federal funds market. While federal funds can and have traded at zero in small volumes, it is unlikely that any significant volume of federal funds would trade below zero. Selling federal funds creates an asset on the DI's balance sheet equal to the reduction in their Federal Reserve balances due to the sale, so the transaction does not reduce the overall balance sheet size. As such, it is not clear why even a GSE would take a counterparty credit risk and simultaneously "lose" money on a negative-rate transaction.

### **Eurodollars<sup>3</sup>**

Many institutions that cannot sell in the federal funds market are able to lend indirectly to U.S. DIs via Eurodollar sales. In fact many domestic DIs borrow heavily from a wide variety of investor types, including corporate accounts and money funds, booking Eurodollar deposits at branches located outside the United States. Non-DI (and non-GSE) lenders in the Eurodollar market generally settle these trades through transactions accounts maintained at a clearing bank. In general, we might expect rate and trading behaviors in the Eurodollar market to be similar to those of the GSEs in the federal funds market, as the incentives would be equivalent.

### **FDIC Guarantee and short-term markets**

On October 14, 2008, the FDIC announced the Temporary Liquidity Guarantee Program (TLGP), and released final rules on November 21, 2008. One aspect of this rule was to guarantee an unlimited quantity of non-interest bearing transaction deposits. With

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<sup>3</sup> Eurodollars are dollar-denominated unsecured deposits made in foreign banks or foreign branches of U.S. banks.

money market rates very close to zero, and with credit risk a prominent concern, this guarantee is apparently seen as attractive. Demand deposits grew at a seasonally adjusted annual rate of over 130 percent in November. Reportedly, some of this growth reflects large money center banks converting large time deposits into demand deposits. If money market rates were all near zero, investors in any other type of money market instrument could easily perceive the guarantee from the FDIC as being more valuable than a modest positive return on a risk-adjusted basis. The implications for the banking system as a whole are likely not adverse, because there would either be net inflows to deposits or a substitution of one type of deposit for another. For other short-term instruments, such as agency discount notes, demand could well be curtailed as investors shift toward bank deposits. Another aspect of the guarantee was that in the final rules, liabilities with maturities under one month were excluded from the guarantee. This exclusion was well received by the market because there were concerns that the 75 basis point guarantee fee would severely impair overnight markets.

### **General Collateral RP Market**

Many investors find general collateral (GC) repurchase agreements (RPs) attractive because they provide an investment that is essentially free of credit risk.<sup>4</sup> If the federal funds rate were cut to a level close to zero, rates on short-term RPs against general Treasury collateral would likely be pushed to zero, apart from associated transactions costs, while rates in other short-term markets, including GC RPs against agency debt and other collateral, would continue to reflect some credit risk. For a more complete discussion, see section 11, “Functioning of Treasury Securities Markets”.

### **The Specials RP Market**

Recently, very low short-term interest rates have created significant disruptions in the special collateral RP market even if the target federal funds rate is still some distance above zero. Ordinarily, securities that are “on special” in the repo market are the most liquid and sought-after securities. In order to obtain these specific securities, market participants are willing to lend cash to counterparties at a so-called “specials rate” that is below the GC rate. For a discussion of the impact, see section 11, “Functioning of Treasury Securities Markets”

### **The FX Swaps Market<sup>5</sup>**

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<sup>4</sup> A general collateral RP is a repurchase agreement in which the lender of funds is willing to accept any type of Treasury security as collateral. This is to be distinguished from a special collateral RP, discussed in the following section, in which the lender of funds seeks to borrow a particular security.

<sup>5</sup> FX swaps are over-the-counter (OTC) instruments involving both a spot and a simultaneously offsetting forward transaction between two currencies. The use of FX swaps is similar to the actual borrowing and lending of currencies on a collateralized basis, and provides an alternative to directly borrowing and lending in the Eurodollar or other offshore markets. FX swaps are extremely popular among OTC interbank dealers, and now account for nearly half of total turnover in the U.S. OTC foreign exchange market. They are widely used by traders and other market participants for managing liquidity and shifting delivery dates, for hedging interest rate or exchange rate risk, taking positions on interest rates, or exploiting comparative advantages in raising funds in one currency versus another.



Very low short-term interest rates are unlikely to create significant distortions in the FX swap market. If each counterparty can borrow in its each currency, then the forward price of a swap agreement should reflect the spot foreign exchange rate adjusted by the interest rate differential in the two currencies. Ordinarily forward prices correspond quite closely to the differential between Libor rates in the two currencies, but since August 2007 for swaps involving dollars, the forward prices have been much higher than differences between Libor rates, with effective dollar costs being much higher, as some foreign financial firms bid at relatively high rates to swap for dollar funding. There is currently little activity in any FX swaps markets involving the dollar as financial institutions have become reluctant to lend dollars.

If the dollar Libor rate fell to close to zero, it would be unlikely by itself to impede the functioning of the FX swap markets. Because the pricing of a swap depends on the interest rate differential, the levels of the interest rate in either of the two currencies do not directly factor in to the FX swap market. Thus, very low dollar interest rates should have little bearing on activity on the market. If both dollar short-term rates and another currency's short-term rate were very close to zero, however, some difficulties may arise. In such a situation, one could imagine greater volatility in short-term rate differentials. This volatility could show through to the pricing of forward foreign exchange rates and the forward pricing in swaps contracts. In principle, such a condition could impair trading.

### **Daylight Overdrafts**

Amid very low overnight rates and extremely high levels of overnight balances, demand for intraday credit has decreased since mid-September. For several days in the wake of the failure of Lehman Brothers, average daylight overdrafts increased significantly, and peak overdrafts reached record levels exceeding \$300 billion. Immediately following the failure, the level of overnight balances began to rise significantly, and the effective federal funds rate declined. During this period, average daylight overdrafts began to diminish slightly, and peak daylight overdrafts declined notably. In late October and into November, the level of overnight balances surged to well over \$600 billion, and daylight overdrafts dropped precipitously to levels below those seen before the beginning of the market stress in August 2007. Concurrently, the effective federal funds rate dropped to levels below the daylight overdraft fee of 36 basis points at an annual rate. Even before the effective rate was below the daylight overdraft fee, the market rate faced by some large banks was likely below the overdraft fee. As a result, the contemporaneous timing of the sharp rise in overnight balances with the fall in the funds rate makes it difficult to assess the independent effect of market rates on the demand for daylight overdrafts. That said, the fact that overdrafts fell somewhat even before the decline in the funds rate suggests that it is the level of overnight balances more than the overnight rate that is responsible for the drop in overdrafts. As a result, further declines in the overnight rate may not be likely to reduce the level of daylight overdrafts, but increases in the level of reserve balances likely will.

### **Important Intermediaries**

A sharp fall in activity in the federal funds market could have an institutional effect in terms of federal funds brokers and reserve managers at banks, though the effect may be only temporary. The number of major brokers has already been halved in the past five years, as economies of scale have created pressure to merge. A collapse of the market could put more pressure on these firms. Similarly, in 2003, when the federal funds rate was at 1 percent, trading desks apparently lost staff. Judging from the experience in Japan, the resumption of money market activity may be delayed for a time by a lack of intermediaries, but it seems plausible that, given time, these roles would be replaced.

The implications of a move towards a zero level of short-term interest rates for two classes of institutions that play a key role in money markets—money market mutual funds and depositories—are discussed in separate notes.

### **Low short-term interest rates, interest on reserves, and the demand for balances**

The combination of very low overnight interest rates, the extraordinarily large supply of balances provided through the various liquidity facilities, and other measures in place seem likely to produce some changes to the composition of balances held by depository institutions. The level of excess balances has increased in the first instance as a result of the extraordinary liquidity operations. Required reserve balances and contractual clearing balances tend to adjust somewhat slowly. It is not clear, however, that this change in composition is likely to have any meaningful effect on market function or market participants.

The very low level of overnight interest rates combined with the FDIC's unlimited guarantee on non-interest bearing transaction deposits has led to an increase in these deposits, and therefore on required reserves and required reserve balances. With depository institutions receiving interest on required reserve balances, there is little or no cost to these institutions to permitting their customers to expand their reservable deposits. As a result of all of these factors, required reserves and required reserve balances have increased by \$7½ billion since the end of September, resulting in a doubling of required reserve balances. Further reductions in the target or effective federal funds rate seem likely to reinforce this trend to some degree.

In contrast, contractual clearing balances have declined almost \$2 billion since the end of September and can be expected to decline further. The interest rate paid on excess balances (now the target federal funds rate) exceeds the rate paid on contractual balances, which is tied to the three-month moving average of the yield on the three-month Treasury bill. This interest differential is likely to continue, so excess balances would appear to dominate contractual clearing balances, and contractual clearing balances should continue to decline. If the target rate or the rate on excess were to decline to zero, the discrepancy in rates could disappear. That said, the level of rates for either excess or contractual clearing balances would be sufficiently low that the greater flexibility of excess balances

would likely still be preferred, and there appears to be little reason to believe that contractual clearing balances would rise.

December 5, 2008

### **13. The Federal Funds Target Rate and Business and Household Borrowing Rates**

William Bassett, Marco Del Negro, John Driscoll, Jonathan McCarthy,  
and James Vickery<sup>1</sup>

#### **Executive summary**

As the target federal funds rate approaches the zero lower bound on nominal interest rates, the Committee will need to consider both the benefits and the costs of further reductions in the target rate. This note considers one aspect of those benefits—the possible decrease in interest rates on household and business credit that may result from further reductions in the policy rate. Our principal conclusions are the following:

1. Most commercial banks have continued to lower the prime rate in lockstep with the target federal funds rate.
2. Sizable fractions of business loans, residential mortgages, and credit card loans have rates that are tied to the prime rate or other short-term interest rates that are influenced by either the target or the effective federal funds rate.
3. From August 2007 through August 2008, interest rates on nonmortgage consumer credit declined to an extent similar to that in prior policy easing episodes; however, since August 2008 they have been unusually sticky.

Of course, the decrease in interest payments for borrowers also represents reduced interest income for holders of the loans, potentially muting the macroeconomic effect of the change.

#### **Adjustment of prime rates**

The prime rate remains an important base rate for the calculation of rates on many types of loans. For instance, about 40 percent of all commercial and industrial (C&I) loan originations at U.S. commercial banks have rates that are based on the prime rate, and of those, about 90 percent reprice or mature within one year. In addition, most variable rate credit cards (which account, in turn, for at least 75 percent of the almost \$1 trillion total credit card debt outstanding), and most home equity lines of credit also have rates that are based on the prime rate. Evidence concerning the response of the prime rate to the funds target rate thus is an important factor in assessing the impact of policy rate changes in the current environment.

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<sup>1</sup> Bassett and Driscoll: Division of Monetary Affairs; Del Negro and Vickery: Federal Reserve Bank of New York; McCarthy: Division of Monetary Affairs/Federal Reserve Bank of New York. We acknowledge the contributions of Diego Aragon (Federal Reserve Bank of New York). This section is a synthesis of memos by Driscoll (prime rates and business loans), McCarthy (consumer credit rates), and Del Negro and Vickery with Aragon (mortgage rates), which are available from the authors on request.

We use the Prime Rate Supplement to the Federal Reserve's quarterly Survey of Terms of Business Lending (STBL) to investigate changes in the prime rate at respondent commercial banks. Over 85 percent of the STBL respondents reduced their prime rates by the same amount as the cut in the target federal funds rate between the August and November 2008 surveys. Nearly all that did not were small and most of those already had maintained a prime rate above the industry standard of the federal funds target rate plus 300 basis points (top panels of Exhibit 1). This pattern is similar to those in previous easing episodes—in particular to the May-August 2003 period, when the funds rate was cut by 25 basis points to 1 percent (lower left panel). However, in contrast to previous episodes, five banks with assets between \$10 billion and \$35 billion lowered their prime rates less than 100 basis points between August and November of this year, perhaps suggesting some incipient sluggishness in the adjustment process. Nevertheless, prime rate-federal funds rate basis swaps indicate that market participants anticipate little change in this spread (once one accounts for continued softness of the effective federal funds rate to the target rate) over the coming year.

### **Business loan rates**

Another major factor influencing C&I loan rates is the spread of such rates over the prime rate. Between 1997 and 2007, the spread of loan rates over the prime rate trended downward (lower right panel of Exhibit 1). However, like many other private credit spreads, this spread has widened this year, but the 30-basis-point increase is considerably less than the decline in the prime rate. Although banks may continue to raise spreads, further reductions in the target federal funds rate would likely lead to lower prime-based C&I loan rates. Moreover, of the C&I loan originations whose rates are not based on the prime rate, 90 percent mature or reprice within a year. Therefore, in the absence of further market disruptions or significant increases in spreads upon the rollover of existing loans, those business borrowers also will benefit from additional reductions in the target federal funds rate.

In addition, nonbank financial institutions hold about \$425 billion of syndicated loans, the rates on which generally are based on Libor and so would be expected to decline with the federal funds rate. However, Libor has been unusually elevated recently, and spreads charged by nonbank participants on new leveraged syndicated credits have risen substantially over the course of the financial crisis. Furthermore, some of those loans have floors on the base rate, which would prevent reductions in those rates from passing through to corporate borrowers.

The other major type of business lending is through commercial mortgages, of which commercial banks hold about \$1.6 trillion. About one-third of these loans are construction and land development loans that are mostly floating rate; some are tied to the prime rate. Data on the composition of commercial mortgages on existing properties are relatively scant. There are apparently some adjustable rate commercial mortgages whose rates are tied to one-month Libor, but much of this lending is at fixed rates with maturities of 5 years or more. The impact of a lower target federal funds rate on this sector thus appears likely to be limited.

## Consumer credit rates

According to the Federal Reserve's G.19 statistical release, rates on consumer credit historically have fallen during periods of policy easing, as seen from the shaded regions in the upper left panel of Exhibit 2.<sup>2</sup> However, the declines in consumer loan rates are smaller than the drop in the funds target rate, as indicated by the rise in spreads during these periods (upper right panel).

To examine the behavior of consumer loan rates during the most recent period, we use Bankrate Monitor data through mid-November. (The G.19 data on bank consumer loan rates are available only through August.) Interest rates on auto loans declined between August 2007 and August 2008 in a manner similar to that of the previous easing cycles, and rates on variable-rate credit card loans fell almost as much as the federal funds target rate (lower left panel). However, over the August-November 2008 period, consumer credit rates changed little despite a further 100-basis-point reduction in the target rate. The minimal response probably reflects the effects of the intensification of the financial turmoil, such as the problems of the auto finance companies and the stresses in ABS markets, which the newly created Term Asset-Backed Securities Loan Facility may help to ameliorate.

Comparing periods where the target federal funds rate was held steady at a relatively low level, consumer credit rates declined more in the early 1990s (the "financial headwinds" period) than in the early 2000s (the "deflation concern" period), as seen in the lower right panel. Two factors likely contributed to the larger decline in the early 1990s: the gradual improvement in financial sector health over that period and, at least in the case of new car loans (whose rates tend to track medium-term Treasury yields), a fall in medium-term Treasury rates (these rates increased modestly in the later period). Thus, to the extent that communicating and following a policy that holds the target federal funds rate at a low level for some time contributes to lower medium-term rates and improved financial sector health, such a policy may facilitate further declines in consumer credit rates over time.

## Mortgage markets

As of the second quarter of 2008, first-lien residential mortgage debt outstanding was about \$9.5 trillion; according to the McDash dataset, about 30 percent (\$2.85 trillion) were ARMs.<sup>3</sup> Currently about 40 percent of outstanding ARMs (\$1.14 trillion) are past the date of the first interest rate adjustment (reset), a share that potentially could rise to about 50 percent by the end of 2009, depending upon possible defaults and refinancings.

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<sup>2</sup> The exhibit shows rates on new car loans and credit card loans, but the patterns for other consumer credit rates are similar to those displayed. Although the G.19 has earlier data on credit card rates, a change in the respondent panel in November 1994 created a break in the series; therefore, we show only the later data.

<sup>3</sup> The McDash dataset is a loan-level dataset of mortgages that provides information about the composition of this debt, including information about mortgage amount, origination date, and terms.

Of these past-reset ARMs, almost 40 percent are indexed to 6-month Libor and about 20 percent are indexed to the 1-year Treasury rate.<sup>4</sup> Both of these reference rates typically have been tightly linked to the target federal funds rate, although 6-month Libor recently has diverged noticeably as a result of the strains in funding markets (Exhibit 3). The magnitude of the effect of a change in the target federal funds rate on mortgage interest payments also depends on refinancing behavior: Historically, homeowners often refinanced ARMs before their first adjustment, but recently this option has become more difficult for many borrowers faced with inadequate equity and tighter lending standards. As a result, a reduction in the base rates that resulted from policy action likely would have a greater effect on ARM interest payments than in the past because a larger-than-usual fraction of ARM borrowers will face the reset.

The prime rate is the most common index rate for home equity lines of credit (HELOCs), so a lower target funds rate should reduce interest payments on those loans. Unpublished data from the Federal Reserve's Flow of Funds accounts indicate that about \$700 billion of draws on HELOCs are currently outstanding.

A lower policy rate could indirectly reduce borrowing costs for households that refinance existing fixed-rate mortgages or take out new loans. This indirect effect can be substantial, as in the refinancing boom during the 2001-03 period, which led to annual interest savings of up to \$61 billion; but it is harder to estimate because it depends on the transmission of easier policy to longer term rates and on the impact on spreads between mortgages and Treasuries.

Furthermore, in the current environment, the magnitude of these effects appears to be even more uncertain. The relationship between the financial incentive to refinance—measured by the difference between the average interest rate on outstanding mortgages and the current average 30-year mortgage rate—and the mortgage bankers' refinancing index has become much weaker recently, suggesting that any indirect effect may be smaller than usual. In contrast, the initial response to the Federal Reserve program to purchase GSE debt and agency-backed MBS—a sharp drop in mortgage rates and a surge in the mortgage bankers' refinancing index—suggests that the effects of incentives to refinance could be relatively large.

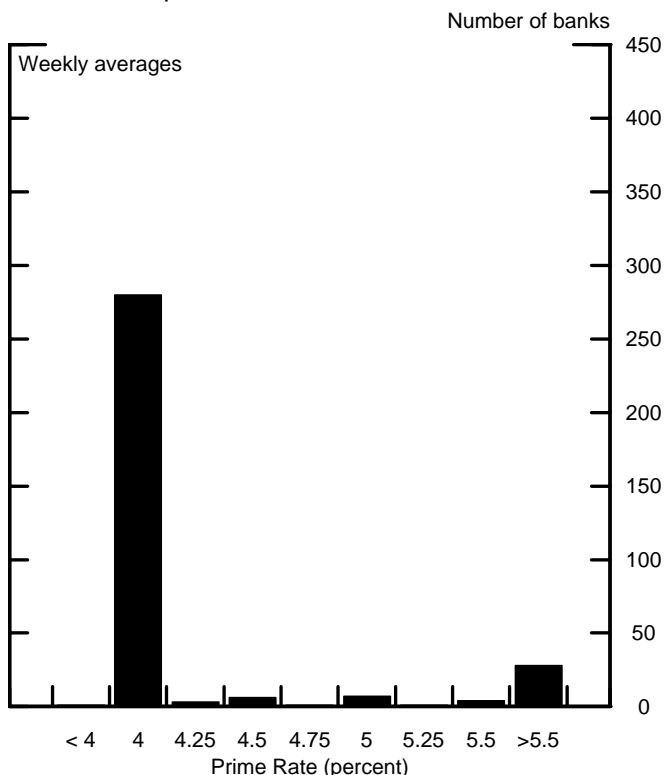
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<sup>4</sup> For the remainder, McDash does not provide indexing rates, but we suspect that in many cases they would be rates that are also influenced by changes in the policy rate. While some ARMs have interest rate floors that would impede the pass-through of lower rates, such floors are binding or close to binding for only a very small fraction of past-reset ARMs.

Exhibit 1

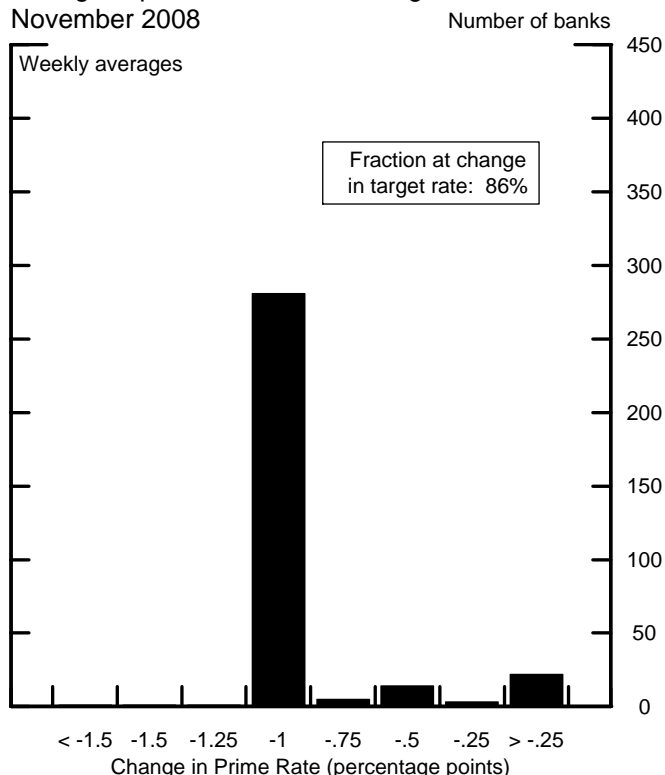
**Prime Rate and C&I Loan Rate Spreads**

Prime rate reported for November 2008



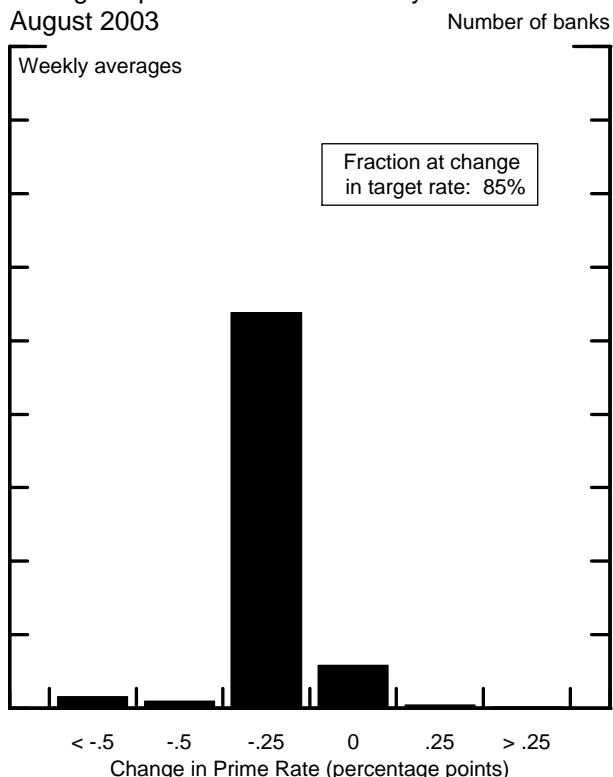
Source: Prime Rate Supplement to Survey of Terms of Business Lending.

Change in prime rate between August and November 2008



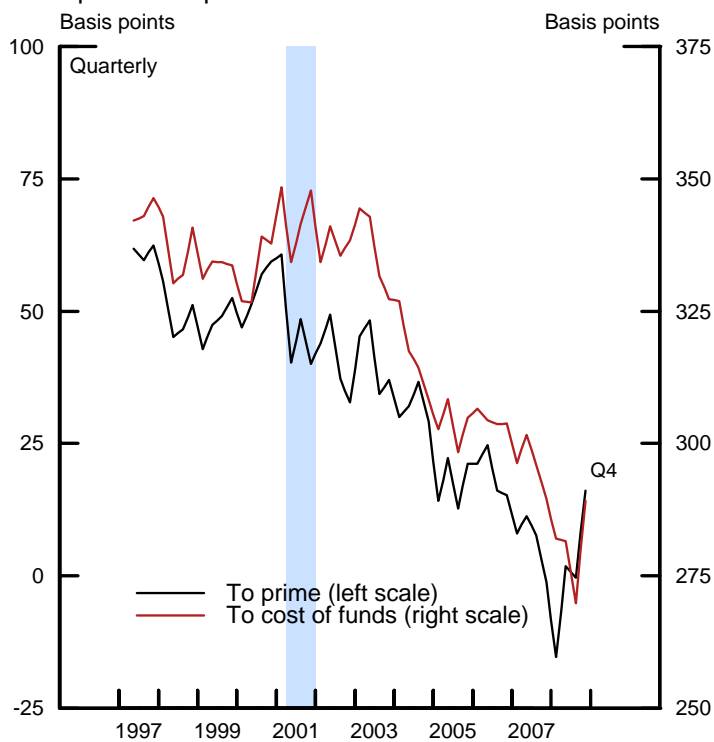
Source: Prime Rate Supplement to Survey of Terms of Business Lending.

Change in prime rate between May and August 2003



Source: Prime Rate Supplement to Survey of Terms of Business Lending.

Spreads on prime-based C&I loans



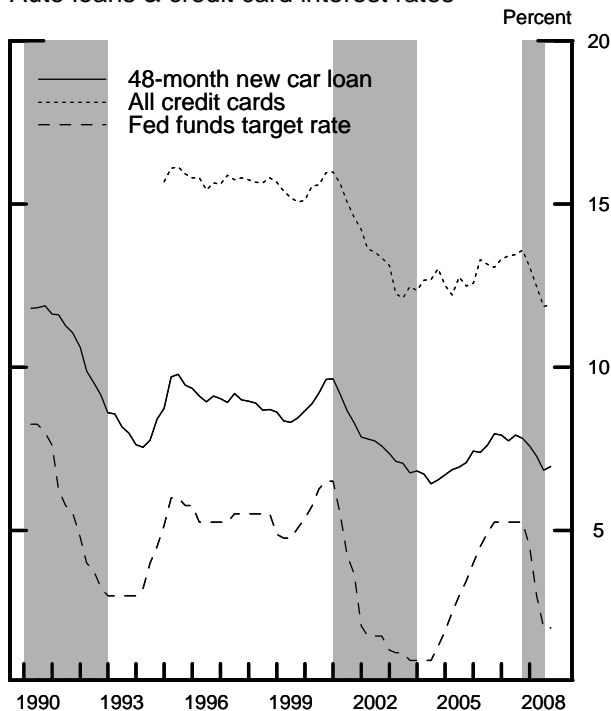
Source: Survey of Terms of Business Lending and staff calculations.



Exhibit 2

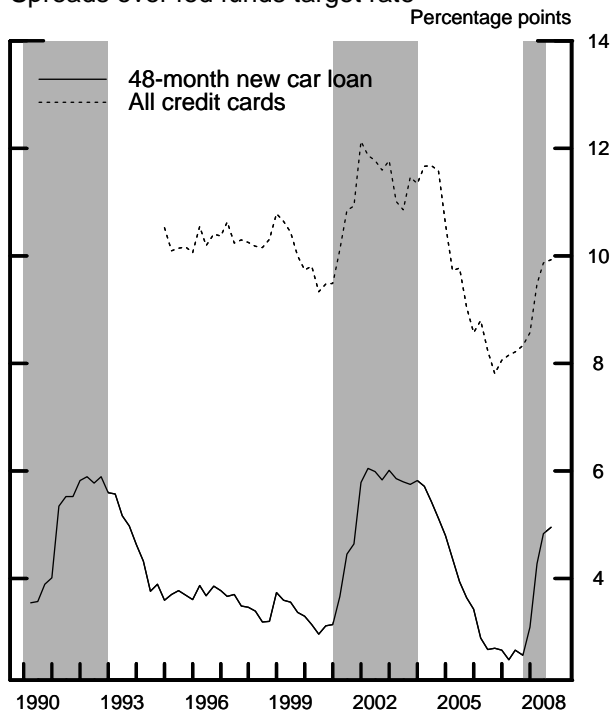
Interest rates and spreads on consumer loans

Auto loans & credit card interest rates



Note: Shaded areas represent recent easing cycles.  
Source: Federal Reserve Board G.19 release.

Spreads over fed funds target rate



Note: Shaded areas represent recent easing cycles.  
Source: Federal Reserve Board G.19 release.

Change in consumer credit rates and target federal funds rate since August 2007

	Aug. 2007 - Aug. 2008	Aug. 2008 - Nov. 2008
Fed funds target rate	-3.25	-1.00
Auto loans	-0.76	0.09
Credit cards variable rate	-2.95	-0.12

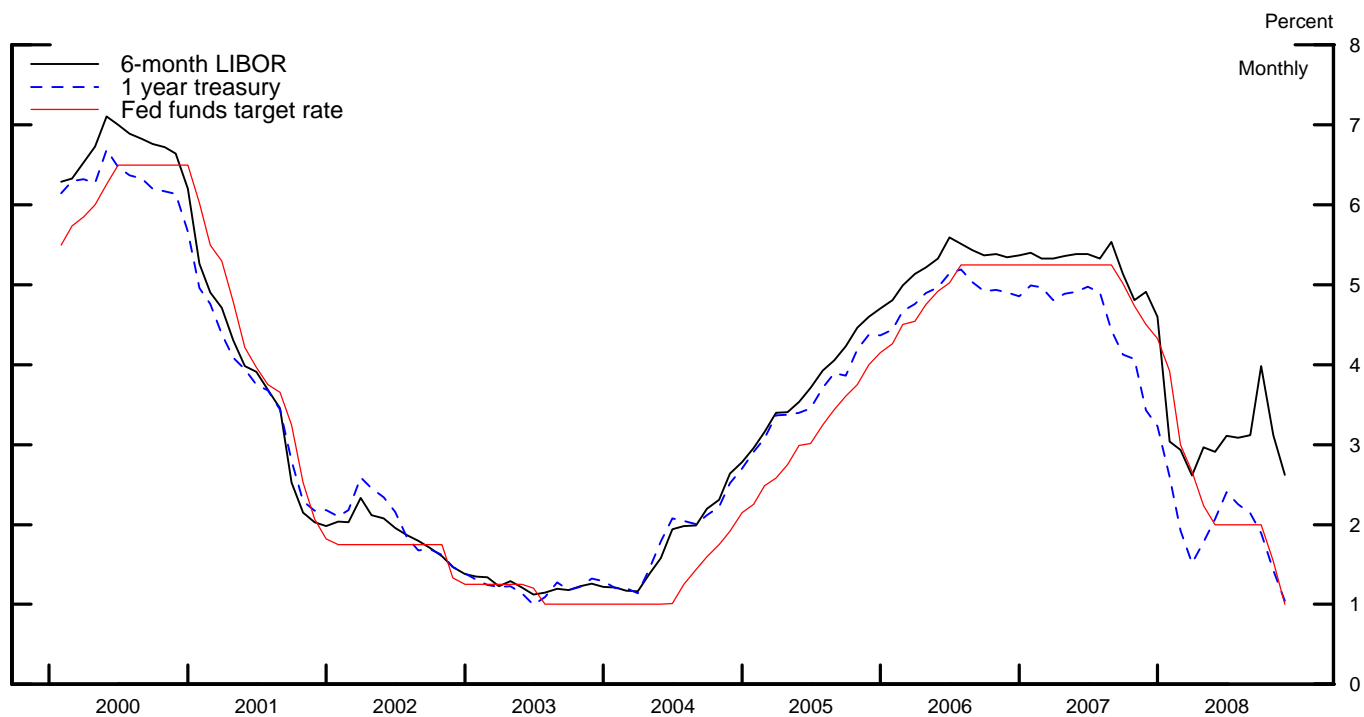
Source: Bank Rate Monitor  
Note: All figures in percentage points.

Federal funds rate and household borrowing rates in 2 'holding' cycles at low rates

	Cycle(first and last dates at that fed funds rate)	
	1992Q4- 1993Q4	2003Q3- 2004Q2
Fed funds target rate level (percent)	3.00	1.00
<b>Change in:</b> (percentage points)		
New car loan rate	-0.97	-0.32
Credit card rate (all)	-1.05*	0.22

Source: Federal Reserve Board G.19 release.  
\*Data prior to 1994 are not directly comparable to post-1994 data.

Exhibit 3  
**ARM indexing rates and the policy rate**



Source: BBA; New York Fed.

December 5, 2008

## 14. Assessing Inflation Expectations and the Risk of Deflation

Michelle Steinberg Ezer, Michael Fleming, Simon Potter, Tony Rodrigues,  
Jennifer Roush, Wilbert Van Der Klaauw<sup>1</sup>

### Executive Summary

Because it limits the lowering of real interest rates, the zero bound on nominal interest rates becomes a larger constraint on monetary policy if expected inflation is low relative to the central bank's inflation objective or if there is a high risk of deflation. We examine a number of different measures of the current level of expected inflation and the risk of deflation and provide some comparisons with the 2003 period. Overall we find that while inflation expectations have declined from somewhat elevated levels earlier this year, we see little hard evidence to date of expected deflation, once the large fall in energy prices and some technical factors are taken into account. However, among those indicators that suggest that the risks of deflation have increased are a number of survey measures and the Greenbook forecast distributions. This is perhaps significant because in earlier volatile periods the Greenbook forecast has been shown to be the most accurate measure of near-term inflation.<sup>2</sup> Lastly, many of the measures we consider do not take into account the surprisingly low reading for the core CPI in October implying that actual perceptions of deflation risks may be somewhat greater than reported here.

We report on four different measures:

1. Inflation expectations from financial markets
2. Inflation expectations from professional forecasters
3. Household inflation expectations
4. FRB/US and Greenbook estimates of deflation.

### Inflation Expectations from Financial Markets

Five-year inflation compensation, as measured by the yield difference between nominal and inflation-indexed Treasury securities, is currently negative 1.1 percent per annum.<sup>3</sup> Taken at face value, this reading suggests that investors are anticipating a decline of about 6 percent in the level of the CPI over the next five years. However, inflation compensation is, at best, a noisy measure of inflation expectations; it is also influenced by changes in inflation risk premia and differential liquidity conditions in the real and nominal Treasury securities markets. Indeed, the latter factor seems to have

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<sup>1</sup> Fleming, Potter, Rodrigues, Van der Klaauw: Research, FRBNY; Steinberg Ezer: Markets, FRBNY; Roush: Division of Monetary Affairs.

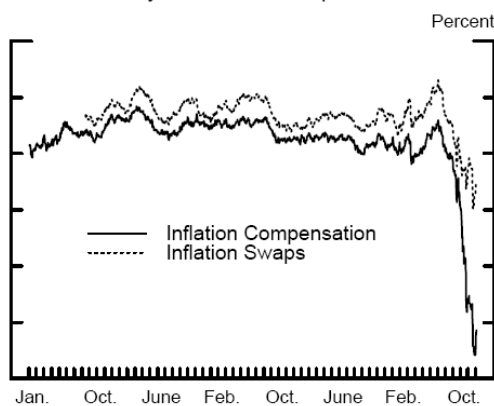
<sup>2</sup> See Christina D. Romer and David H. Romer (2000), "Federal Reserve Information and the Behavior of Interest Rates," *American Economic Review*, vol. 90 (June), pp. 429-57.

<sup>3</sup> This value is adjusted for the lagged indexation of TIPS.

played a significant role in driving movements in inflation compensation in recent months.<sup>4</sup>

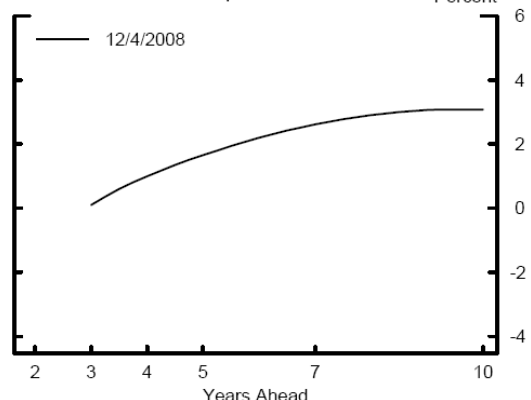
Exhibit 1 shows the substantial decline in five-year inflation compensation—from about 1.5 percent in mid-September to about -1 percent in recent days. While the decline coincided with economic data that was significantly weaker than market expectations, it also occurred during a period of severe strains in Treasury markets. As domestic and international financial markets experienced extreme volatility beginning in mid-September, investors reportedly flocked to nominal U.S. Treasury securities, driving down their yields. At the same time, anecdotal reports indicate that conditions deteriorated significantly in the TIPS market. In particular, dealers noted an increase in one-way flows, wider bid-ask spreads, and discontinuous price movements. Poor liquidity in TIPS relative to nominal Treasury securities causes investors to demand a higher return (or liquidity yield premium) to hold TIPS versus their more liquid nominal counterparts, thereby driving down inflation compensation. Indeed, amid the dramatic shifts in market conditions during September and October, TIPS yields rose rapidly even as the economic outlook worsened, suggesting that such effects were having an important influence on readings on inflation compensation.<sup>5</sup>

Exhibit 1: Five-year Inflation Compensation\*



\*Adjusted for the carry effect.

Exhibit 2: Term Structure of Implied One-Year Forward Inflation Compensation from TIPS



Note. Forward rates are the one-year rates maturing at the end of the year shown on the horizontal axis as implied by smoothed yield curves fitted to nominal and indexed Treasury securities and adjusted for the carry effect.

The size of this liquidity effect is difficult to estimate. An informal survey of TIPS traders and investors by the Desk indicates a widespread expectation of

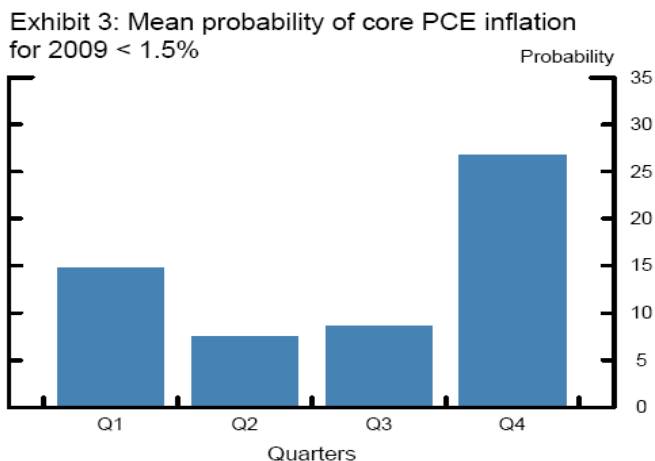
<sup>4</sup> Inferences about the level of inflation compensation also are likely clouded by measurement problems. Fitting errors in the estimation of real and nominal yield curves have increased dramatically in recent months as investors have apparently been unable (perhaps due to balance sheet constraints) or unwilling (due to market volatility) to trade away noticeable price differences between otherwise very similar securities. As a consequence, inflation compensation may also be measured with error.

<sup>5</sup> Board staff models suggest that, absent the liquidity yield premium, five-year inflation compensation would be about 2 percent. Although fitting errors for these models have been relatively large throughout the financial crisis and have risen of late, these errors are small relative to the change in inflation compensation over recent months, suggesting they provide a reasonably reliable estimate of the likely size of these effects. For additional discussion on this issue see “Liquidity Conditions Make it Difficult to Gauge Inflation Expectations from TIPS and Inflation Swaps” by Michelle Steinberg Ezer and Tony Rodrigues posted to FRBNY MarketSOURCE on November 19, 2008.

significantly lower levels of the CPI NSA index over the next few months, but a majority believes that the current level of inflation compensation in TIPS is overstating the degree of deflation expected by the market over the medium run. Measures of five-year inflation compensation from inflation swaps, which are not influenced by flight-to-quality flows in the Treasury market, were much less volatile over this period and currently point to a rate of about 1.5 percent annually over the next five years. Nonetheless this measure should also be interpreted cautiously because volume in the inflation swaps market is only a small fraction of that in TIPS market. Finally, exhibit 2 shows the implied forward structure of inflation compensation from TIPS. While the level is likely distorted by the considerations discussed above, the shape of the curve is consistent with the decline in energy prices driving the low values of five year inflation compensation.

**Inflation Expectations from Professional Forecasters**

With the confluence of technical factors affecting financial market measures of inflation expectations, survey measures may be more informative even if they are less timely. The most recent Survey of Professional forecasters (November 17th) and Blue Chip Survey (November 10th) showed large drops in near-term point forecasts of inflation consistent with the large drop in energy prices but longer term inflation forecasts showed little change and are close to the views on the Fed’s inflation objectives.<sup>6</sup> The SPF had 8 forecasters out of 38 expecting core PCE inflation to be below 1.5 percent in 2009 with none expecting core inflation below 1 percent. However, 64 percent of respondents to the Blue Chip survey for November responded affirmatively to a special question on whether the percentage change in the CPI from year ago levels will fall to 1.0 percent or less sometime within the next 12 months. The last time this occurred in the U.S. was in the early 1960s.



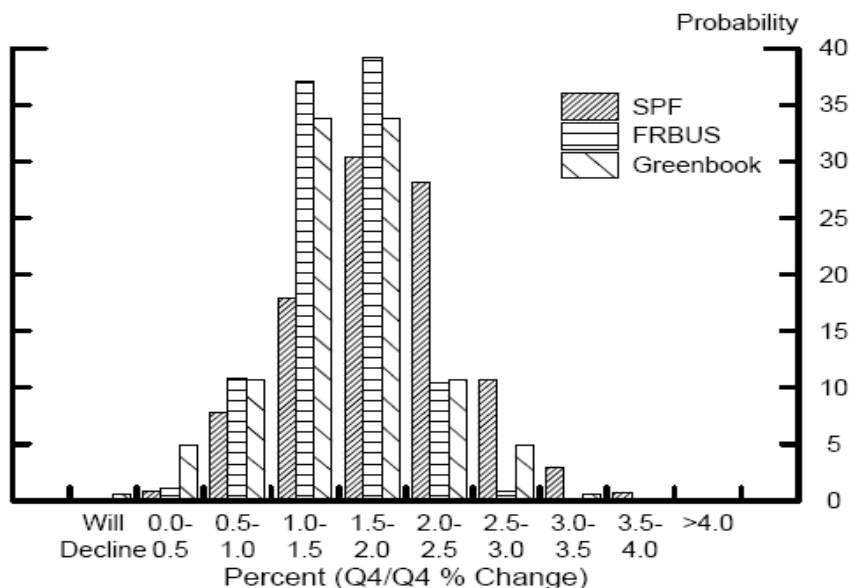
Source. Survey of Professional Forecasters (2008)

Risks of low inflation have also risen in the SPF, judging from responses to a question about forecast uncertainty about core inflation in 2009. Exhibit 3 compares the mean probability attached to core inflation below 1.5 percent for the four surveys

<sup>6</sup> Both surveys were taken before the release of the October CPI.

conducted in 2008. In the most recent survey the mean probability increased substantially to 27 percent (using a matched sample that only includes the 19 forecasters who responded to all four surveys the probability is 21 percent). Exhibit 4 also compares the SPF core PCE inflation forecast distribution with the Greenbook and FRB/US forecast distributions from October. Professional forecasters are placing considerably less weight on core PCE below 1.5% than the Greenbook and FRB/US forecast distributions indicate.

Exhibit 4: Probabilities of core PCE inflation for 2009



Source. Survey of Professional Forecasters (2008 Q4), stochastic simulations of the FRBUS model and historical distribution of the Greenbook inflation forecast experience

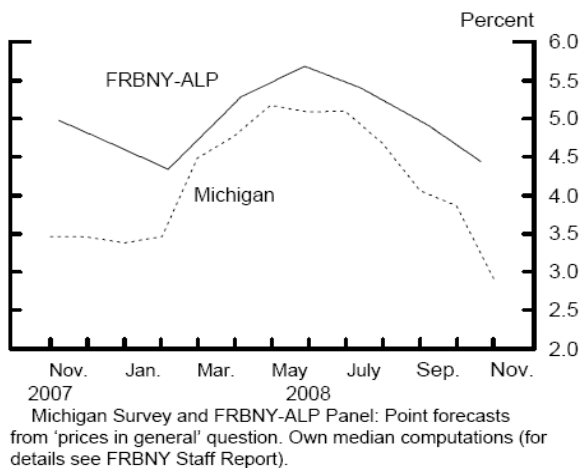
### Household Inflation Expectations

We examine the behavior of two measures of household inflation expectations: the Reuters-Michigan, nationally representative random sample of around 500 households conducted each month by phone; and the FRBNY-ALP, a national panel of more than 200 households collected each six-week period over the Internet with a much larger set of questions on inflation expectations than the Michigan survey.<sup>7</sup> Both the Michigan and the FRBNY-ALP surveys show a substantial decline in median year-ahead inflation forecasts from high levels earlier this year as can be seen in exhibit 5. In case of the FRBNY-ALP survey, the decline in median values is seen both when the question is worded in terms of the rate of inflation as well as the general price level. These declines in inflation expectations were likely strongly influenced by the abrupt decline in energy

<sup>7</sup> This new survey is described in detail in “Rethinking the Measurement of Household Inflation Expectations: Preliminary Findings,” Federal Reserve Bank of New York Staff Report #359, December 2008. In addition to the Michigan style question about “prices in general”, it asks direct questions about the rate of inflation and on inflation uncertainty.

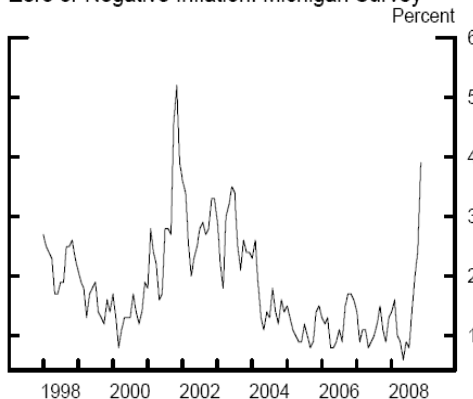
prices in recent months; the 5-to-10-year-ahead measure from the Michigan survey and the three-year-ahead from the FRBNY-ALP have declined less (not shown).<sup>8</sup>

Exhibit 5: Trends in Median Year-Ahead Forecast



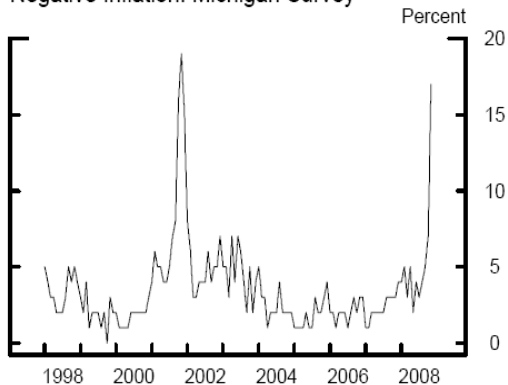
Regarding inflation risks, the proportion of respondents in the Michigan Survey reporting zero or negative point forecasts for prices in general over the next 12 months increased to 39 percent in November from a low of 5 percent in May. As shown in exhibit 6, the proportion of respondents giving zero or negative point forecasts during the previous period of low interest rates was 35 percent in June 2003 and the maximum proportion over the history of the survey is 52 percent in November 2001. Further, as shown in exhibit 7, 17 percent of the November Michigan respondents expected deflation over the next 12 months, similar to the record high in November 2001.

Exhibit 6: Proportion of Respondents Expecting Zero or Negative Inflation: Michigan Survey



Michigan Survey micro-data: proportion of year-ahead point forecasts with zero or negative expected changes in 'prices in general'.

Exhibit 7: Proportion of Respondents Expecting Negative Inflation: Michigan Survey

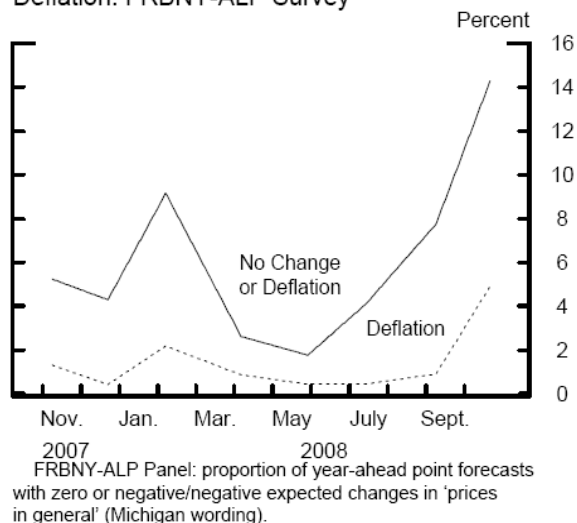


Michigan Survey micro-data: proportion of year-ahead point forecasts with negative expected changes in 'prices in general'.

<sup>8</sup> Historically the Michigan median inflation expectation and recent lags of headline inflation exhibit a strong positive correlation, and recently movements in energy prices have been important in driving headline inflation.

The FRBNY-ALP survey shows a similar increase in deflation forecasts in recent months although the absolute proportions are lower (see exhibit 8). The discrepancy between the two survey results may be due to the fact that most of the latest responses in the FRBNY-ALP were submitted during the second half of October. A calculation using the Michigan survey mid-month readings suggests that the proportion of respondents in the Michigan survey expecting no change in prices or a decline increased from 21 percent in the first half of October to 42 percent in the second half of November.

Exhibit 8: Proportion of Respondents Expecting Deflation: FRBNY-ALP Survey

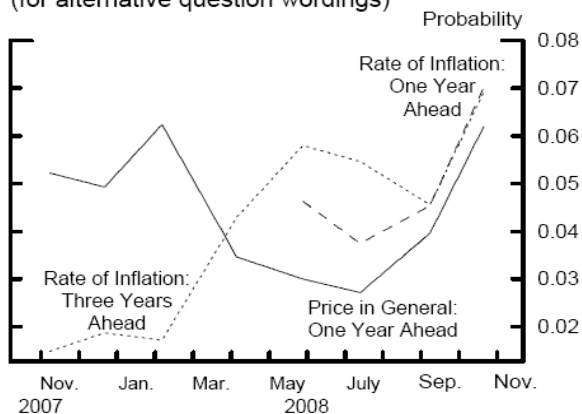


The FRBNY-ALP survey indicates that the decline in inflation expectations and the increase in the proportion of respondents providing point forecasts of zero or negative inflation was accompanied by a recent increase in disagreement among respondents as well as an increase in overall individual inflation uncertainty. As shown in exhibit 9, the mean probability assigned by individual respondents to year-ahead deflation measured in the FRBNY-ALP survey has recently increased to the 6- to 7-percent range (depending on whether respondents are asked about prices in general or rate of inflation), a level similar to that seen in February 2008. During the latest survey period, the mean probability of deflation in 2010-11 was equal to that of one-year-ahead deflation.<sup>9</sup>

<sup>9</sup> While the sharp increase in 3years-ahead deflation expectations in March 2008 is likely to reflect the severe deterioration of conditions in financial markets, part of the increase may reflect the addition in that month of a small number of brackets for negative inflation in the question eliciting density forecasts.



Exhibit 9: Average Probability of Deflation  
(for alternative question wordings)



FRBNY-ALP Panel: Means across individuals of probability of deflation derived from individual density forecasts for changes in prices in general' (Michigan wording) and the 'rate of inflation'.

### FRB/US and Greenbook Estimates of Deflation

The memo “Uncertainty Around the Greenbook Forecast and Alternative Simulations” that is distributed by the Board staff to Bank research directors prior to each FOMC meeting contains information on deflation risk in Table C. Two measures of deflation risk have been produced since January 2004: the probability of core PCE inflation below 0.5 percent on a Q4/Q4 basis; the joint probability of core PCE inflation below 0.5 percent and the unemployment rate above 6 percent in the last quarter of the year. As of the October Greenbook, the probabilities of these two events were equal in 2009 and were 0.01 and 0.05 using FRB/US errors and Greenbook errors, respectively, from the period from 1987 to 2007. Exhibits 10 and 11 graph the history of the time series of both measures of deflation risk. As can be seen, deflation risks were assessed to be a little higher in early 2004 but by the Greenbook error measure have increased quickly recently. Taking into account the deterioration in the outlook since the October Greenbook, a very large increase in the deflation risk is to be expected in the December Greenbook forecast distribution.

Exhibit 10: Probability of core inflation < 0.5% in following year

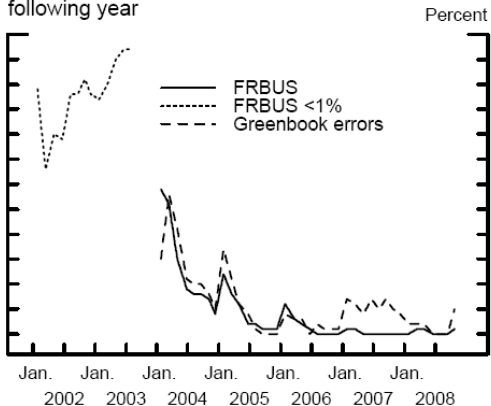
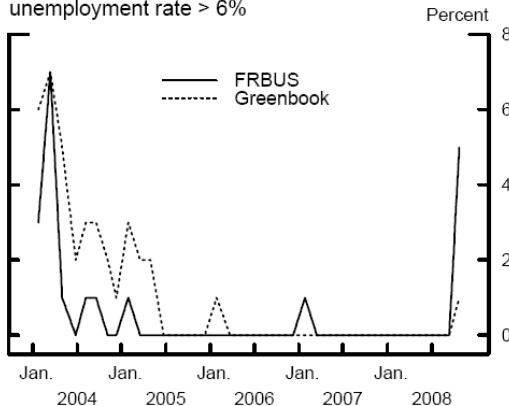


Exhibit 11: Probability of core inflation < 0.5% and unemployment rate > 6%



December 5, 2008

## 15. Purchases of Conventional SOMA Assets

Joseph Gagnon and Spence Hilton<sup>1</sup>

### Executive Summary

This note examines whether an expansion of excess reserves (ER) via large-scale purchases of short-term conventional SOMA assets—Treasury bills and repurchase agreements—would have a significant effect on prices of financial assets or otherwise influence economic activity when the federal funds rate is at the zero bound. We focus on ER expansion through purchases of short-term assets to minimize possible effects operating through term premiums. Note 16 on purchases of long-term Treasury securities considers effects operating through term premiums.

A policy of ER expansion could have effects on financial asset prices because it provides a useful signal of future policy intentions when combined with a strategy of communicating a commitment to keep future policy interest rates lower than would otherwise be expected. Note 20 of this package discusses such a communications strategy. In this note, however, we assume that the Federal Reserve does not make any commitment concerning future policy actions.

We consider several possible channels for ER expansion to affect financial markets and economic activity. All of the resulting effects appear likely to be small. Neither the U.S. experiences of the 1930s and 1940s nor the Japanese experience with quantitative easing appears to be a useful guide to the effects of this policy tool.<sup>2</sup> In each case, at least some of the ER expansion was achieved through purchases of longer-term or nonconventional assets and there was an element of long-term policy commitment.

### Introduction

A sustained expansion of excess reserves (ER) could be accomplished through an increase in the financial assets held by the Federal Reserve. Notes 16-18 consider the financial and economic implications of the acquisition by the Federal Reserve of several different types of assets, with a focus on the possible effects on the markets for those assets. These policies are all characterized by a corresponding increase in ER and they all can be considered examples of quantitative easing of monetary policy. In this note, we hypothesize that the operating objective itself is a large, sustained increase in ER, and that this increase is accomplished via an increase in conventional System Open Market Account (SOMA) assets. Moreover, we assume that the increase is concentrated at

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<sup>1</sup> Gagnon: Division of Monetary Affairs; Hilton: Federal Reserve Bank of New York. We thank Seth Carpenter, Jim Clouse, Bill English, Diana Hancock, Dale Henderson, Brian Madigan, Steve Meyer, Wayne Passmore, and Dave Reifschneider for helpful comments.

<sup>2</sup> Note 2 discusses the U.S. experience in the 1930s. Notes 3-8 discuss the Japanese experience with quantitative easing.

shorter maturities, in order to abstract from the effects of purchases of longer-term assets, which are discussed in Notes 16 and 17. The restriction to conventional SOMA assets allows us to focus on the role of increased ER balances and not any alteration of the risk profile of assets held by the public, which is the subject of Note 18.

To achieve a positive target for the federal funds rate, the Federal Reserve normally has had to limit the level of ER. However, when the target federal funds rate is zero, the level of ER may be expanded indefinitely with no further effects on the level of this interest rate. We assume that the target funds rate has been set to zero, and we try to isolate the effects that a sustained increase in ER would have in this setting. As a practical matter, the payment of interest on reserves held at the Federal Reserve may allow an unlimited expansion of ER at a somewhat higher level of the funds rate—an important consideration given the possibility that some institutions and markets could face operational problems at zero, as discussed in Notes 9-13.

### **Possible Channels for ER to Influence Economic Activity**

In theoretical macroeconomic models without financial frictions, quantitative easing that is not associated with a change in the expected future short-term policy interest rate cannot affect economic outcomes.<sup>3</sup> However, because such frictions are important in practice, there are several potential channels for quantitative easing to affect the economy.

For example, if investors are risk averse and have preferred portfolio allocations across types and maturities of assets, then quantitative easing can affect the economy by altering the mix of assets available to investors. Here, we consider the effects of a particular form of quantitative easing, namely expanding ER by buying short-term conventional SOMA assets, such as Treasury bills and repurchase agreements. As discussed in Note 16, there is some evidence that issuing short-term Treasury securities to buy long-term Treasury securities lowers the yield spread between them. To the extent that ER have an even shorter maturity than Treasury bills and repurchase agreements, this evidence suggests that increasing ER to acquire these assets should push down their yields. Thus, as long as yields on short-term conventional SOMA assets are greater than zero, this policy should be able to provide stimulus to the economy.<sup>4</sup> But once the yields on these assets reach zero, buying more of them cannot have any further effect on their yields, and thus this channel for providing further macroeconomic stimulus becomes blocked.

Bernanke, Reinhart, and Sack (BRS, 2004) point out that another channel through which expanding ER could affect the economy is the transactions services that are provided by currency and reserves. These assets can be used to pay for goods and services, whereas other assets, including short-term conventional SOMA assets, cannot

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<sup>3</sup> See, for example, Eggertsson and Woodford (2003).

<sup>4</sup> This stimulus will be reduced if financial market frictions impede the transmission of lower risk-free yields to the borrowing costs of households and businesses. Notes 17 and 18 consider tools to lower these borrowing costs more directly.

be used directly for most transactions. However, BRS argue that this transactions demand is likely to be satiated quickly as the level of ER rises above historical levels associated with transactions needs. With yields on Treasury bills and repurchase agreements near zero, banks may view additional reserves as just another safe and liquid asset to hold for precautionary, rather than transactions, purposes.

Yet another potential channel operates through the impact of expanded ER on bank deposit rates. The Federal Reserve pays for its acquisitions of assets by crediting the accounts of the sellers' banks at the Federal Reserve. These banks experience an exogenous increase in deposit liabilities which is initially accompanied by an equal increase in their holdings of ER.<sup>5</sup> The empirical results of Frame, Hancock, and Passmore (2007) suggest that when a bank receives an unexpected surge of deposits, it tends to reduce other liabilities, especially managed liabilities such as borrowed federal funds. In normal times, the federal funds rate is higher than most short-term deposit rates, so this response lowers total costs of the bank. However, if the federal funds rate were zero and short-term deposit rates were positive, the inflow of deposits would likely encourage the bank to lower its deposit rates and shrink its total deposits. As depositors moved to competing banks, deposit rates would fall throughout the banking system.<sup>6</sup> To the extent that this process reduces banks' overall cost of funds, competition would likely push down their lending rates, thus helping to stimulate economic activity.<sup>7</sup>

If short-term bank funding costs fall all the way to zero, the response of the banking system to further deposit inflows created by expanded ER depends importantly on the expected returns on alternative investment options and on the costs of longer-term funding sources. If the expected excess returns on these alternative uses of funds—reflecting term and risk premiums—are small, then banks have little incentive to rebalance their portfolios toward loans or other investments or to reduce longer-term funding. In this case, they are likely to hold more short-term deposits and more ER with no apparent impact on the overall economy.<sup>8</sup> On the other hand, if term and risk premiums in alternative uses of funds are large, then banks have an incentive to rebalance their portfolios. Whether they act on this incentive depends on whether the cushion of additional ER makes them feel more comfortable with their liquidity position and thus better able to take advantage of opportunities to lend or to reduce long-term funding. If so, the resultant increased willingness to lend (or reduced demand for long-term

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<sup>5</sup> Even if the asset sellers use their deposits to purchase other assets or goods and services, total deposits in the banking system will have risen because the deposits will merely have been transferred to the providers of these purchases. The exception is when banks themselves are selling these assets to the Federal Reserve. We assume that these assets are purchased in sufficient volume that at least some of them are sold by nonbanks.

<sup>6</sup> Indeed, the only way the banking system can disgorge an aggregate increase in ER is by lowering deposit rates far enough to induce households and businesses to hold more currency. However, the elasticity of currency demand is believed to be very low, so we ignore this effect.

<sup>7</sup> The decline in deposit rates also would encourage consumption by lowering the return to saving, but there is an offsetting income effect that tends to reduce consumption; the overall effect of lower deposit rates on consumption is ambiguous.

<sup>8</sup> If the rate of interest on ER is zero, banks are likely to increase service charges to cover the cost of managing deposits.

borrowing) could potentially stimulate real activity by lowering term or risk premiums and easing tight credit standards.

However, a potentially offsetting factor in bank behavior is capital adequacy. In terms of their regulatory capital, banks must satisfy two risk-based capital ratios and the leverage ratio.<sup>9</sup> Increases in loans and risky investments reduce all three ratios; because the risk-weight for ER is zero, increases in ER affect only the leverage ratio. Increasing bank balance sheets by expanding ER can increase loans and other private investments only to the extent that all three ratios are viewed as sufficiently high by bank managers and supervisors. On the other hand, expanding ER could have a negative effect on bank lending for banks whose leverage ratios are viewed as low because the increase in ER would reduce the leverage ratio further. In that case, banks might try to offset the increase in the size of their balance sheets from ER by reducing their lending.

Finally, the creation of a large volume of ER might potentially alter expectations of future short-term interest rates even in the absence of any communication from the FOMC regarding the future course of the funds rate. For example, market participants might believe that it would take longer to return ER to normal levels from an initial position that is very large, and thus take longer to raise the federal funds rate as conditions return to normal. Some observers might even take the extreme view that increased purchases of Treasury bills under this strategy constitute a permanent monetization of the federal debt (despite the inconsistency with past Federal Reserve actions and statements), thereby leading them to expect higher inflation in the future. Such expectational effects would tend to put downward pressure on real long-term interest rates, thereby stimulating aggregate spending.

### **Historical Experience**

As discussed in Hanes (2006), the U.S. banking system held substantial volumes of ER at times in the 1930s.<sup>10</sup> Hanes shows that there was a significant negative relationship between ER and the yields on long-term Treasury securities. He argues that it is unlikely that changes in ER were associated with changes in expected future short-term rates, which remained near zero over most of the period. However, the changes in ER during this period were driven largely by purchases of gold to enforce the Roosevelt Administration's devaluation of the dollar and in response to politically driven outflows

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<sup>9</sup> The capital ratios are tier 1 capital to risk-weighted assets and total capital to risk-weighted assets. The leverage ratio is tier 1 capital to tangible assets. Tier 1 capital consists of common equity (excluding intangible assets such as goodwill and excluding net unrealized gains on investment account securities classified as available for sale) and certain perpetual preferred stock. Tier 2 capital consists of subordinated debt, preferred stock not included in tier 1 capital, and loan-loss reserves up to a cap of 1.25 percent of risk-weighted assets. Total capital is the sum of tier 1 and tier 2 capital. Risk-weighted assets are calculated by multiplying the amount of assets and the credit equivalent amount of off-balance-sheet items (an estimate of the potential credit exposure posed by the items) by the risk weight for each category. Tangible assets are equal to total average consolidated assets less assets excluded from common equity in the calculation of tier 1 capital.

<sup>10</sup> According to Hanes, ER ranged from \$1 billion to \$6 billion between 1934 and 1939, a time when total Treasury debt held by the public was around \$30 billion to \$40 billion. At its peak in this period, the total value of ER was roughly equal to 15 percent of outstanding Treasury debt.

of gold from Europe. Moreover, as discussed in Note 2, communication by the Federal Reserve and the Administration concerning desired future rates of inflation also played an important role during this period. Thus, it is not clear that this experience is relevant for understanding the effects of a policy of expanding ER through purchases of short-term conventional SOMA assets.

Note 2 also discusses the period of low U.S. interest rates in the 1940s. Although banks held substantial volumes of ER at times during this period, the most important facet of policy appears to have been the widely perceived commitment of the Federal Reserve to purchase Treasury securities in sufficient volumes to hold yields below fixed ceilings across the maturity spectrum for an extended period of time.

The other historical episode of substantial increases in ER occurred in Japan earlier this decade. From 2001 to 2006, the Bank of Japan (BOJ) expanded reserves far beyond the level needed to achieve zero short-term interest rates. However, a significant fraction of the assets it purchased were longer-term government bonds and it also stated a commitment to maintain the new policy until inflation returned to positive territory on a sustained basis.<sup>11</sup> Thus, it is difficult to disentangle the effects of expanding ER from the other elements of the BOJ's policy. Moreover, as discussed in Note 6, Japanese bank lending continued to contract for several years after the start of the quantitative easing period, casting doubt on the transmission of effects of ER operating through the banking system.

### **Excess Reserves above the Zero Bound**

The ability to pay interest on ER raises the possibility that ER could be expanded while maintaining at least some short-term interest rates above zero. Indeed, this appears to describe the situation of the past two months. During this period, the Federal Reserve's provision of extraordinary liquidity to key markets and institutions under stress has exceeded its ability to drain reserves from the system, leaving banks with substantial volumes of excess reserves. Paying interest on reserves has enabled the federal funds rate to remain above zero, even if it is below the target. Over time, as banks become accustomed to the new regime and change their practices accordingly, it is possible that federal funds will trade closer to, or even above, the rate of interest on reserves.

The main reason for keeping some interest rates above zero while easing monetary policy through nonstandard tools is that very low interest rates could harm some markets or institutions and that the cost of this harm might be greater than the benefit from the macroeconomic stimulus of moving all the way to zero interest rates. Notes 9-13 discuss the effects of very low interest rates on financial markets and institutions.

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<sup>11</sup> Note 3 provides further detail.

## Conclusions

All in all, neither theory nor historical experience provides much basis for believing that a policy of expanding ER through purchases of short-term conventional SOMA assets would have a significant impact on other financial variables, including longer term interest rates, or on the general level of economic activity.

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December 5, 2008

## 16. Purchases of Longer-Term Treasury Securities

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### Executive Summary

This note examines the use of large-scale purchases of long-term Treasury securities as an alternative monetary policy tool when short-term interest rates are at the zero bound. We assume that the goal of such purchases would be to reduce long-term Treasury yields and thus to push down long-term borrowing costs for the private sector, including mortgage rates and corporate bond yields. Lower long-term Treasury yields would tend to push up the value of government bonds held by the private sector and might also be associated with downward pressure on the foreign exchange value of the dollar.

Overall, the evidence suggests that this policy tool could have the desired effects, but that the scale of the purchases would have to be very large. Estimates from historical data suggest that a purchase of \$50 billion of longer-term Treasury securities (1 percent of all marketable Treasury debt held by the public) would lower the 10-year Treasury yield somewhere between 2 and 10 basis points.<sup>2</sup> It is possible, however, that were Federal Reserve holdings of long-term Treasury securities as a share of the total to reach very high levels, the effect of further purchases on bond yields could increase substantially. This potential nonlinearity reflects the existence of a large class of bond investors whose demand is probably relatively inelastic with respect to yields. Evidence on the effects on private yields is less well developed. While it is generally agreed that supply-induced reductions in Treasury yields would lower private yields, there is less agreement on the size of the reduction.

Operationally, large-scale purchases of Treasury notes and bonds could be conducted in a manner similar to current practices for outright operations. However, the selection criteria and operational frequency could be affected by whether or not the Federal Reserve set explicit rate goals for these purchases.

### Operating Objectives

The operating objective for a policy tool of large-scale purchases of longer term Treasury securities could take one of several different forms. The Federal Reserve could simply announce its intention to purchase a large quantity of longer-term Treasury debt

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<sup>1</sup> Cabana, Forster, Frost, Hilton, Rodrigues, Steinberg: Federal Reserve Bank of New York; Gagnon: Division of Monetary Affairs.

<sup>2</sup> This range is based on purchases spread evenly across securities with maturities greater than two or three years. If purchases were concentrated at the longest maturities, the effect on the 10-year yield would be somewhat higher, but there would probably be proportionally less effect on medium-term yields.



over some specified period of time. It might also indicate a cumulative total of such purchases, and provide some guidance about how purchases might be distributed across the maturity spectrum. Policymakers might have some rate objectives in mind, but wish to remain noncommittal, at least publicly, about achieving any particular rate outcome. Alternatively, explicit rate pegs or ceilings at different maturities could be announced.

Use of either explicit rate pegs or ceilings (“rate targets”) would introduce several additional considerations and challenges. Rate targets might be set across the entire yield curve, or established just for specific issues or maturity ranges. Special challenges likely would exist in keeping market rates in line with their target around any point of discontinuity in the structure of announced rate targets. Selection of rate targets may need to take account of both investors’ expectations for the path of future short-term rates as embedded in longer term yields and of the Committee’s objectives. The effectiveness of even large-scale purchases on rates could depend on whether they are designed only to reduce positive term or risk premiums or to go further and maintain longer term rates below the expected path of future short-term rates. And the role of Treasury’s inflation-indexed securities in a regime with explicit bond rate targets would need to be handled particularly carefully. An expected exit date from rate targets (whether announced or just widely perceived), or even market expectations about possible changes in such targets, could confound operations to maintain market rates around their targets.

In this discussion, we do not consider all the possible implications of the various operating objectives policymakers could adopt in the context of large-scale purchases of longer term Treasury debt. This discussion assumes policymakers have not made any pre-commitments about the path of future short-term rates, and so outright purchases as a tactical device to reinforce such a commitment on the policy path are not addressed here; that possibility is discussed in Note 20.<sup>3</sup>

We also consider only briefly the role of other operational forms, e.g., the sale by the Federal Reserve of options on Treasury securities. Finally, we assume that short-term interest rates would be at the zero bound if this strategy was implemented, and so sidestep the issue that limits on the level of excess reserves could constrain the scale of outright purchases of longer term Treasury securities.<sup>4</sup>

### **Evidence on the Efficacy of Purchases of Long-Term Treasury Securities**

At the zero bound on short-term nominal interest rates, Federal Reserve liabilities—currency and bank reserves—are likely to be close substitutes for short-term Treasury bills. All of these assets would yield a zero nominal rate of return and would be completely free of default risk and highly liquid. In this circumstance, purchasing long-

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<sup>3</sup> Even if this strategy were not accompanied by any FOMC statements about the future path of short-term policy rates, large-scale purchases of longer term Treasury securities could influence market expectations about the future policy path. While this possibility is certainly plausible to some degree, the size of any impact is difficult to anticipate. In this note we do not consider the possible impact that these purchases could have on longer-term interest rates operating through this mechanism.

<sup>4</sup> Note 15 discusses possible effects of large quantities of excess reserves operating through the banking system.

term Treasury securities via reserve creation may have a similar effect on the yield curve as issuing Treasury bills to purchase long-term Treasury notes and bonds. There is a substantial literature on the effects of the Treasury maturity mix, or debt management, on the slope of the yield curve. We turn to this literature to gauge the likely effects of this nonstandard policy tool.

In principle, changes in the maturity mix of Treasury securities held by the public could affect the yield curve by changing expectations of future short rates. However, studies generally find little evidence of such moves. Indeed, one of the most recent and comprehensive studies found a slight tendency for *ex post* future short rates to move in the opposite direction.<sup>5</sup> Thus, the studies appear to be capturing effects operating through term premiums arising from the “habitat” preferences that investors have for certain securities.

A metric we use to summarize the historical evidence is the elasticity of the term spread with respect to changes in the share of long-term Treasury debt out of total Treasury debt. Studies uniformly find that the effects on term spreads are greater at longer maturities. Studies use different measures of the maturity mix, but the broad conclusions do not appear sensitive to these differences. To the extent possible we have tried to convert reported results into a canonical elasticity defined as the reduction of the 10-year to 3-month yield spread in basis points for every percentage point decline in the share of total Treasury debt composed of securities with maturities greater than 2 or 3 years. We focus on long-term responses whenever possible.

There are two broad categories of studies: time-series analyses and event studies. Within the time-series category, studies differ greatly in terms of the theoretical structure they impose on their estimates. Relatively unrestricted estimates often are large, but generally appear to lack robustness to modest changes in methodology or sample period. More restricted estimates, generally based on the Capital Asset Pricing Model as in Frankel (1985), tend to be smaller but more robust, although the restrictions are generally rejected by the data. Also important is the sample period. Studies with sample periods that have significant shifts in the Treasury maturity mix generally find estimates that are more statistically significant.<sup>6</sup> Overall, the estimated elasticities from the studies that appear most reliable are in a range from 2 to 10 basis points.

Event studies examine yield curve movements in narrow windows around news announcements that provide information about the future maturity pattern of Treasury securities.<sup>7</sup> For the United States, there are three events that have received particular attention: 1) the February 2000 Treasury announcement that it would buy back certain long-term securities, 2) the October 2001 announcement that the 30-year Treasury bond

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<sup>5</sup> Greenwood and Vayanos (2008, p. 2).

<sup>6</sup> Studies of Operation Twist in the 1960s generally did not find statistically significant effects, most likely because there was little movement in the maturity mix over this period.

<sup>7</sup> In general, estimates from event studies suffer from a potential downward bias because markets may anticipate announcements to some extent and because the full market reaction may take longer than the observation window.

would be discontinued, and 3) the October 2008 announcement that certain long-term securities would be reopened. None of these announcements was anticipated by the market nor appeared to contain any new information on future fiscal deficits or the future path of short-term rates. The first two announcements caused long-term rates to fall and the third announcement caused long rates to rise. To get an estimated elasticity from these events requires an assumption about the views of market participants concerning the likely size of the future supply shifts. Based on a range of plausible assumptions and focusing on 10-year yields, one can obtain a range of elasticity estimates from 1 to 7 basis points for the first two events and 4 to 40 basis points for the third event. The larger estimates for the 2008 event may reflect the greater market turbulence in 2008 compared to 2000 and 2001.<sup>8</sup>

There are some empirical studies that do not fit well into the two broad categories described above. Although these generally do not yield elasticity estimates, they do agree that a policy of purchasing long-term Treasury securities is likely to lower long-term Treasury yields. Hanes (2006) shows that monetary expansion via gold purchases in the 1930s—when short-term rates were at the zero bound—tended to lower long-term Treasury yields. By logical extension, a monetary expansion to purchase long-term Treasuries directly should have an even greater negative effect on long-term yields. Note 2 documents that large-scale Fed purchases of long-term Treasury securities were successful in holding down long-term yields in the 1940s, but this success occurred in the context of a widely perceived commitment to maintain a ceiling on Treasury yields, including on future short-term rates.

A limitation of these studies is their reliance on historical movements in the maturity structure of Treasury debt. If the Federal Reserve were to engage in a scale of purchases that was unprecedented, causing the share of long-term securities in the hands of the public to fall below levels previously experienced, it could have an effect on yields much greater than suggested by the historical experience. In addition to the scale of purchases that could be contemplated, this possibility partly reflects the emergence of an important class of Treasury investors who arguably are less sensitive to market yields, in particular foreign central banks and other foreign official investors. Inducing these investors to sell their securities to the Federal Reserve would likely require relatively large movements in yields. Currently, foreign official institutions are estimated to hold approximately 50 percent of the \$1.7 trillion of nominal Treasury securities in the hands of the public that have remaining maturities in excess of 3 years. If large-scale purchases of longer-term debt by the Federal Reserve were heavily concentrated amongst holdings by other types of accounts, the effects on longer-term yields could be even greater than is suggested by the historical estimates.

As discussed in Note 7, the Bank of Japan (BOJ) was apparently successful in lowering long-term Japanese government bond (JGB) yields during a period in which it

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<sup>8</sup> The speech by Chairman Bernanke on December 1, 2008 mentioned the possibility of purchasing long-term Treasury and agency securities. In the hour after the speech was delivered, 10-year Treasury yields fell 11 basis points. This effect likely does not reflect expectations of lower future short-term rates, as 2-year Treasury yields were unchanged.

stepped up its purchases of JGBs. However, there were other elements of the BOJ's strategy that may have contributed to this effect—such as its announced policy of keeping its policy rate low for an extended period of time—and so it is difficult to separately identify the effect of long-term bond purchases. It is also worth noting that 10-year JGB yields during this period were close to 1 percent, around 200 basis points lower than current 10-year yields in the United States. This difference is potentially important, given that the ability to push bond yields down further probably diminishes as they approach zero because the risks of capital gains and losses become skewed toward losses.

The effectiveness of this policy tool at providing macroeconomic stimulus hinges critically on the response of long-term private yields to any induced decline in long-term Treasury yields. A number of the papers that looked at supply effects on the Treasury yield curve also considered the implications for corporate bond yields and equity prices. Based on the strong historical correlation between Treasury yields and corporate yields, these studies generally concluded that corporate yields would decline by 80 percent or more of any decline in Treasury yields. The effect on equity prices, through lower expected holding yields, was viewed as positive but small, reflecting the weak correlation between Treasury yields and equity yields in the data. In the three Treasury market events of 2000, 2001, and 2008, corporate bond and mortgage-related yields moved about as much as Treasury yields.<sup>9 10</sup>

Finally, some uncertainty exists about whether the eventual cumulative size of purchases needed to achieve a particular effect on longer term yields would be less if the Federal Reserve were to announce longer term interest rate objectives, including explicit interest rate targets, and assuming market participants were convinced of the Federal Reserve's resolve to achieve those outcomes through outright purchases as needed. There is little question that an announcement effect could by itself induce at least some portion of the desired interest rate movements ahead of any actual purchases. But it is doubtful as to whether these interest rate effects could be maintained without actual follow-up operations. Yields on longer term Treasury assets will be determined by their supply relative to available supplies of other assets that serve as imperfect substitutes in the portfolio. And without an actual change in relative portfolio amounts, relative yields would likely drift back towards their previous state in the absence of actual buying by the Federal Reserve.<sup>11</sup>

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<sup>9</sup> Long-term swap rates also moved in line with long-term Treasury yields immediately after these events. However, Bernanke, Reinhart, and Sack (2004) note that long-term swap spreads widened several weeks after the February 2000 event and remained wide for more than a year, suggesting that the pass-through of lower Treasury yields to private yields was not permanent. This pattern of offsetting movements in private yield spreads did not occur in the weeks after the other two events.

<sup>10</sup> Krishnamurthy and Vissing-Jorgensen (2007) find a strong negative effect of Treasury supply on the spread of corporate bond yields over Treasury yields; they speculate that this effect reflects a special liquidity demand for Treasury securities. If the reserves created to purchase long-term Treasuries do not satisfy this liquidity demand, these results imply that corporate bond yields will not decline very much. However, the Krishnamurthy and Vissing-Jorgensen results are difficult to reconcile with the results of other studies.

<sup>11</sup> The analogy is sometimes made with how the Federal Reserve had (prior to the recent period of high excess reserves) maintained control over its policy target, the overnight federal funds rate, by announcing a change in target and without the need for follow-up operations to affect reserve supply. The analogy is

## Implementation Issues

Operationally, outright purchases of Treasury notes and bonds as part of a program of large-scale acquisitions would be conducted in a similar fashion to current outright purchases, e.g., using the same trading systems, operating through primary dealers, focusing on particular segments of the yield curve in any single operations, but perhaps adapting the selection methodology to different operating objectives. If the Federal Reserve had as an objective acquiring a large share of total outstanding longer-term Treasury debt but without definite rate objectives, the selection methodology could closely resemble current practice which evaluates propositions relative to current market yields. With explicit rate objectives, propositions might instead be accepted according to which bids are cheapest to those targets. Even in this case the Federal Reserve would need to decide whether to operate more or less continuously as long as yields were away from their rate targets, or whether the timing and choice of each operation size were to remain discretionary.

The sale of put options on Treasury notes and bonds might be an effective complement to outright purchases as a way of helping lower longer-term Treasury yields. The underlying instrument would likely be a basket of Treasury issues instead of a specific issue to minimize distortions across the yield curve. Use of options, however, would introduce more operational complexity into the program. Moreover, options would necessarily specify a strike price which, in the absence of announced rate targets, would likely be interpreted as being an explicit rate objective of policymakers.

With short-term rates at the zero bound, operational issues associated with having to sterilize reserves created through purchases are avoided. Moreover, use of this instrument could be more effective because it could be employed on a larger scale than otherwise. However, operational issues associated with the exit strategy and restoring the portfolio to its steady-state size and composition are compounded. Alternatively, if there were a desire to sterilize the reserve effects of outright purchases of Treasury securities, one option could be to use the acquired securities as collateral in reverse repurchase agreements (RRPs) arranged by the Trading Desk. Draining excess reserves in this way could be a way to limit the impact that a program of outright purchases would have on leverage ratios of banking institutions.<sup>12</sup> In practice, however, it could be difficult for the Desk to arrange RRP of sufficient size to sterilize the reserve effects of large-scale purchases. The current set of counterparties to the Desk's open market operations, the primary dealers, ordinarily need financing and themselves wouldn't be the holders of the excess reserves. This problem could be addressed by arranging the RRP with banks directly, but if the general financial environment were characterized by short-term

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flawed, however, because the demand for reserves is essentially fixed (also by the Federal Reserve) through the structure of reserve requirements, unlike the demand schedule for Treasury assets which is assumed to be downward sloping.

<sup>12</sup> As discussed in Note 15, a decline in the leverage ratio under some circumstances could inhibit bank lending. Of course, sterilizing excess reserves would also undo any possible beneficial effects that might be associated with an expansion of excess reserves when at the zero bound on interest rates.

interest rates at or near zero, banks might have little incentive to participate in short-term funding operations that offer no yield advantage over holding excess reserves.

### **Additional Considerations of Federal Reserve Purchases**

#### *Impact on Foreign Official Investors*

Large-scale purchases of Treasury securities by the Federal Reserve would result in the movement of funds into other asset classes as the previous owners of these Treasury securities reinvested their funds. While it is difficult to know into what assets these displaced funds would be invested, private sector investors would likely shift a large portion into other similar, but higher-yielding, assets such as agency debt, agency MBS, investment-grade corporate debt, or other highly-rated private debt instruments. In this way, purchases of Treasury debt by the Federal Reserve would begin to affect yields more broadly—a necessary result for this strategy to have a noticeable effect on aggregate demand.

As noted previously, the likely response of foreign official holders of Treasury securities to a program of large-scale purchases of Treasury debt is of particular interest, given that these investors currently hold such a large portion of total outstanding Treasury debt. Their reaction could be somewhat different than the stylized response just described. Total foreign official holdings are estimated to equal approximately 40 percent of outstanding marketable Treasury debt, compared to just under 10 percent for SOMA holdings (Table 1).<sup>13</sup> Foreign official accounts largely tend to be buy-and-hold investors, and so would be less likely to be sellers directly to the Federal Reserve, and less likely to adjust their holdings in response to movements in Treasury yields relative to other rates. Thus, large-scale Federal Reserve purchases would predominantly affect holdings of investors that collectively possess about half of the total outstanding debt.

#### *Impact of Increased Treasury Issuance*

At present, Treasury faces unprecedented financing needs in upcoming years, with estimates suggesting that marketable Treasury debt may need to expand by over \$2 trillion in FY2009 alone as a result of various fiscal initiatives and revenue implications of a projected slowing economy. The maturity distribution of new Treasury debt issuance, the distribution of new issuance between account holders with different sensitivities to movements in Treasury yields, and the implications of any new supply for the level of rates are unknown. These sources of uncertainty do not suggest that large-scale purchases of Treasury debt by the Federal Reserve would necessarily be any less effective than under normal circumstances, but they do increase the uncertainty about the likely rate impact that large-scale purchases of longer-term Treasury securities would have on yields, and would present particular challenges to selecting any explicit rate objectives for such a program.

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<sup>13</sup> The values for foreign holdings in Table 1 are based on TIC-reported transactions, and are believed to represent lower-bound estimates of actual foreign official holdings. These include holdings by Foreign and International Monetary Authorities (FIMA) that maintain accounts at the Federal Reserve Bank of New York, which are estimated to represent about 75 percent of the total.

### *Impacts on the Federal Reserve*

Large-scale purchases would almost certainly require overhauling current internal portfolio guidelines, which limit SOMA ownership to 35 percent of the outstanding supply of a given issue. Because it would be difficult to know *ex ante* how much of any given issue will be purchased to meet policy objectives, these limits may need to be entirely suspended. When the larger holdings begin to mature, rollover guidelines would have to be re-evaluated to avoid large redemptions, which would be problematic for Treasury's cash management purposes. An increase in the SOMA portfolio would benefit some current policy tools by providing greater capacity for some programs (including reverse repos and the Term Securities Lending Facility) and by providing more supply to lend via SOMA's daily securities lending program. At the same time, this could create some uncertainty in longer term financing transactions for single issues, as investors would not know how much of a given security would be available in the open market or through the Federal Reserve via its securities lending program. The program's wind-down could also create dislocations in the market, depending on its pace, especially if large sales of longer term Treasury securities are needed. Large-scale sales of Treasuries also open the SOMA up to potential capital losses, as securities purchased at high premiums could very well be sold at a loss.<sup>14</sup> The extent of any losses is likely to be positively correlated with the success of the overall program at encouraging growth and avoiding deflation. Any future losses would be offset at least partially by higher profits in the near term from the expanded Federal Reserve balance sheet and its positive net interest margin.

### *Impact on Market Liquidity*

Treasury market liquidity could be impaired if the Federal Reserve wound up purchasing a substantial amount of the floating supply of a number of issues (although this outcome may be less likely in general in view of expected increases in total supply). As market participants learned of the reduced supply that could be held on an outright basis, this would increase the scarcity premium for individual securities in high demand and could potentially lead to elevated failures to deliver in these issues. While SOMA would have more supply to lend to help to mitigate these fails, reduced outright supply held in private hands could still lead investors to avoid these issues. However, the Federal Reserve may be able to avert these situations through its selection of individual issues to purchase.

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<sup>14</sup> Private sector holders of longer-term Treasury debt would also be exposed to potential losses during the unwinding of a strategy for the Federal Reserve to acquire longer-term Treasury securities.

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Table 1

Holdings of Marketable Treasury Securities  
(billions of dollars)

<b>Remaining Maturity</b>	<b>SOMA*</b>	<b>Foreign Official**</b>	<b>Total Outstanding***</b>
0 – 3 months	37	276	1222
3 – 6 months	27	179	460
6 – 12 months	40	221	489
1 – 3 years	91	552	889
3 – 6 years	77	461	694
6 – 11 years	80	341	578
11+ years	78	67	433
TIPS	41	N/A**	536
<b>Total</b>	<b>470</b>	<b>2097</b>	<b>5301</b>

\* SOMA holdings are as of November 21, 2008

\*\* TIC-based estimates as of end-November 2008. TIPS are estimated to comprise about just 2 percent of Foreign Official holdings and are included in the corresponding maturity bucket.

\*\*\* Total Outstanding values are as of October 31, 2008

December 5, 2008

## 17. Purchases of Agency MBS and Debt

Joseph Gagnon and Michael Holscher<sup>1</sup>

### Executive Summary

This note examines the use of large-scale purchases of agency debt and agency MBS as an alternative monetary policy tool when short-term interest rates are at the zero bound. The goal of such purchases is to reduce conventional fixed mortgage rates and, more broadly, to lower long-term borrowing costs for the private sector, including corporate bond rates. The Federal Reserve announced on November 25, 2008 that it would conduct such purchases over the next few quarters.

Overall, the evidence suggests that this policy tool can have the desired effects, but that the scale of the purchases has to be very large. We are not aware of any studies of the effects of such operations *per se*, but the announcement of planned purchases on November 25, 2008 apparently had a significant effect on mortgage rates and bond yields. Moreover, there is a substantial literature supporting the view that purchases of long-term Treasury securities can lower long-term Treasury and private yields.<sup>2</sup> Similar conclusions should apply to purchases of private debt securities.

To the extent that the primary goal of this policy tool is to lower mortgage rates (and private borrowing costs more broadly) purchases of agency MBS are likely to be somewhat more effective than purchases of agency debt. Purchases of either are likely to lower long-term private borrowing costs more and provide greater macroeconomic stimulus than purchases of long-term Treasury securities of comparable size.

Two broad strategies for the use of this policy tool could be considered. The first strategy would be to purchase a specified quantity of securities over a specified time horizon. The second strategy would be to set a target for, or a ceiling on, the conforming fixed mortgage rate or some other market yield or yield spread. Under the second strategy, the Federal Reserve would stand ready to purchase as many securities as needed to enforce the target or ceiling. Relative to the first strategy, the second would pose more operational challenges and would create more uncertainty about the size of the Federal Reserve's balance sheet; in addition, it would require the FOMC to take full responsibility for the determination of an important asset price. However, policymakers might find the macroeconomic benefits of the second strategy comparatively easier to gauge and to explain to the public.

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<sup>1</sup> Gagnon: Division of Monetary Affairs; Holscher: Federal Reserve Bank of New York. We thank Jim Clouse, Bill English, Mike Gapen, Dale Henderson, Spence Hilton, Andreas Lehnert, Brian Madigan, Wayne Passmore, and Dave Reifschneider for advice and comments.

<sup>2</sup> See Note 16, "Purchases of Longer-Term Treasury Securities."

## Evidence on the Impact of Purchases

Outstanding agency debt and agency MBS combined, netting out agency holdings of agency MBS, are about \$7 trillion, somewhat larger than the \$5 trillion of marketable Treasury securities held by the public. As Note 16 discusses, a \$50 billion purchase of longer-term Treasury securities would reduce 10-year Treasury yields (holding short-term yields constant) by 2 to 10 basis points, based on the most plausible historical estimates. According to simple portfolio models, in order to have the same effect on yields, purchases need to be scaled by the size of the market; thus, a \$70 billion purchase of long-term agency debt or agency MBS would have the same effect on long-term agency yields as a \$50 billion purchase of long-term Treasury securities would have on long-term Treasury yields.<sup>3</sup>

The spreads between yields on agency debt and yields on comparable-maturity Treasury securities are well above historical averages, and, prior to the November 25 announcement, spreads of option-adjusted agency MBS yields over Treasury yields were also well above historical averages.<sup>4</sup> Given the strained conditions in these markets, the prospect of a large Federal Reserve program to purchase agency debt and agency MBS could have a positive effect on sentiment that would lead to larger declines in their yields than implied by these historical estimates.

Standard portfolio models, such as the Capital Asset Pricing Model, imply that an exogenous change in the supply of one asset will affect yields on other assets according to the expected covariance of their returns. A reduction in the supply of an asset will tend to lower not only its yield, but also the yields of other assets whose yields move closely together. Table 1 displays the correlations of monthly changes in long-term interest rates since 1991.<sup>5</sup> All of these markets are closely connected, providing support to the view that large-scale purchases of any long-term debt instrument should lower yields on other long-term debt securities. The correlation between agency MBS yields and conventional fixed mortgage rates is very high, suggesting that conventional mortgage rates will decline nearly one for one with agency MBS yields. Indeed, the link between conforming mortgage yields and agency MBS yields is even more direct than the links between other debt instruments; the difference between these yields reflects a relatively small and stable amount of guarantee and transaction fees.

The behavior of yields around the November 25 announcement provides further evidence on the efficacy of this policy tool. Assuming that the market expects a net

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<sup>3</sup> This analysis does not factor in differences in the maturity structure and duration of the agency market relative to the Treasury market. It also assumes that agency debt and agency MBS are close substitutes. Lehnert, Passmore, and Sherlund (2008) find that purchases of agency MBS funded by issuance of agency debt have little effect on mortgage rates (or agency MBS yields). However, yields on these assets have moved less closely together in recent months than under normal circumstances, suggesting that they may be less substitutable at present.

<sup>4</sup> Option-adjusted yields are lower than coupon yields because they include an adjustment for the value of the prepayment option in the underlying mortgages.

<sup>5</sup> Similar results hold for the post-2000 period. Correlations are generally lower, though still significantly positive, over the past 18 months.

	Treasury	Swap	MBS	Mortgage	AA	BBB
10-Year Treasury	1.00					
10-Year Swap	.97	1.00				
Fannie MBS	.91	.95	1.00			
30-Year Mortgage	.87	.90	.95	1.00		
AA corporate	.81	.80	.83	.80	1.00	
BBB corporate	.68	.66	.74	.72	.93	1.00

Treasury yield is on-the-run. MBS yield is coupon yield, not option-adjusted. Mortgage rate is conforming fixed rate. Corporate bond yields are 10-year.

increase in future government purchases of agency long-term debt and MBS equal to \$600 billion, the estimates discussed above imply that agency long-term debt and MBS yields would decline 17 to 85 basis points.<sup>6</sup> On the day of the announcement, 10-year agency debt yields and option-adjusted agency MBS yields fell about 60 basis points, 10-year Treasury and swap yields fell about 20 basis points, and corporate bond yields fell about 10 basis points. However, some of these declines may have come in response to weaker-than-expected data releases that day. On the other hand, it is possible that the full market reaction to the program did not take place on the day; by November 28, all of these yields had fallen a further 10 to 20 basis points. Moreover, additional effects may be coming when actual purchases get underway.

### **Advantages and Disadvantages of Agency Purchases Relative to Treasury Purchases**

A program of large-scale purchases of agency debt and agency MBS has significant advantages over comparable purchases of Treasury securities. Such a program would help to alleviate problems at the heart of the financial turmoil. It removes from the market assets that are in relatively low demand, as opposed to Treasury securities, which are in relatively high demand; thus, it may improve overall functioning in the fixed-income market. It is easier to explain the benefits of this policy tool to the public than the benefits of purchases of Treasury securities. Indeed, to the extent that it is clear that this policy is not permanent, it may encourage potential home buyers to enter the housing market in order to secure financing at an attractive rate; this could help to break the downward trend in house prices and establish a more favorable dynamic. The Mortgage Bankers Association reported large increases in mortgage applications during the week ending November 28 for both refinances and home purchases.

Dollar for dollar, this policy tool would provide more macroeconomic stimulus than purchases of long-term Treasury debt. Simulations with the staff's FRB/US model,

<sup>6</sup> The volume of purchases was specified as "up to" \$600 billion, leaving open the possibility of a smaller program. Also, markets may now expect Treasury to abandon its program of purchasing agency MBS, ceding this role to the Federal Reserve, so that future government purchases of agency MBS on balance may have increased by less than the amount of the Federal Reserve program. On the other hand, the history of Federal Reserve actions over the past 15 months suggests that the program could be increased at a future date.

presented in Note 21, show that GDP rises slightly faster after large-scale purchases of agency MBS than after a similar magnitude of purchases of long-term Treasury securities. This result reflects the larger reduction in the private cost of capital that is assumed to occur through purchases of agency MBS. The lower cost of capital stimulates business and residential investment.

Other potential channels for this policy tool to support economic activity are not incorporated into FRB/US. For example, lower mortgage rates could prevent house prices from declining as much as otherwise, thereby minimizing the fall in private wealth and supporting consumption. Also, a wave of refinancing activity would raise disposable income for homeowners. Although this higher income would be offset to a large extent by reduced income to investors, about a quarter of the investors in mortgage-related assets are not U.S. residents, and investors in general may have a lower marginal propensity to consume than borrowers.

On balance, increased mortgage refinancing is probably a positive feature of this policy tool, as the current high risk spread evident in mortgage rates likely implies that borrowers would value the reduction in monthly payments more than investors.<sup>7</sup> Holding the term of the mortgage constant, if the mortgage rate were to drop to 5 percent, households refinancing out of 6 percent mortgages would save about \$125 per month on a typical \$200,000 mortgage; moreover, these savings would last for the life of the loan. Overall, the gross boost to aggregate household income from this action would be roughly \$25 billion per year, given that about 80 percent of agency-backed mortgages have interest rates above 5½ percent, and so would be likely to be refinanced. Of course, a mass wave of mortgage refinancing might temporarily increase bond yield volatility as investors seek to maintain the duration of their portfolios as the mortgages they hold are prepaid.<sup>8</sup> Nevertheless, this volatility would be only a transitory side effect of the beneficial transmission of lower long-term agency borrowing costs to long-term interest rates in other sectors.

This policy tool would tend to skew credit allocation toward one sector of the economy—something that, while perhaps appropriate at this time given the central role played by housing in the current crisis, would be unusual from a historical standpoint. Nonetheless, some distortion of credit allocation may be an acceptable price to achieve the Federal Reserve's dual mandate of maximum employment and price stability.

This policy tool would expose the Federal Reserve to minimal credit risk. The mortgages backing agency MBS are generally to borrowers with high credit scores and moderate loan-to-value ratios. Treasury has committed to providing at least \$100 billion in new capital to cover future losses for each of Fannie Mae and Freddie Mac, while

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<sup>7</sup> The agencies appear to be fairly well hedged against prepayment risk, including through use of short-term debt, callable debt, and swaptions. Fannie Mae's latest quarterly statement estimates that a 100 basis point decline in interest rates would cause it losses of only \$300 million.

<sup>8</sup> Perli and Sack (2003) show that duration hedging activities by mortgage investors can temporarily magnify yield movements on Treasury securities when long-term yields move up or down.

Ginnie Mae has the full backing of the U.S. government.<sup>9</sup> From the point of view of the overall U.S. government (assuming that the GSEs will not be allowed to fail) use of this policy tool would likely reduce credit risk exposure by making mortgage payments more affordable for many borrowers and also helping to stabilize house prices.

### **Implementation Strategy**

There are two broad approaches to implementing this policy tool. The first approach is to announce a volume of purchases over a specific time period. Advantages to this approach include:

- It allows the Federal Reserve to maintain control over the size of its balance sheet.
- It is easier to balance purchases over different market segments, perhaps through an index replication strategy.
- It requires less active trading of the portfolio.
- It does not require the Federal Reserve to take full responsibility for the price of these mortgage-related assets.

The second approach is to try to set a target for, or a ceiling on, conventional fixed mortgage rates. For example, the Federal Reserve could announce a commitment to purchase at par all newly issued agency MBS with a given weighted average coupon in the to-be-announced market.<sup>10</sup> Advantages of this approach include:

- It would provide a clear signal of policy, analogous to the regime of targeting the federal funds rate.
- It would be easily interpretable by the general public.

Setting a low ceiling on mortgage rates would likely spark a refinancing boom and the Federal Reserve would have to stand ready to purchase a potentially large volume of MBS. Given that 95 percent of agency-backed mortgages carry interest rates of 5 percent or higher, if the Federal Reserve were to set a mortgage rate ceiling much below this level, issuance of new MBS backed by refinanced mortgages could total \$5 trillion, or even more, to the extent that homeowners are able to increase the size of their mortgages or new buyers are drawn into the market. It is difficult to estimate the ultimate share of these MBS issues which the Federal Reserve would have to purchase.

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<sup>9</sup> Freddie Mac recently announced it had received \$14 billion in new capital from Treasury.

<sup>10</sup> The weighted average coupon refers to the weighted average rate of an underlying mortgage pool, less servicing, guarantee, and other fees. It is the interest rate received by the holder of the MBS. Market participants have indicated that over 90 percent of all agency MBS are traded in the “to-be-announced” or “to-be-assigned” forward market. Certain characteristics of the underlying mortgages are specified when the trade is assigned, such as agency program and coupon rate. However, the terms of these transactions also typically allow for some variation in the characteristics of the underlying pool that will be delivered, resulting in a “cheapest-to-deliver” option for the seller of the contract.

The Federal Reserve's announcement on November 25, 2008 essentially was a compromise between these two strategies. It leaned toward the first strategy by announcing a specific number for the volume of purchases and no specific number for mortgage rates. However, the volume number was described as a ceiling, leaving open the possibility that a smaller volume might be purchased if the effect on mortgage rates is viewed as sufficiently large.

As with other nonstandard central bank policy tools, use of this tool would expand the volume of excess reserves. Should policymakers desire to sterilize some of the excess reserves created, the Federal Reserve could borrow against agency debt and MBS in the short-term repo market. Such borrowings would not undo the benefits to housing finance from the original purchases. However, the markets for non-Treasury repo collateral have been strained in recent months, and a large volume of additional borrowing demand could put further pressure on spreads and haircuts in this market. On the other hand, Federal Reserve purchases of a substantial quantity of agency securities might improve conditions in the agency repo market even if a substantial volume was financed through repo borrowing.

### **Operational Considerations**

The Markets Group at the Federal Reserve Bank of New York currently does not have the capacity to execute monetary policy objectives in the agency MBS market and thus this activity is being outsourced to an external asset manager.<sup>11</sup> Hiring an outside manager raises concerns about the confidentiality of Federal Reserve trading strategy and the potential for "front-running" by the manager or by third parties in contact with the manager. In addition, the System will need to devise non-market performance measures by which to monitor the money manager.

As with purchases of long-term Treasury securities, this policy tool exposes the Federal Reserve to possible capital losses in the future should long-term interest rates rise above the levels that prevailed at the time the assets were purchased. The risk of such losses is compensated by the extraordinary profits that will accrue to the Federal Reserve from the extra asset holdings, financed by zero- or low-interest-rate reserves, in the period prior to any future capital loss. Moreover, maximizing its net worth is not part of the Federal Reserve's legislative mandate.<sup>12</sup>

The Federal Reserve should keep in close contact with the Treasury and the Federal Deposit Insurance Corporation regarding their plans for supporting mortgage markets, including through subsidized loan rates and assistance with restructuring

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<sup>11</sup> Agency MBS are much more complicated than Treasuries or agency debt, and holding them directly would require significant outlays in personnel and technology to properly execute trades and perform all post-execution functions. In addition, time to implementation could prove unacceptably long. In 2003, staff at the Federal Reserve Bank of New York estimated that the effort to prepare to buy Ginnie Mae MBS would take 2 to 5 years.

<sup>12</sup> As long as the Federal Reserve can set the interest rate on its liabilities at zero, as it always did prior to this year, it need not have a positive net worth to maintain budgetary independence.

troubled loans. Ideally, our actions would complement these other actions and not appear to create confusion.

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December 5, 2008

## 18. Liquidity Facilities as Policy Tools at the Zero Bound

Bill Nelson and Roberto Perli<sup>1</sup>

### Executive Summary

The targeted provision of Federal Reserve liquidity to counter strains on financial institutions and in financial markets may provide an effective means by which the Federal Reserve can foster increased output and employment when conventional monetary policy actions are constrained by the zero bound on nominal interest rates. Thus far, such interventions appear to have been effective to a certain extent, but markets and institutions remain under considerable pressure, suggesting significant scope for additional action. In particular, further expansion of the Federal Reserve's balance sheet aimed at increasing institutions' liquidity, reviving or substituting for moribund markets, or even providing credit directly to economic agents in selected sectors may have the potential for bringing about substantial improvements in market functioning and reductions in borrowing costs. Importantly, such policies may be coordinated with the Treasury and amplify the impact on the financial system of scarce congressionally appropriated funds (such as TARP funds). A rough estimate of the potential impact of such actions suggests that it could be substantial. Possible disadvantages of broadening the System's liquidity provision may be increasing moral hazard and complicating the management of the System's balance sheet.

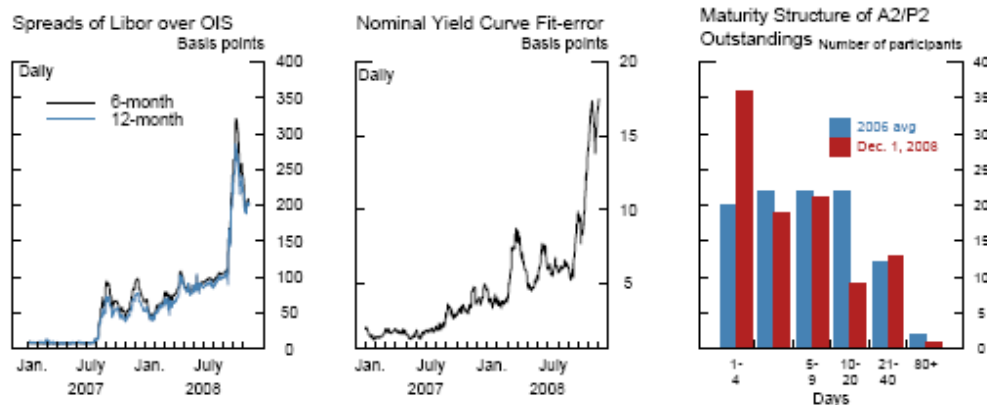
### Effects of Existing Liquidity Facilities

As shown in figure 1, by many measures, financial markets remain severely disrupted. As illustrated by longer-term Libor-OIS spreads, a wide range of risk and liquidity premiums remain very elevated. While it may be unrealistic to expect that these spreads will eventually settle to the same low levels that prevailed prior to August 2007, it also seems likely that the new equilibrium will be well below current values. The arbitrage forces that normally equilibrate pricing across assets are exceptionally weak at present, reflecting impaired liquidity and balance sheet pressures. Even the arbitrage between Treasury securities of similar maturities—one of the safest to exploit—has broken down, as exemplified by the mean absolute error in the Board staff's Treasury yield curve model, which is nearly fifteen times its normal level. Moreover, many borrowers are being forced to fund themselves at much shorter maturities than previously. As an illustration, more than 35 percent of A2/P2 commercial paper currently matures in one to four days (up from 20 percent on average in 2006); term lending in many other markets is also minimal.

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<sup>1</sup> Division of Monetary Affairs.

Figure 1



Of course, the Federal Reserve has been extremely active in trying to offset these market disruptions over the past year or so. It is difficult to know with any precision how effective Federal Reserve liquidity provisions have been, in part because a number of measures were also put in place by the Treasury, the FDIC, and the SEC, and disentangling the effects of each is impossible. Market participants, however, appear to largely agree that the Federal Reserve's interventions have been beneficial, and some of the available empirical evidence seems to support that view. For example, McAndrews, Sarkar, and Wang (2008) find that the cumulative effect of TAF auctions has been to lower the Libor-OIS spread by 50 basis points.<sup>2</sup> Unpublished work by Board staff also finds that the spread between Eurodollar and fed funds futures narrowed appreciably in the two hours surrounding TAF announcements containing positive surprises between December 2007 and May 2008. More recently, after the Commercial Paper Funding Facility (CPFF)—which purchases only highly rated ninety-day A1/P1 paper—was introduced, the spread on thirty-day A1/P1 ABCP fell from 400 to 120 basis points, while the spread on nonfinancial A2/P2 paper remained persistently above 400 basis points. Independent of their effects on market prices, those facilities have certainly provided term credit at reasonable prices to institutions that were previously facing great difficulties in borrowing beyond very short terms—mostly overnight.

To the extent that the liquidity facilities put in place by the Federal Reserve are beneficial to the financial system and the economy, more such interventions, perhaps aimed at different markets, would seem to be helpful. However, additional Federal Reserve liquidity facilities would add assets to the Federal Reserve balance sheet that most likely would be funded with increases in reserves, putting additional downward pressure on the federal funds rate. Based on experience to date, the payment of interest on excess reserve balances is not likely to be sufficient to counter that downward pressure.<sup>3</sup>

<sup>2</sup> Taylor and Williams (2008) use a different methodology and conclude that the introduction of the TAF had little effect on market rates. See McAndrews *et al.* (2008) for a critique of Taylor and Williams' methodology.

<sup>3</sup> The fact that the payment of interest on reserves is not putting a floor on the federal funds rate can itself be viewed as a failure to arbitrage a profit opportunity—buying cheap funds in the market and holding them as excess reserves. Several reasons could be behind this failure, ranging to the fact that some participants in the fed funds market (chiefly, the GSEs) are not eligible to receive interest, to the small size of the profits that could be reaped by such an

## Options for Further Intervention at the Zero Bound

If the FOMC's target for the federal funds rate were lowered to zero, however, there would be scope for large (or, in principle, unlimited) increases in the Federal Reserve's liquidity facilities, since the federal funds rate cannot fall below zero. In that case, the Federal Reserve could modify existing facilities that were designed to address systemic liquidity issues as needed to fully achieve their stated objective, for example by increasing their size, easing their terms, or expanding the lists of eligible counterparties or collateral in those programs. The Federal Reserve could also add new programs to jump-start other markets that are not currently being targeted, along the lines of the efforts announced recently to help the ABS market. If successful in unclogging existing bottlenecks in financial markets, these facilities could restart the credit flow to households and businesses and significantly lower market interest rates.

The Federal Reserve could also take a different approach and decide to provide credit directly to economic agents in specific sectors. While this may seem to take the Federal Reserve into new policy territory, the distinction between direct provisions of credit and more traditional operations aimed at improving liquidity conditions can be fuzzy. For example, the CPFF is intended to reduce rollover risk in the CP market, but it also increases credit availability to A1/P1-rated borrowers that are not able to obtain term funding in the market. An expansion of the CPFF to include A2/P2 borrowers, a possibility currently being discussed, would be closer to a provision of credit to those borrowers than to a step to help a systemic problem, given the relative small size of the A2/P2 market.

Direct provision of credit through unconventional policy may be desirable from a macroeconomic perspective given that credit is currently unavailable or very expensive to many households and businesses. More conventional forms of liquidity provision may take too long to restart the flow of credit across the economy and thus unnecessarily delay the economic recovery—for example, depository institutions may continue to be reluctant to lend funds that they obtain from the Federal Reserve until their balance sheets are repaired. Or, the purchase of large volumes of government securities, even if successful in lowering long-term Treasury and agency rates, may not propagate promptly to other interest rates of more immediate concern to households and businesses if financial markets remain disrupted. Alternatively, there is at least the possibility that some financial markets—for example, securitization markets, which have been a significant source of credit for households and businesses in recent years—may never return to their pre-crisis condition; in that case, it may be appropriate for the Federal Reserve to help the transition between the present and the new steady state that will ultimately prevail by supporting the provision of credit in the interim.<sup>4</sup>

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arbitrage, to capital constraints that may make it difficult for banks to exploit the arbitrage, to simple ignorance on the part of some institutions about the fact that excess reserves now receive interest.

<sup>4</sup> While it is not the purpose of this memo to advocate specific sectors for support, there is certainly no shortage of potential candidates. Since the Federal Reserve began invoking section 13(3) of the Federal Reserve Act to provide liquidity to a variety of markets and counterparties, a wide range of requests for support have come in, including from student loan providers, auto rental companies, auto manufacturers, mortgage servicers, local government investment pools, municipalities, securities lenders, SBA lenders, bank commingled funds, investors in commercial real estate, and manufactured-housing retailers .

There are costs associated with additional extraordinary liquidity interventions. Additional facilities could add to moral hazard by reducing the incentive for borrowers to maintain sufficient liquidity. Interventions generally entail some credit risk and so can result in the Federal Reserve taking financial losses. The credit allocation decisions implicit in any steps by the Federal Reserve to provide credit to specific sectors is, at least in more normal times, more efficiently handled by private markets and institutions. It may be difficult to withdraw Federal Reserve credit, especially credit to specific sectors, even when the situation begins to normalize. Consequently, a clear exit strategy would be beneficial. In part, such exit strategy would be dictated by the law, since most of the existing and likely future interventions have been authorized under section 13(3) of the Federal Reserve Act, which, among other things, requires “unusual and exigent circumstances” (as described in the next section). Thus, once economic and financial conditions start to improve, these facilities would have to be unwound.

If it is determined that the benefits of further liquidity and credit interventions outweigh the costs, it would remain necessary to decide what interventions to execute. It is difficult to provide specific recommendations for further intervention at this time, in part because facilities that are most obviously valuable to address current conditions have already been put in place or are in train. Given the operational burden involved, it may be desirable, when possible, to escalate the Federal Reserve’s interventions by expanding existing facilities. Possibilities along those lines include expanding the type of AAA ABS allowable for pledging in the TALF to include CMBS, non-agency RMBS, or corporate debt securities. In addition, the Federal Reserve could establish new programs to provide credit to other entities. The specific programs chosen will presumably be influenced importantly by market developments. In particular, new liquidity facilities may become necessary to address disruptions in key markets and to support systemically critical institutions.

## **Legal and Policy Limits on Liquidity Intervention**

### **Legal Limits**

Many of the extraordinary liquidity operations to date and many of those contemplated for the future (including the PDCF, the TSLF, the AMLF, the CPFF, the MMIFF, and the TALF) are authorized under section 13(3) of the Federal Reserve Act (FRA), which allows Federal Reserve Banks to discount the note of individuals, partnerships, and corporations in certain circumstances.<sup>5</sup> In particular,

1. the circumstances must be unusual and exigent,
2. the note must be endorsed or secured to the satisfaction of the lending Reserve Bank,
3. the borrower must be unable to secure adequate credit accommodations from other banking institutions, and
4. at least five (or, in certain circumstances, all available) Board members must approve the loan.

There are a number of lending structures that the Federal Reserve has used under section 13(3), but the options are constrained by the text and purpose of the statutory provision.

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<sup>5</sup> The AMLF is also authorized under section 10B of the FRA.

Consistent with the requirements in section 13(3), the Federal Reserve has authority to lend to an individual, partnership, or corporation on a collateralized or guaranteed basis; this would include, under certain circumstances, lending to a special purpose vehicle (SPV) that purchases debt instruments. However, applying the legal limits in the Federal Reserve Act to particular liquidity facility proposals often requires difficult judgments, and a careful case-by-case analysis of all the terms and conditions of a proposed facility generally is required to ensure compliance with the statute. In borderline situations, legal and policy considerations would have to be carefully balanced.

### **Policy Limits**

In addition to limits placed by the law, Federal Reserve policymakers are also guided by their conception of the role of the central bank within the financial architecture. Policymakers have generally expressed a preference for asset allocation policies that maintain Federal Reserve control of its balance sheet, avoid credit allocation, and minimize credit risk.<sup>6</sup> Interventions have been limited in duration and, when possible, offset so as to leave only manageable effects on reserve balances. They have been focused on providing liquidity to creditworthy institutions that have lost access to funding, on reviving important markets that have seized up, and stabilizing systemically critical failing institutions. These policies have been structured to avoid explicit credit allocation and minimize the credit risk borne by the Federal Reserve.

As the turmoil has widened and macroeconomic concerns intensified, policy objectives for financial stability and maximum sustainable growth have offset policymakers' asset allocation preferences, leading to larger and more long-lived interventions. Many of the facilities put in place recently have swelled the Federal Reserve balance sheet and put downward pressure on the federal funds rate because of the large amount of reserves they created. Moreover, some facilities have led to the assumption of somewhat greater credit risk by the Federal Reserve. For example, while the most recent intervention—the TALF—is in part structured to revive the asset-backed market by financing AAA-rated ABS, it is also intended to stimulate the extension of credit to consumers and small businesses and, to do so, is explicitly designed to take on tail risk.<sup>7</sup>

An important reason why the Federal Reserve has sought to avoid engaging in credit allocation and taking on credit risk in the past is a view that, if such governmental actions are desirable, they are more appropriately exercised by the fiscal authority.<sup>8</sup> An approach to liquidity intervention that respects this policy preference as well as the legal limits discussed above is to lend using an SPV that obtains capital from the Treasury and liquidity from the Federal Reserve, as in the TALF. This approach would limit the credit risk borne by the Federal Reserve. Moreover, the Treasury could be actively involved in identifying appropriate sectors to support. Interventions designed this way would have the added advantage of effectively leveraging scarce congressionally appropriated funds and thus would magnify the power of the

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<sup>6</sup> See, for instance, *Alternative Instruments for Open Market and Discount Window Operations*, Federal Reserve System Study Group on Alternative Instruments for System Operations, December 2002, pp 1-1 to 1-2.

<sup>7</sup> The program, however, largely preserves a key role for markets, in the sense that investors (and not the Federal Reserve) will decide which assets (within the broad category of consumer ABS) will get funded.

<sup>8</sup> *Alternative Instruments for Open Market and Discount Window Operations*, pp. 1-6 to 1-7.

Government's efforts to mitigate the effects of the financial crisis and ultimately restore the functioning of the financial system. Such close collaboration between the Federal Reserve and the Treasury may raise issues related to Federal Reserve independence; however, the Federal Reserve always retains the option to decline a Treasury proposal. It may also raise concerns about circumvention of limitations placed by Congress on the amount of government resources put at risk.

### **The Potential Economic Stimulus from Liquidity Intervention<sup>9</sup>**

It is very difficult to measure with any precision the scope for further liquidity interventions to stimulate the economy. One possibility is to estimate the extent to which the optimal-control policy path presented regularly in the Greenbook and Bluebook has been reduced as a result of the financial turmoil. While further liquidity measures cannot repair all the damage that has been caused by the turmoil, if they help return financial markets and institutions to their pre-crisis conditions over time, they would arguably impart a stimulus to the economy on the order of lowering the federal funds rate by an amount similar to, albeit somewhat less than, the reduction in the optimal path owing to the turmoil.

Optimal control simulations similar to those presented regularly in the Bluebook and Greenbook indicate that financial turmoil has lowered the average 2008-2010 value of the optimal-control federal funds rate path by a little over 5 percentage points; stress has lowered the 2009 average value of the path even more, by over 6 percentage points. Liquidity interventions cannot, of course, address all the consequences of the financial crisis; for this reason, an optimal control simulation that estimates the consequences of only the staff's judgmental estimates of nonstandard financial turmoil effects may be better suited to provide a measure of the effects amenable to expanded liquidity and credit interventions. Those estimates suggest that the nonstandard financial turmoil effects lowered the average 2008-2010 and the average 2009 value for the optimal control path by about 2-1/4 percentage points.

In sum, liquidity interventions that ameliorate the effects of the financial market turmoil may have economic benefits comparable to cuts in the federal funds rate ranging from 2-1/4 to 6 percentage points, with the lower end of that range likely being more realistic because the interventions would no doubt offset at most only part of the effects of the turmoil.

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<sup>9</sup> Dave Reifschneider, Division of Research and Statistics, provided substantial input to this section.

December 5, 2008

## 19. Targeting Term Funding Conditions in U.S. Depository Institutions

Olivier Armantier, Todd Keister, James McAndrews, and David Skeie<sup>1</sup>

### Executive Summary

This memo examines the possibility that the Federal Reserve could target term funding conditions for U.S. banks as a way to improve overall financial conditions. Under this proposal, the Fed shifts the focus of monetary policy away from the overnight federal funds rate and toward directly influencing the *term* funding conditions faced by banks, either at the one-month or three-month horizon. This is accomplished using a combination of a modified Term Auction Facility together with a new Term Deposit Facility. The Fed would not explicitly target a market interest rate; rather, the stance of monetary policy would then be indicated by the interest rates associated with these facilities. Once the crisis abates, the Fed could choose to return to focusing on an overnight interest rate.

### Background:

In normal circumstances in recent years, the operation of monetary policy has led to a low and stable term premium in interbank money markets. The spread between the three-month U.S. dollar Libor rate and the three-month overnight index swap rate, for example, has typically averaged less than 10 basis points. This tight link between the expected overnight federal funds rate and the comparable term interest rate in the money market is important to the transmission of monetary policy, since it implies that expected changes in the target federal funds rate are quickly reflected in term interbank lending rates. These interbank rates represent the marginal cost of term funding for banks and, therefore, heavily influence the rates at which banks lend to their customers.

During the current period of financial turmoil, this tight link between the expected federal funds rate and term money market rates has broken down, as term premia in the interbank market have become persistently high and variable. This change is likely being driven by factors related to both the supply of funding and the demand for funding. Lenders in the money market might have restricted their supply of credit in the term market for two reasons. First, lenders may perceive that their counterparties are risky, leading to high credit risk premia, particularly beyond very short maturities. Second, lenders may be concerned about their own actual or expected liquidity position and thus restrict their supply of term credit, adding a large liquidity premium to any credit they extend for terms longer than a day.

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<sup>1</sup> Federal Reserve Bank of New York.

On the other side of the market, borrowers may be willing to pay high term premia because doing so is more attractive than facing the risks associated with funding themselves daily in the overnight money market. Individual depositories may not be certain that the Federal Reserve will succeed in operating monetary policy in future weeks in a way that will allow that depository to fund itself at a rate near the target federal funds rate. A commitment to targeting the term funding conditions for depository institutions would allow the Federal Reserve to reassure depositories that it will succeed in achieving the desired funding conditions in future weeks. This reassurance, in turn, would decrease the demand for term funding and help reduce the term premium.

### **Instruments:**

First, daily account balances in Federal Reserve Accounts would earn the deposit rate on excess reserves.

Second, the Term Auction Facility would be modified and a new Term Deposit Facility introduced. By offering to take both sides of the market, either lending to or borrowing from banks, the Fed will be able to affect term funding conditions in both directions.

- 1) **Modified Term Auction Facility (TAF):** The TAF structure would be changed to allow banks to borrow unlimited quantities at a 5 basis-point spread to the desired term funding rate.

In order to encourage participation in the auction, the Fed could set an increasing supply schedule like the blue line in the graph below. If total bids are low, the auction would stop out at a low rate. This structure would give banks the additional incentive to participate in the auction of particularly cheap funding even if they expected that few other banks would. As with past TAF auctions, this incentive would continue to help offset any potential stigma of participation that may exist. The interest rate would increase as the dollar volume of bids increased. Banks would be permitted to borrow unlimited funds (only) at a pre-set maximum bid rate, which would be set at or slightly above the desired marginal cost of term funds (labeled the “policy rate” on the graph).<sup>2</sup>

- 2) **Term Deposit Facility (TDF):** On the same days as the TAF auctions, hold auctions in which banks bid to hold term deposits at the Fed. The Fed would accept term deposits in these auctions in unlimited quantities at a rate 5 basis points below the desired term funding rate.

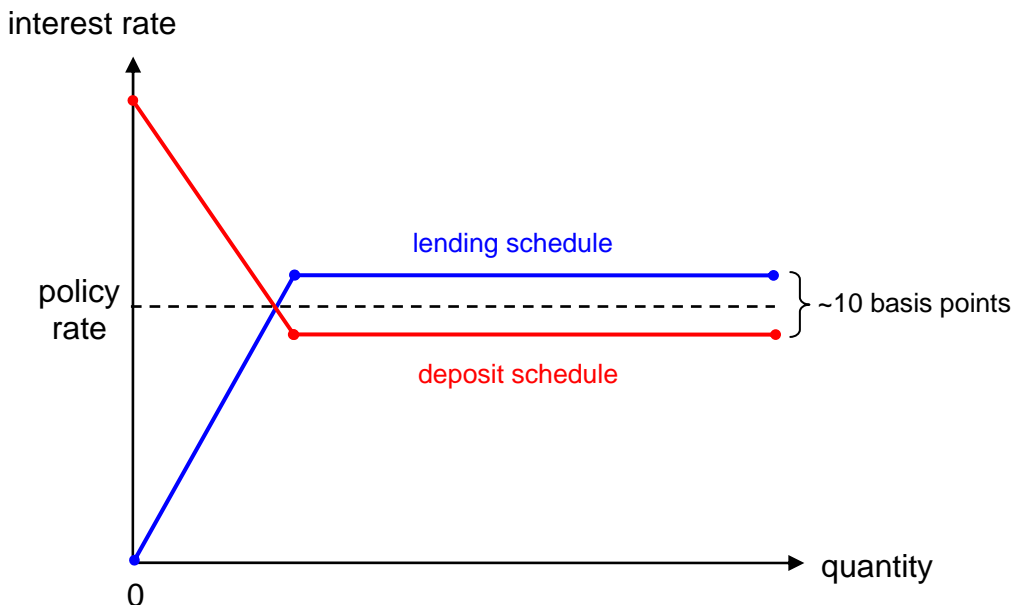
In order to encourage participation in this auction, the Fed could set a decreasing schedule, as depicted by the red line in the graph above. If few banks participate in

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<sup>2</sup> For stop-out rates below the maximum bid rate, concentration limits similar to those in the current TAF auctions would apply to amounts awarded to individual depository institutions; at the maximum bid rate, a depository institution would be constrained only by its collateral (a level of overcollateralization consistent with term borrowing would apply). A similar provision would hold in the term deposit auction; an unlimited amount would only be allowed at the minimum deposit rate.



the auction, the stop-out rate will be high and those banks that participate will receive an attractive rate for their deposits. The minimum bid rate would be set 5 basis points below the desired marginal cost of term funds.



Term deposits could be treated in one of three ways, arrayed here in order of increasing attractiveness to depository institutions.

- The term deposit could be withdrawn from the account of the depository institutions at the inception of the term, and returned at the conclusion of the term. In this way, the depository institution would not have use of the funds for the term of the deposit.
- The depository institution could be required to maintain the amount of its term deposit in its account at the end of each day, but the term deposits could be made available to it for use during the day. (Alternatively, the amount of the term deposit would serve as collateral supporting a free daylight overdraft for the depository institution.)
- The depository institution could be required to maintain the amount of its term deposit in its account on average over the term, or over each Reserve Maintenance Period within the term of the deposit.

These alternatives allow the funds deposited with the Fed to play increasing roles as a source of liquidity. In the first case, the term deposit does not serve as liquidity to the depository institution; in the second, the deposit allows the depository to access the funds during the day; in the third, it allows the depository to access the funds daily and to maintain its deposit equal to the term deposit on average over a period. To better distinguish between term and overnight deposits, but to recognize that funds on

deposit exist, the second alternative may be most appropriate. In that case, the amount of term deposits are segregated from influencing overnight interest rates.

### **Discussion:**

We do not advocate adopting an explicit target for market interest rates for term interbank loans. There is substantial risk in announcing an explicit target and then failing to meet it. Instead, we advocate using the stop-out rate on the facilities as indicators of the stance of monetary policy. If the FOMC desires to ease monetary policy, for example, the stop-out rates on both auctions could be lowered, thus decreasing banks' cost of term funding.<sup>3</sup>

The Swiss National Bank follows a policy of influencing 3-month rates in the interbank market for Swiss Francs. Instead of tightly targeting the 3-month Swiss franc Libor rates, it announces a target range (of one percentage point) within which it aims to maintain that rate.<sup>4</sup> It influences the 3-month rate by intervening in the one-week repo market on a daily basis. This approach relies on allowing the one week and overnight rates to fall far enough to accommodate the term premium in the 3-month rate. A limitation to this approach is the zero bound on the overnight rate, which the SNB is grappling with now. The Fed could not use this approach at this time because of this constraint.

The Danmarks Nationalbank targets a one-week rate (see the appendix) by intervening on a weekly basis in a fashion similar to that described in this memo: the Danmarks Nationalbank simultaneously offers one –week certificates of deposit and one-week collateralized loans. The certificates of deposit can be used as collateral by banks to obtain intraday credit from the Danmarks Nationalbank, but cannot function as current account balances. Current account balances earn a daily interest rate set at a discount to the one-week rate on certificates of deposit. On occasion, because of fluctuations in autonomous factors that affect the quantity of current account balances, the Danmarks Nationalbank will intervene during the week, outside of its weekly operation. An alternative suggested by the Danmarks Nationalbank example would be to eliminate the 5 basis point premium and discount in the two facilities and to “buy and sell” term funds at the same rate.

Correcting for term spreads by targeting a term rate is beneficial based on the work of Bernanke and Gertler (1989). Their work suggests that the overnight federal funds rate should be adjusted to compensate for an increase in the external finance premium, which is closely related to the credit and liquidity premiums in the federal funds rate. In fact, one of the rationales for the FOMC lowering the federal funds target since September 2007 has been the tightening of credit conditions, which was partly reflected in term

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<sup>3</sup> An especially difficult problem in targeting any currently-published term U.S. dollar interest rate, such as the Libor or NYFR, is that these rates include many participants other than U.S. depositories, and effectively measure Eurodollar, rather than federal funds rates. This measurement problem is another reason not to target a rate, but instead to target funding conditions for U.S. banks at the specific term.

<sup>4</sup> See the memo by Alain Chaboud, September 26, 2008, “The Swiss National Bank’s 3-Month Libor Target,” Board of Governors of the Federal Reserve System.

Libor spreads. An advantage of the approach proposed here is that the stance of monetary policy could be more independent of financial disruptions because variations in the term premium caused by such disruptions are automatically stabilized. It is notable, for example, that the Swiss National Bank has maintained the 3-month Swiss franc Libor rate within its target range throughout the period 2007-2008, even as the 3-month Libor rates in other currencies rose well outside of previous trading ranges and historical spreads to the overnight rates in the currency.

The interest rate at the modified TAF auction would represent a secured lending rate and, as such, the facility may not directly decrease the unsecured term interbank lending rate. However, increasing the quantity of term lending should decrease the overall demand for term borrowing (both secured and unsecured), and so should decrease the equilibrium rate for unsecured term borrowing.

The modifications to the Term Auction Facility discussed here would make it more similar to the Discount Window in some ways, especially in offering unlimited funding (against collateral) at a fixed interest rate. However, several important distinctions would remain. The TAF auctions would continue to be conducted on a fixed schedule, rather than providing funding on demand, and the auctions would continue to settle with some delay. These features make the auction less attractive to institutions with an immediate need for funds and, therefore, minimize the “stigma” effect of borrowing from the facility.

It should be noted, however, that both the potential for stigma and the distinction between secured and unsecured borrowing may limit the ability of the facility to create a hard ceiling for the market interest rate. Similarly, the Term Deposit Facility may not create a hard floor for the market interest rate because not all lenders would be eligible to hold Fed deposits. Nevertheless, the facilities would be effective in influencing term funding conditions for depository institutions both directly, for those institutions that use the facilities, and indirectly by changing the supply of and demand for funds in the market.

**Appendix: A description of the monetary policy implementation of the Danmarks Nationalbank<sup>5</sup>**

Danmarks Nationalbank's monetary-policy counterparties comprise banks and mortgage-credit institutes. The monetary-policy counterparties have access to the monetary-policy instruments, i.e. they can place liquidity with Danmarks Nationalbank as overnight deposits (current-account deposits) and participate in Danmarks Nationalbank's weekly market operations. In the weekly market operations, counterparties can obtain 7-day loans against collateral in securities, or deposit liquidity for 7 days by purchasing certificates of deposit. Current-account deposits accrue interest at the current-account rate. Danmarks Nationalbank's monetary-policy loans bear interest at the lending rate, which is equivalent to the rate of interest on certificates of deposit.

The net positions of the monetary-policy counterparties are their portfolios of certificates of deposit and current-account deposits, less their loans from Danmarks Nationalbank. The net positions are primarily affected by fluctuations in government payments and Danmarks Nationalbank's purchase and sale of foreign exchange. In the weekly market operations, the monetary-policy counterparties normally structure their net positions so that the total current-account deposit covers the expected liquidity requirement for the next week. When major liquidity fluctuations are expected, Danmarks Nationalbank may announce in advance that it will buy back or sell certificates of deposit outside the fixed market operations. Danmarks Nationalbank may also buy back or sell certificates of deposit without prior announcement.

Limits have been set for the size of the monetary-policy counterparties' current-account deposits. The purpose of these limits is to prevent the build-up of large current-account deposits that may be used for speculation in interest-rate and/or exchange-rate changes. If the total limit for the counterparties is exceeded, current-account deposits in excess of the individual limits will be converted into certificates of deposit.

Access to and use of accounts at Danmarks Nationalbank are determined in Danmarks Nationalbank's terms and conditions for accounts (Documentation basis for the monetary-policy instruments).

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<sup>5</sup> This description is found on the website of the Danmarks Nationalbank, <http://www.nationalbanken.dk/DNUK/MonetaryPolicy.nsf/side/Instruments!OpenDocument>

December 5, 2008

## 20. Communication and Commitment Strategies at Very Low Interest Rates

Christopher Erceg, Michael Kiley, and Andrew Levin<sup>1</sup>

### Executive Summary

In this note, we consider strategies for FOMC communications that could generate additional macroeconomic stimulus in an environment in which the degree of conventional policy easing is constrained by the zero bound on nominal interest rates. We begin by analyzing two potential enhancements in Federal Reserve communications that could be implemented without requiring significant changes to the existing policy framework:

- The FOMC could provide quantitative information regarding policymakers' assessments of the mandate-consistent inflation rate and thereby help ensure that long-run inflation expectations remain firmly anchored. This approach might be particularly helpful during a protracted period of high unemployment and very low inflation, in which a lack of clarity about the Committee's longer-run strategy could be misconstrued as "opportunistic disinflation" and hence contribute to a downward drift in longer-run inflation expectations.
- The FOMC could start providing in the Minutes quantitative information regarding the anticipated trajectory for the federal funds rate accompanied by fan charts or alternative scenarios to highlight the uncertainty and conditionality associated with these projections. This approach might be helpful in addressing potential misalignments between the expectations of policymakers and those of financial market participants and professional forecasters.

We then consider more substantial changes in the policy framework that would establish a conditional commitment to maintain a relatively accommodative stance of policy for some period once the setting of the federal funds rate is no longer constrained by the zero lower bound. If the commitment strategy were sufficiently transparent and credible, investors would anticipate a lower trajectory for future short-term interest rates, leading to a decline in current longer-term real interest rates and thereby providing near-term stimulus to the macroeconomy. We discuss two strategies along these lines:

- The FOMC could commit to following a nonlinear variant of the Taylor rule, in which the degree of extra policy stimulus in future periods would depend on the extent to which the zero lower bound had constrained the near-term setting of the funds rate.
- The FOMC could establish an explicit target for the price level at a fairly long horizon. In this case, if actual inflation over the next several years fell below the desired long-run average rate, then policymakers would be more accommodative in subsequent years until the price level returned to its target path.

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<sup>1</sup> Erceg: Division of International Finance; Kiley: Division of Research and Statistics; Levin: Division of Monetary Affairs.

## Introduction

Over the past several decades, academic researchers and policymakers have emphasized the role of expectations formation in the evolution of the macroeconomy. Indeed, through this expectations channel, a central bank's communications about its policy strategy can have significant effects on current economic activity, even in the absence of any contemporaneous change in the setting of the monetary policy instrument. First, such communications can affect the level of aggregate demand by shifting investors' expectations regarding the future path of short-term nominal interest rates, because those expectations are reflected in the prices of medium- and longer-term assets (such as bonds and equities) that in turn influence the borrowing costs and spending decisions of households and firms. Second, monetary policy communications may have a direct effect on actual inflation by influencing the views of wage- and price-setters regarding the medium- and longer-term inflation outlook. Of course, the effectiveness of central bank communication depends on how private agents form their expectations and on the credibility of these communications in light of the historical context and the strength of the institutional framework. As discussed in Notes 2 and 6, however, the empirical evidence suggests that central bank communications can have significant effects on private sector expectations and hence on actual output and inflation.<sup>2</sup>

In this note, we consider strategies for FOMC communications that could generate additional macroeconomic stimulus in a context in which the federal funds rate is already very low and therefore the room for further conventional policy easing is constrained by the zero bound on nominal interest rates. We begin by discussing possible enhancements to current Federal Reserve communications that the FOMC could implement without making any significant changes to the existing policy framework. For example, policymakers could be more specific about their assessments of the mandate-consistent inflation rate, perhaps by extending the horizon of their inflation projections. Policymakers could also be more specific about the likely trajectory for the federal funds rate and its sensitivity to economic developments, perhaps using fan charts or alternative scenarios to highlight the uncertainty and conditionality of these interest rate projections. Both of these approaches could be useful in enhancing the information provided through existing modes of verbal communication, such as FOMC statements, minutes, congressional testimony, and speeches by FOMC participants.

We then proceed to consider more substantial changes in the policy framework that would involve establishing a conditional commitment to maintain a relatively accommodative stance of policy for some period once the setting of the federal funds rate is no longer constrained by the zero lower bound. If the commitment strategy were sufficiently transparent and credible, investors would anticipate a lower trajectory for future short-term interest rates, leading to a decline in current longer-term real interest rates and thereby providing near-term macroeconomic stimulus. While enumerating a full set of state-contingent commitments is not practical, this approach could be roughly approximated by establishing a price level target or by adopting a nonlinear variant of the Taylor rule as a policy benchmark.

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<sup>2</sup> For additional evidence, see Bernanke, Reinhart, and Sack (2004) and Gürkaynak, Sack, and Swanson (2005).

## Communication about Inflation Objectives

Recent research has highlighted the extent to which the firm anchoring of inflation expectations can be crucial for ensuring that a large contraction in aggregate demand does not push the economy into a liquidity trap. For example, Bullard and Cho (2005) showed that the effects of large contractionary shocks are typically compounded when agents face uncertainty about the central bank's inflation objective and hence must infer its value from recent economic outcomes.<sup>3</sup> Similarly, Evans, Guse, and Honkapohja (2007) analyze a learning model in which low outcomes for actual inflation cause private agents to mark down their inflation forecasts; thus, when monetary policy becomes constrained by the zero lower bound, real interest rates start rising and choke off economic activity, leading to further downward revisions in the inflation outlook and in some cases to a full-blown deflationary spiral.

In practice, longer-term inflation expectations would be most likely to drift downward in response to a persistent drop in actual inflation, especially if this sequence of inflation outcomes were perceived as an "opportunistic disinflation" that reflected the implicit preferences of policymakers.<sup>4</sup> For example, as shown in the upper panel of figure 1, expectations about the 10-year average U.S. CPI inflation rate (as measured by the Philadelphia Fed's Survey of Professional Forecasters) remained in a range of 4 to 4½ percent from 1985 to 1991, roughly similar to the average CPI inflation rate over that period, but then declined gradually through the 1990s. Actual CPI inflation was at or below 3 percent from 1992 to 1996, and long-run inflation expectations converged to that rate by the middle of the decade. Realized inflation dropped somewhat further with the onset of the "new economy" and contributed to a further decline in long-run inflation expectations to around 2½ percent by the end of the 1990s. Professional forecasters' long-run projections for U.S. CPI inflation have remained fairly stable at that level over the past decade—a period in which actual CPI inflation has been subject to some large but relatively transitory fluctuations.

The Swedish experience suggests that a transparent and credible inflation objective may be helpful in providing an anchor for long-run inflation expectations, especially during a period of persistent low inflation. The lower panel of figure 1 shows the evolution of Swedish CPI inflation since 1993 in comparison with the longer-run projections of professional forecasters (as measured by Consensus Economics semiannual surveys that have been conducted since 1995). When the Sveriges Riksbank's governing board announced the adoption of an inflation target in January 1993, the target was initially specified as a range of 1 to 3 percent, but the Riksbank subsequently placed greater emphasis on the midpoint of this range, and long-run inflation expectations gradually converged to the inflation target of 2 percent. Notably, these expectations remained firmly anchored during the period from 2004 to mid-2007 when Swedish inflation outcomes were also persistently low, suggesting that, by then, the inflation target was well understood and credible.

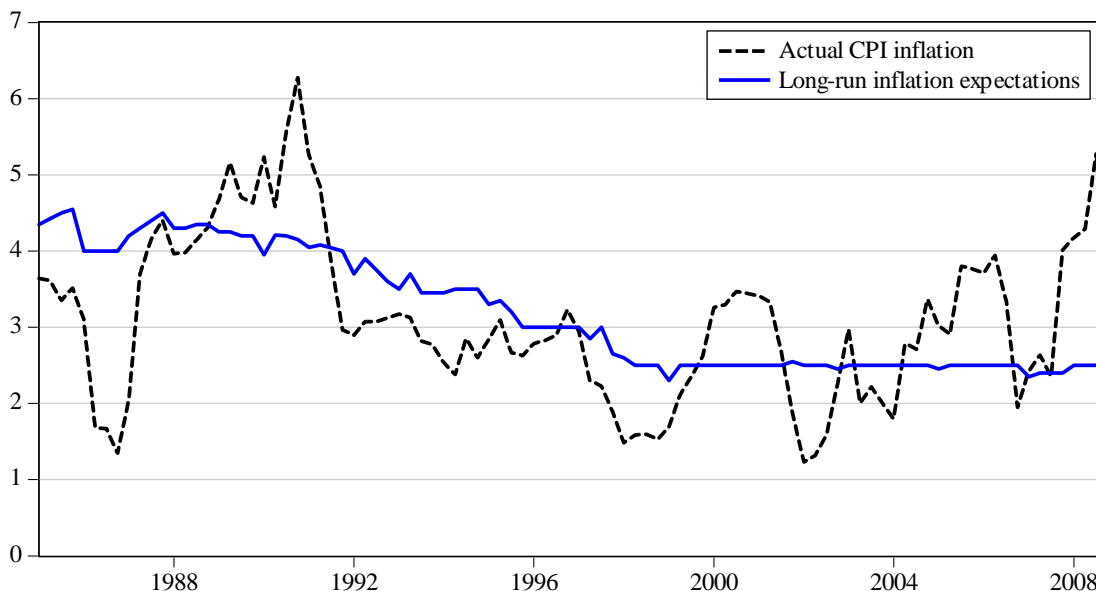
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<sup>3</sup> In the framework of Bullard and Cho (2005), agents perceive that the central bank's inflation objective is subject to variation over time and hence make inferences about the current value of the inflation objective by running least-squares regressions that place relatively greater weight on recent economic outcomes.

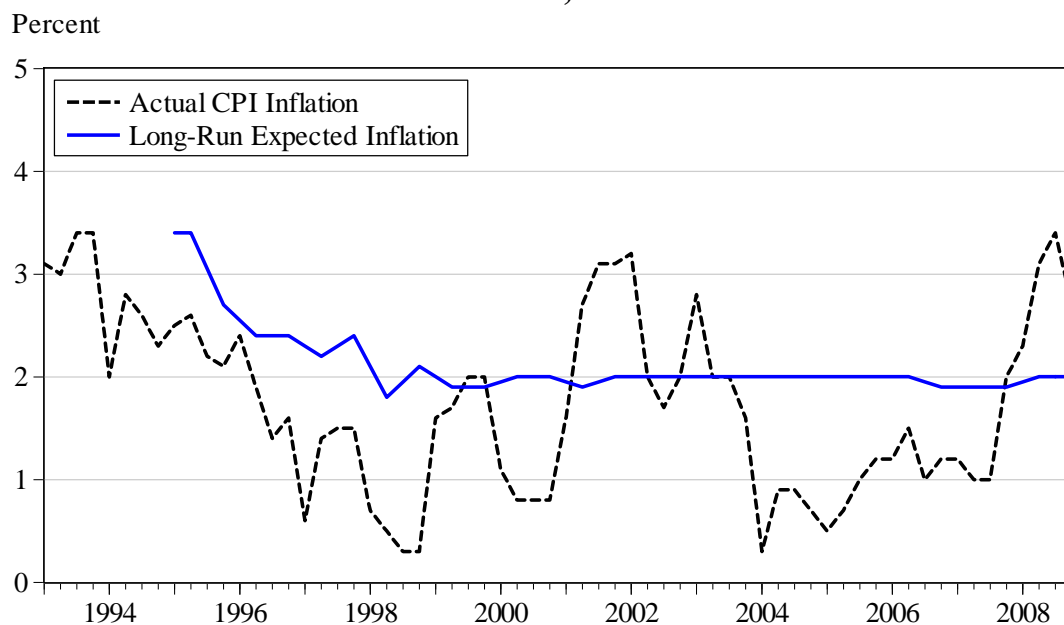
<sup>4</sup> Meyer (1996) describes the origin of this phrase as follows: "A couple of years ago, I gave the name 'opportunistic disinflation' to an alternative strategy for bridging between short-run policy and long-run goals, a strategy that I observed the Federal Reserve to be following at the time." For further analysis and discussion, see Bomfim and Rudebusch (2000), Orphanides and Wilcox (2002), and Aksoya, Orphanides, Small, Wieland, and Wilcox (2006).

**Figure 1: Inflation Outcomes and Long-Run Inflation Expectations**

*United States, 1985-2008*



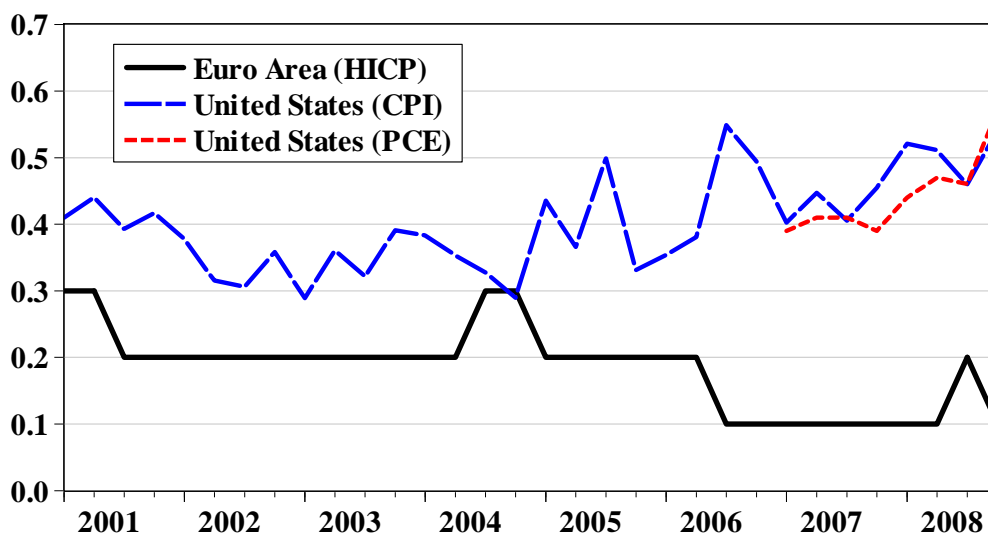
*Sweden, 1993-2008*



*Note:* In the upper panel, long-run expected inflation (solid line) denotes the median projection of the 10-year average rate of inflation of the U.S. consumer price index (CPI) from the Federal Reserve Bank of Philadelphia’s Survey of Professional Forecasters, and actual inflation (dashed line) denotes the four-quarter average U.S. CPI inflation rate. In the lower panel, long-run expected inflation (solid line) denotes the median projection of Swedish CPI inflation 6-to-10-years ahead in the Consensus Economics semiannual survey of professional forecasters, and actual inflation (dashed line) denotes the four-quarter average Swedish CPI inflation rate, excluding household mortgage interest and the direct effects of changes in value-added taxes and subsidies.



**Figure 2: Dispersion in the Long-Run Inflation Expectations of Professional Forecasters in the Euro Area and the United States**



*Note:* This figure depicts the dispersion in the views of professional forecasters' long-run inflation outlook for the euro area and the United States, as measured by the standard deviation across the individual projections at each date. For the euro area (solid line), these data are taken from the ECB's quarterly survey of professional forecasters and refer to the 5-year-ahead projected inflation rate for the harmonized index of consumer prices (HICP). For the United States, these data are taken from the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters and refer to expected inflation over the next 10 years for the CPI (long dashed line) and the total PCE deflator (short dashed line).

In recent years, Federal Reserve communications have provided significant information about policymakers' long-run inflation goals. For example, in spring 2003, the FOMC noted that further substantial declines in inflation would be "unwelcome," and in summer 2006 the FOMC referred to recent outcomes for core inflation as "elevated." These communications, together with the FOMC's policy actions, were viewed as indicating that policymakers preferred to keep inflation within a range of about 1 to 2 percent over time. In the first Summary of Economic Projections (SEP), published in conjunction with the minutes of the October 2007 FOMC meeting, participants' inflation projections for 2010 had a central tendency of 1.6 to 1.9 percent and a range of 1.5 to 2 percent. These projections were described as "importantly influenced" by participants' judgments about the measured rates of inflation consistent with the dual mandate, leading many commentators to conclude that the Federal Reserve's 'comfort zone' for inflation was about 1½ to 2 percent.

Nevertheless, the empirical evidence indicates that the degree of uncertainty regarding the longer-run outlook for U.S. inflation is substantially higher than in other major industrial economies.<sup>5</sup> For example, as shown in figure 2, the standard deviation across individual long-run inflation projections in the Philadelphia Fed survey has had an average value of about 0.4 percentage points over the past eight years, underscoring the dispersion in views even among professional forecasters who are presumably paying close attention to Federal Reserve policies

<sup>5</sup> See Gürkaynak, Sack, and Swanson (2003), Levin, Natalucci, and Piger (2003), Gürkaynak, Levin, and Swanson (2007), Gürkaynak, Levin, Marder, and Swanson (2007), and Beechey, Johannsen, and Levin (2008).

and communications. Indeed, in the latest SPF that was published in early November, the degree of dispersion in long-run inflation projections reached its highest level in a decade. In contrast, since the European Central Bank (ECB) clarified its policy strategy as aimed at keeping inflation “below, but close to, 2 percent in the medium term” (ECB 2003), forecasters’ longer-term projections for the euro area have become very tightly clustered around the average forecast of about 1.9 to 2 percent, even in the latest ECB survey that was published in mid-November.<sup>6</sup>

In light of the global financial crisis, the FOMC could face a significant challenge in preventing a gradual downward drift in longer-run inflation expectations, especially if global economic activity deteriorates further and inflation falls close to or below zero for an extended period. For example, in the latest SEP, participants’ projections for core PCE inflation in 2011 had a central tendency of 1.3 to 1.7 percent and a range of 0.8 to 1.8 percent, and these projections were described as “close to or a bit below” participants’ assessments of the mandate-consistent inflation rate. Moreover, participants might now perceive the outlook for economic activity and inflation as having deteriorated significantly since those projections were made in late October, and they might also see substantial risks of an even more precipitous downturn. In such circumstances, participants’ inflation projections for 2011 might deviate even further from their longer-run inflation goals, and a sense of those goals might become increasingly difficult to convey solely using verbal descriptions.

The potential difficulty in communicating participants’ assessments of the mandate-consistent inflation rate within the timeframe of the current SEP underscores the potential benefits of extending the projections to a longer horizon over which the economy would be likely to converge to its balanced-growth path. In effect, such longer-run projections would more clearly provide information about participants’ assessments of the mandate-consistent inflation rate as well as their estimates of sustainable rates of output growth and unemployment. This approach could also be quite helpful in explaining further changes in the economic outlook and in elucidating the Committee’s policy strategy over the next few years.

### **Communication about the Likely Path of Policy**

Investors’ expectations regarding the future path of short-term nominal interest rates play a key role in determining the prices of medium- and longer-term assets—such as bonds and equities—that influence the borrowing costs and spending decisions of households and firms. When the setting of the policy instrument is close to the zero lower bound, the anticipated path of short-term interest rates—and hence the current levels of other asset prices—will be sensitive to investors’ perceptions about the likely timing and pace of future monetary policy tightening. Moreover, in a highly uncertain macroeconomic environment, these perceptions may exhibit substantial volatility and might even diverge markedly from the views of policymakers.

Thus, the rationale for the central bank to provide information about the likely path of monetary policy may be particularly strong under circumstances in which the current stance

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<sup>6</sup> It seems reasonable to attribute these contrasting patterns to differences in policy communication rather than to differences in the policy framework, because recent econometric studies by Smets and Wouters (2005), Christiano, Motto, and Rostagno (2007), and Uhlig (2007) found that the policy reaction functions for the euro area and the United States were broadly similar.

of policy is constrained by the zero lower bound. Such communication can provide clarification about the length of time that policymakers anticipate keeping rates close to zero and about the speed at which they expect to tighten once aggregate demand begins to recover.

Indeed, in mid-2003, when the federal funds rate stood at 1 percent and policymakers became concerned about the possibility of an unwelcome further decline in inflation, Federal Reserve communications began providing an unprecedented degree of policy guidance. During the summer and fall of 2003, FOMC statements indicated, “In these circumstances, policy accommodation can be maintained for a considerable period.” During winter 2004, the Committee stated that it expected to be “patient” in removing policy accommodation, and from spring 2004 through the end of 2005, FOMC statements indicated that policy accommodation would be removed “at a pace that is likely to be measured.” As discussed in Note 2, FOMC communications during this period appear to have been reasonably successful in aligning the policy expectations of financial market participants with those of the FOMC.

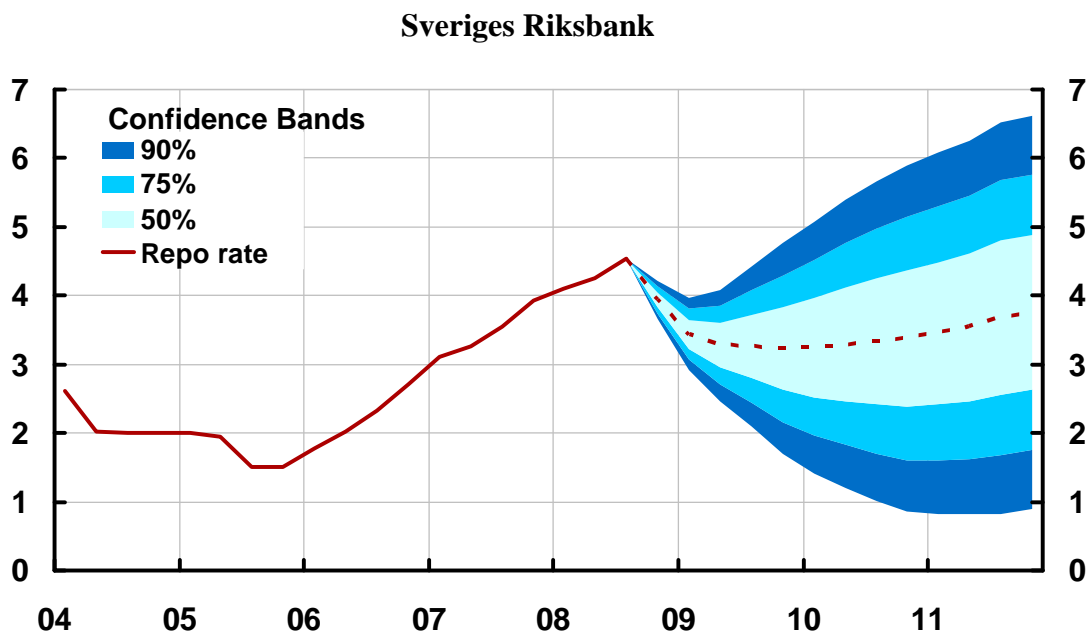
Although the policy guidance provided by the FOMC from mid-2003 through late 2005 has occasionally been characterized as a set of unconditional commitments, the language of these statements and from other Federal Reserve communications (including FOMC minutes, testimony, and speeches) clearly seems to indicate that the policy guidance was intended to convey information about the Committee’s *conditional expectations*. From August 2003 through May 2004, each FOMC statement employed the phrase “in these circumstances” or similar words. And from June 2004 through December 2005, each statement concluded by emphasizing that “the Committee will respond to changes in economic prospects as needed to fulfill its obligation to maintain price stability.” Nevertheless, the very low level of implied volatility in forward markets does suggest that investors may have placed insufficient odds on the possibility of a shift in the economic outlook that could have led to a markedly different pace of policy tightening; hence, in retrospect this episode might be viewed as underscoring the challenges and pitfalls of giving policy guidance solely through verbal descriptions.<sup>7</sup>

If the Committee perceives that some quantitative information about the likely path of policy might be helpful under present circumstances, it might wish to follow an approach similar to the communication strategies adopted by several other central banks in recent years. For example, figure 3 reproduces fan charts from the latest inflation reports of the central banks of Sweden (upper panel) and Norway (lower panel). Both of these exhibits use progressive shading to denote confidence intervals, which effectively highlights the degree of uncertainty surrounding the modal forecast. The Norges Bank chart also includes two alternative scenarios (labelled as “lower demand” and “higher demand”), underscoring the conditionality of the benchmark forecast and conveying potentially significant information about how the stance of policy would be adjusted in response to plausible deviations from the baseline outlook. Of course, these exhibits are accompanied by extensive discussion of the factors shaping the outlook and the risks to that outlook, thereby illustrating the notion that verbal and quantitative forms of communication may be viewed as complements rather than substitutes.

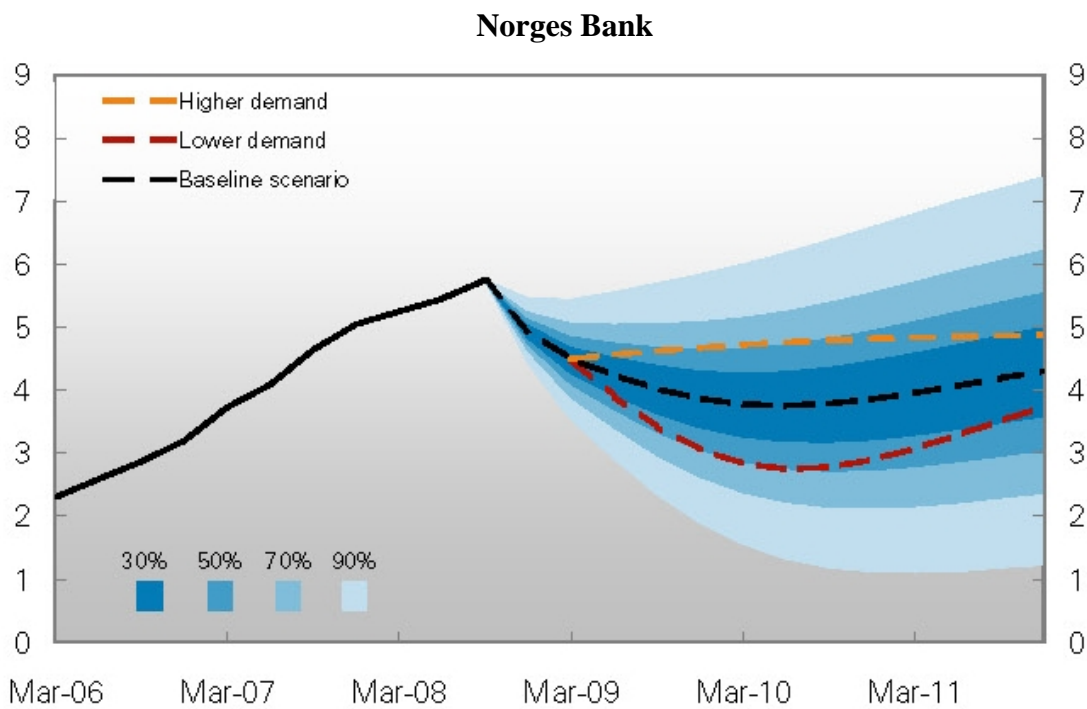
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<sup>7</sup> As emphasized by Moessner and Nelson (2008), the level of realized volatility was also very low over this period, reflecting the extent to which the forward policy guidance succeeded in minimizing the incidence of surprises in the actual path for the federal funds rate.

**Figure 3: Policy Projections of Other Central Banks**



Source: Figure 1 from *Monetary Policy Report*, Sveriges Riksbank, October 2008.



Source: Figure 1.23a from *Monetary Policy Report 3-08*, Norges Bank, October 2008.

## Optimal Policy under Commitment

Monetary policymakers can potentially stimulate the economy and thereby mitigate the impact of the zero bound constraint by making commitments about the future course of policy. In particular, monetary policy can influence current long-term real interest rates and expected inflation by making commitments about the future path of short-term real interest rates.

An obvious question concerns the framework that should be adopted to formulate such commitments. One useful perspective, adopted in the FRB/US simulations discussed in Note 21, applies optimal control theory to derive an “optimal” policy rule. This rule is obtained by minimizing a specific loss function (e.g., one that depends on the output gap, inflation gap, and perhaps other factors) subject to a particular behavioral model of the economy. This approach takes full account of intertemporal tradeoffs, including the possibility of influencing current expectations about future short rates and inflation through making promises about future policy, assuming that the monetary policy rule is both well understood by the public and is fully credible.

A significant difficulty with “optimal” rules derived in this framework is that such rules tend to be very complex and their performance may be quite sensitive to specific features of the modeling environment. Nevertheless, a considerable body of research suggests that several robust features characterize optimal rules that are derived in the presence of an explicit zero bound constraint.<sup>8</sup> This characterization is useful in evaluating the merits of some alternative simple rules considered below.

The first feature of an optimal rule is that it promises that *future* policy will be more expansionary than usual after the economy no longer faces a binding zero bound constraint. To be specific, the optimal policy consists of a commitment to pursue a policy that is expansionary relative to the policy that the central bank would follow if it faced similar macroeconomic conditions, but had made no prior commitments. Policymakers communicate this promise by indicating to markets that they expect to push output above potential for an extended period after the economy no longer faces a zero bound constraint, and to allow inflation to rise above target for some time (rather than aiming to keep output at potential, and inflation at its long-run target, as would be done in the absence of such a commitment).

Assuming full credibility, markets will interpret the commitment as implying a lower expected path for future short-term real interest rates. This serves to reduce current long-term real interest rates, which boosts current output even when the economy faces a zero bound constraint. The stimulus to current activity would be amplified to the extent that the promise of expansionary policy also raised near-term expected inflation, as this would reduce real interest rates even in the near-term. Nonetheless, an important consideration is that while the optimal policy can benefit the economy in the near-term by keeping output and inflation closer to target, this policy also entails the cost of running positive output gaps and inflation gaps once the economy no longer faces the zero bound constraint.

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<sup>8</sup> Eggertson and Woodford (2003) and Eggertson (2008) provide excellent discussions of the optimal policy under commitment in the presence of a zero bound constraint.

A second feature of the optimal policy is that it is “history dependent,” so that the extent and duration of policy stimulus in the period after the economy exits the liquidity trap depends on the evolution of output and prices during the period in which policy was constrained. Intuitively, as an economy facing a zero bound constraint becomes mired in a deeper recession, an optimal policy would promise even more stimulus in the future in order to reduce long-term real interest rates. This type of policy framework, which conditions heavily on past outcomes, contrasts with the typical maxim advocating that central bank’s allow “bygones to be bygones.”

A third feature of the optimal policy is that the timing and size of adjustment in policy rates after the economy leaves the liquidity trap depends crucially on the evolution of economic conditions. Thus, if the recovery turns out to be unexpectedly robust, policy rates could be adjusted upward relatively quickly and by a substantial amount, though to a degree that still leaves an expansionary tilt to policy.

Finally, because the benefits of the optimal policy are front-loaded—hence serving to reduce long-term real interest rates—while the costs are paid later, policymakers may have a strong incentive to renege on their commitments. Thus, the credibility of the central bank’s commitment is a critical question because the efficacy of strategies that rely on commitment hinge on whether the private sector believes that the central bank will carry through on its promises. The credibility problem may be exacerbated by governance issues, especially if the economy remains in prolonged recession and the central bank does not have to deliver on its promises for several years. Without an institutional framework that reinforces the commitment, the central bank cannot guarantee that promises made by one group of central bankers will be heeded by their successors.

### **Commitment Strategies in Practice**

These considerations provide a useful benchmark against which to evaluate several alternative “commitment-based” strategies that might be adopted in practice to help mitigate the impact of a zero-bound constraint.

One strategy is to commit to holding the nominal funds rate at zero for a prolonged period after exiting the liquidity trap. A seeming advantage is that this strategy would appear to be easy to communicate to markets. However, a key shortcoming is the lack of conditionality of interest rate adjustment, in sharp contrast with optimal policy. Nominal short-term rates would have to remain frozen even if the recovery was characterized by booming output and escalating inflation. A second difficulty is that this strategy leaves open the question of what considerations would govern the adjustment of policy rates after the extended period of zero interest rates had ended. In principle, policy could be sufficiently aggressive subsequently to keep output at potential and inflation at target, which would be inconsistent with the commitment to keep policy expansionary. Thus, at the least, the success of this policy would seem to hinge on a careful articulation of the monetary policy strategy after the extended period with low nominal rates had ended.

A second strategy is to follow a history-dependent Taylor rule along the lines of that proposed by Reifschneider and Williams (2000). The basic idea is that policy follows a Taylor rule in normal times, but the rule is modified to allow for a lower intercept term (implying more stimulative policy) in periods in which the economy is constrained by the zero bound. This rule captures all of the key features of optimal rules noted earlier. First, the time-varying intercept indicates that policy promises to be expansionary relative to what it would usually be when faced with similar conditions for output and inflation. Second, because the adjustment to the intercept depends on the length and severity of the recessionary period associated with the zero-bound constraint, this strategy takes account of history-dependence in roughly the same way as the optimal rule. Thus, policy promises to be more stimulative in the future as the current recession becomes more severe. Third, this rule only modifies the intercept of the Taylor rule and hence implies that interest rates will be adjusted in a conditional way that takes full account of pressures on inflation and the output gap once recovery is under way. Finally, the extra stimulus fades over time, because the adjustment to the intercept is reduced as the economy recovers.

From a practical perspective of implementation, a very desirable feature of the Reifschneider-Williams rule is that its implementation does not require any major departure from the usual decision-making framework of central banks. The greater history dependence relative to a standard Taylor rule is confined to periods around the unusual situation of a liquidity trap. During most other times, monetary policy follows a standard Taylor rule that focuses on the near-term evolution of inflation and the output gap, with minimal consideration of how those variables behaved a year or more in the past.

A key practical challenge presented by using this framework to communicate future policy intentions is that the Federal Reserve does not describe its policy actions in normal times in terms of a reference rule such as the Taylor rule, even if the Taylor rule seems to capture quite well the historical evolution of policy rates. This consideration would seem to preclude making specific promises about future behavior using the standard Taylor rule as a rigid benchmark. Instead, such promises would need to be less precise, essentially conveying that the Federal Reserve would commit to leaving interest rates considerably below the level that would normally be set given the prevailing outlook for inflation and output. In the spirit of the Reifschneider-Williams rule, some rough guidance might be provided about the magnitude of initial stimulus and how this stimulus would diminish through time. Given the imprecise nature of the promise, markets would likely face difficulties in making quantitative assessments about the magnitude of future easing. Even so, this approach could well have a noticeable and positive effect on market expectations, especially if accompanied by tangible actions such as large-scale quantitative easing that could be regarded as bolstering the credibility of the commitment to remain expansionary.

From the standpoint of communication, it is worth pointing out that a time-varying intercept in the central bank's reaction function has the alternative interpretation of a time-varying inflation target. In particular, promising to follow a Taylor rule with a temporarily low intercept (as in the Reifschneider-Williams rule) has the same macroeconomic effects as setting an inflation target in the near- to medium-term that is higher than the central bank's long-run inflation objective.<sup>9</sup> Although it is conceivable that there would be some benefit of

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<sup>9</sup> Note 21 uses the FRB/US model to assess the impact of a highly persistent rise in the Federal Reserve's inflation target.

communicating a commitment to remain expansionary in terms of a time-varying inflation target, characterizing strategy in these terms may also appear inconsistent with a dual mandate.

A third option is price-level targeting. This strategy also captures the salient features of optimal rules mentioned above and has been shown to be the optimal policy in the context of a stylized New Keynesian model by Eggertson and Woodford (2003). The distinctive feature of price-level targeting is the promise to maintain a positive output gap for an extended period after the economy no longer faces a binding zero bound constraint until prices rise back to their “trend” level. Thus, if the price level fell by 3 percent in absolute terms over a three-year period and the target price level increased 2 percent per year, policy would commit to eventually making up the 9 percent “price level gap” that emerged. For instance, if policymakers found it desirable to close this gap over a period of three years, they would target policy at an inflation rate averaging 5 percent per year over that interval.

Thus, price-level targeting goes beyond policies that simply promise only to be expansionary in the post-recession future. In particular, price-level targeting pledges that policy will remain expansionary until any gap between the actual and target price level is eliminated. Provided that inflation expectations are significantly forward-looking, and the policy is viewed as highly credible, this strong commitment to reflate could play a very constructive role in stabilizing expected inflation during the period in which the economy was in a liquidity trap and thus help keep real rates relatively low in the near-term as well as at longer horizons.<sup>10</sup> Indeed, simulations of the FRB/US model under model-consistent expectations tend to find an important stabilizing role for price-level targeting, at least under some conditions, despite the high degree of intrinsic inertia in inflation in that model; whether such gains would accrue in practice over the horizon currently in play is more questionable, as it is not obvious that expectations formation would adjust to a shift in policy regime quickly.

From a communication perspective, an attractive feature of price-level targeting is that the ultimate goal of keeping prices stable relative to a deterministic trend would seem quite straightforward to communicate to the public (even if, as noted below, it remains a nontrivial task to establish a timeframe and operational approach for achieving this goal). Indeed, the simplicity of the objective and relative ease in verifying the success of policymakers in attaining it have made price-level targeting attractive to economists for nearly two centuries, dating at least to John Rooke in the early 19<sup>th</sup> century.<sup>11</sup> Even aside from the modern argument that price-level targeting can help anchor inflation expectations, another intuitive conclusion is that keeping prices stable can help avoid the unanticipated changes in the distribution of wealth that invariably occur due to price level surprises (given that most contracts, including financial contracts, are denominated in nominal terms).

However, formal adoption of price-level targeting would entail a major shift in the Federal Reserve’s framework for conducting monetary policy by making policy much more history-dependent. Policy would have to focus heavily on correcting past mistakes (departures of the price level from target) even in normal times, in contrast with the Reifschneider-Williams

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<sup>10</sup> In the context of a model that embeds these assumptions, Eggertson and Woodford (2003) show that the expectation that the authorities would reverse any price level gap in the future is sufficient to largely forestall any price decline from occurring in response to a negative aggregate demand shock, notwithstanding that the same shock would have sizable contractionary effects if policy followed a standard Taylor rule.

<sup>11</sup> A discussion of Rooke’s contributions may be found in Fisher (1934).



rule that introduces history dependence only under restricted conditions. Such a shift in the conduct of monetary policy implies tackling the important issue of how to accommodate the goal of stabilizing prices near their desired trend with the Federal Reserve's legislated objective of a dual mandate. Because reconciling the two objectives entails balancing the cost of returning the price level to target quickly against the impact on the real economy, it poses a significant challenge to for the design and communication of policy.

Somewhat more broadly, how price-level targeting would perform in practice is an open question, given that no major industrial country has adopted price-level targeting for a sustained period. While price-level targeting clearly performs very adeptly in stabilizing inflation expectations and output in simple models in which expectations are highly forward-looking and the monetary regime is fully credible, the robustness of these results to alternative and perhaps more realistic settings is unclear. In reality, when the economy faced a zero bound constraint, prices could conceivably fall considerably even under price-level targeting either because inflation expectations were not very forward-looking, or due to credibility problems. Under these conditions, price-level targeting could fail in the objective of stabilizing inflation expectations, but would still saddle the policymaker with the commitment to pursue a sufficiently expansionary policy to push prices back to trend. Fulfilling such a commitment could require a large positive output gap if the Phillips Curve slope was fairly flat.

Given these considerations, a shift to price-level targeting might be reserved for more extreme circumstances than we are currently anticipating—a situation in which the business downturn became even more severe and protracted, and was accompanied by a declining price level and shift in expected inflation into negative territory. Such circumstances might warrant a major departure from our current policy framework. In particular, if the price level did decline markedly, the private sector would plausibly regard a commitment to reverse this decline in the context of a new regime of price-level targeting as quite credible and desirable. Price-level targeting might well prove efficacious in boosting inflation expectations, as well as in alleviating the adverse effects of debt deflation on the real economy. Overall, although price-level targeting appears to offer significant benefits, the success of the Federal Reserve's existing policy framework in keeping inflation low and stable over the past quarter century provides a rationale for being cautious about shifting to a new regime.

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December 5, 2008

## 21. Quantitative Analysis of Policy Alternatives Using the FRB/US Model

Christopher Erceg, Michael Kiley, and Andrew Levin<sup>1</sup>

### *Executive Summary*

This note provides a quantitative assessment of the macroeconomic effects of various policy options. We examine the possible effects of alternative commitments to maintain the federal funds rate at (or near) zero for extended periods, quantitative easing in Treasury or agency securities, and fiscal actions, as well as the effects of a combination of various policies. In each case, we examine policy interventions of plausible magnitudes.

Based on model simulations, each policy intervention would provide a moderate degree of stimulus to economic activity and would prevent some of the decline in inflation projected in the October Greenbook. However, indicators of real activity and developments in financial markets—which have continued to deteriorate since the last FOMC meeting—point to persistently weak real activity and a substantial slowing in inflation over the next several years, and none of the policy options presented here would be sufficient, in isolation, to change this basic outlook. A combination of policy responses could yield appreciably more desirable outcomes for activity and inflation.

The degree of stimulus imparted by each policy option considered falls within a plausible range, but uncertainty about the size of these effects is considerable, with a number of factors suggesting that the effect of each policy examined may be larger or smaller than we present. All of the simulations use the FRB/US model, and other models would undoubtedly yield somewhat different estimates. This sensitivity is likely to be especially pronounced for the simulations that analyze the effects of conditional commitments to maintain a low path for the federal funds rate, as the degree of macro stimulus depends crucially on the importance of forward-looking behavior and on the perceived credibility of the commitments.

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## ***Introduction***

The projection in the October Greenbook included a substantial rise in unemployment and a pronounced deceleration in prices over the long run, with PCE price inflation falling to almost 1 percent in 2011. Since the October Greenbook closed, data on real activity and developments in financial markets imply a further weakening in the economic outlook, suggesting that the unemployment rate might well exceed 8 percent in 2009 and 2010 and that core PCE price inflation would be likely to fall below 1 percent by 2011.

Given these developments, the prescriptions for the path of the federal funds rate from some simple policy rules and from the optimal control exercises presented in the Bluebook call for holding the funds rate at zero for an extended period. As a result, any additional stimulus cannot come from lower *current* values of the funds rate, but instead must stem from alternative strategies. Such strategies include communicating a conditional commitment to keep the federal funds rate low for a protracted period, quantitative easing brought about by a large-scale increase in excess reserves, nontraditional policy actions (such as large-scale purchases of MBS), fiscal policy, and other types of policy actions discussed in the companion memos.

This note examines the quantitative magnitude of the stimulus from conditional commitments about the path of the funds rate and from nonconventional policy measures (such as those discussed in Notes 16 and 17) as well as from fiscal policy measures. All simulations use the FRB/US model and assume perfect-foresight/model-consistent expectations in financial markets; the latter assumption implies that expectations of future actions drive asset prices. The simulations are based on the October Greenbook projection. We assume that the Committee's underlying preferences are to stabilize inflation at 1¾ percent and the unemployment rate at the NAIRU (4¾ percent) over the longer run. In all of the simulations, we assume that the effective floor on the nominal federal funds rate is zero; Notes 9 through 13 consider reasons for why the Committee might want to adopt a somewhat higher floor.

The following section focuses on commitments to keep the funds rate near zero; such commitments, if credible, are found to be quite powerful, particularly if the Committee were to signal a desire to push inflation somewhat higher on a sustained basis, perhaps to 2¾ percent. We follow these simulations with a discussion of the effects of nontraditional policy actions (designed to lower term and/or risk premia) and fiscal policy, both of which provide moderate degrees of macro stimulus. The moderate degree of stimulus imparted by most of the options in isolation leads us to consider a simulation that combines a commitment to maintain the funds rate near zero, nontraditional policy actions to lower term/risk premia, and a fiscal stimulus package. Such a combination brings the unemployment rate back to the NAIRU more quickly and is much more successful at keeping inflation near 1¾ percent.

### ***Benchmark Simulation under the Estimated Policy Rule***

The first row of Table 1 reports simulation results under the assumption that the nominal federal funds rate follows the path implied by the staff's estimated policy rule (subject to the zero lower bound). This policy rule can be interpreted as providing a reasonable characterization of the behavior of the FOMC over the past twenty years, and hence serves as a useful benchmark for the simulations presented below (including those showing the effects of alternative paths for policy); roughly speaking, it represents "policy as usual." The benchmark simulation is constructed using residuals from the FRB/US behavioral equations that are derived from the October Greenbook under the staff's projected path for the federal funds rate. Because the estimated rule implies a somewhat different path for the federal funds rate than that projected by staff, there is a small disparity between the simulation results reported in the first row of the table and the projections reported in the October Greenbook.

As indicated in Table 1, the estimated policy rule causes the federal funds rate to fall to zero during 2009-10 and thereafter to rise gradually, to about 1½ percent at the end of 2011 and 4¾ percent by the end of 2013. This policy stance is consistent with the unemployment rate remaining substantially above the NAIRU through 2011 and core PCE inflation falling to 1 percent by 2012-13.

### ***Conditional Commitments to Keep Short-term Interest Rates Low***

We next consider the implications of using an optimal control approach to derive an "optimal" policy path. This approach, which is routinely taken in Bluebook simulations, takes full account of intertemporal tradeoffs that may be exploited in formulating monetary policy, including the possibility of influencing current expectations about future short rates by making promises about future policy. As discussed in more detail in Note 20, monetary policy can potentially lessen the impact of a zero bound constraint by promising that it will maintain an expansionary tilt after the economy starts to recover. This can be achieved through a conditional commitment to keep future short-term interest rates relatively low, which in turn reduces current long-term real interest rates and stimulates output.

It bears emphasizing that the optimal policy paths reported below are *conditioned* on the future shocks that are projected to affect the economy, which in our simulations are simply the residuals derived from October Greenbook forecasts. The promise implied by the optimal policy requires only that policy remain expansionary relative to what it would do if it faced similar macroeconomic conditions, but had made no prior commitments that constrained its behavior. Thus, while maintaining very low nominal interest rates for a prolonged period turns out to be an implication of the optimal policy strategy based on the shocks implied by the October Greenbook, the optimal policy could imply a sharper upward adjustment of policy rates if economic fundamentals turned out to be more robust.<sup>2</sup>

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<sup>2</sup> The fact that the commitment is to a strategy for adjusting policy rates, rather than to a particular path, raises important communication challenges that are discussed in Note 20.

Moreover, the potential stimulus provided through a commitment channel should not be regarded as a “free lunch.” The *quid pro quo* is that the policymaker expects to have to keep output above potential and inflation above target for a prolonged period after the economy recovers. Clearly, the policymaker would prefer not to bear this cost, and indeed, would not do so in the absence of prior commitment. Accordingly, because the benefits of optimal policy are front-loaded, but the costs are paid afterwards, there is an incentive for policymakers to renege on their commitments. Our simulations make the strong assumption that the policymaker’s commitment to adhere to the optimal policy – and thus to follow through on its commitment – is fully credible. However, the benefits of strategies that rely on commitment hinge crucially on whether the private sector believes that the central bank will follow through on its promises.

The second row of Table 1 reports the outcome of a model simulation based on an optimal control policy which assumes that the Federal Reserve has a time-invariant inflation objective of 1¾ percent. The optimal policy implies a conditional commitment to pin the federal funds rate near zero percent through 2011; as emphasized above, this commitment is conditional on the outlook in the simulation. This policy commitment lowers long-term interest rates nearly 40 basis points in the short run and about 25 basis points over 2009-10.<sup>3</sup> The resulting stimulus to demand lowers the unemployment rate relative to that associated with the estimated policy rule path roughly ¼ percentage point over 2009-13. Less slack, and the signal from the zero federal funds rate that the Committee desires higher inflation than is perceived under “policy as usual,” boost inflation relative to the path associated with the estimated policy rule by nearly ½ percentage point; nonetheless, core PCE inflation remains below 1½ percent in 2012-13.

The third row of Table 1 considers a second optimal control simulation in which the Federal Reserve substantially raises its inflation target, at least for the foreseeable future. In particular, the inflation objective is set at 2¾ percent through 2017 (and eventually reverts back to 1¾ percent thereafter). This choice of inflation target is mainly meant to illustrate the possible effects of a target that is roughly one percentage point higher than the central tendency of the longer-run projections of FOMC members. However, it is worth observing that a long-run inflation target in this range is only modestly higher than the long-term inflation forecast of the Survey of Professional Forecasters.

The higher level of the inflation objective implies that the funds rate is pinned at zero through 2012 and only rises modestly in 2013. This strategy, which again is assumed to be fully credible in the simulation, lowers long-term interest rates 60 basis points in the near term; moreover, the maintenance of a low value for the funds rate in the face of an improving labor market in 2010-12 leads to a rise in inflation expectations. As a result, core PCE inflation does not decelerate much through 2011 and picks up substantially thereafter.

Overall, conditional commitments to keep the funds rate low can have powerful stimulative effects in the FRB/US model because the model both embeds forward-looking asset price determination and assumes full policy credibility on the part of financial market participants. The effects would be even larger if wage and price setters also had model-

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<sup>3</sup> This policy path is the optimal policy path given the assumed inflation objective of 1¾ percent and balanced preferences over the deviation of inflation from target, the unemployment gap, and changes in the federal funds rate; we routinely report these simulations for inflation objectives of 1.5 and 2 percent in the Bluebook.

consistent expectations, as a credible commitment to keep the funds rate persistently low would boost inflation expectations. However, it is worth emphasizing that the effects would be smaller under various other assumptions, such as imperfect credibility of the conditional commitment to a low path of the funds rate.

**Table 1: Commitment Strategies**

Measure and scenario	2009	2010	2011	2012-13
<i>Real GDP</i>				
Estimated policy rule	-0.2	2.4	4.8	4.8
Optimal control commitment	0.3	2.7	4.9	4.7
with higher inflation target	0.7	3.1	5.2	5.1
<i>Unemployment rate</i>				
Estimated policy rule	7.3	7.2	6.3	4.4
Optimal control commitment	7.1	6.9	6.0	4.2
with higher inflation target	7.0	6.7	5.6	3.6
<i>Core PCE inflation</i>				
Estimated policy rule	1.5	1.4	1.2	1.0
Optimal control commitment	1.6	1.5	1.3	1.4
with higher inflation target	1.7	1.6	1.5	1.8
<i>Federal funds rate</i>				
Estimated policy rule	0.0	0.0	1.4	4.7
Optimal control commitment	0.1	0.0	0.1	3.3
with higher inflation target	0.0	0.0	0.0	1.1

*Note:* The values for real GDP and core PCE inflation refer to percent changes from the fourth quarter of the preceding year. The unemployment rate and the federal funds rate are reported in percentage points for the final quarter of the specified year.



### *Nonconventional Policies and Fiscal Stimulus*

As discussed earlier (and in Notes 16 and 17), the Committee may implement nonconventional policies in an attempt to lower longer-term interest rates. Moreover, actions coordinated with fiscal authorities may prove desirable. We examine three related simulations.

In the first simulation, we assume that the Federal Reserve purchases \$750 billion of longer-term Treasury securities in the next two quarters and holds them through 2010. The staff estimates that such a program may reduce term premiums on long-term Treasury yields by 75 basis points through 2010. This large-scale purchase of Treasuries is assumed to have spillover effects in private debt markets, but with the effect on private term and risk premiums somewhat attenuated because investors regard public and private debt as imperfect substitutes; accordingly, our simulation assumes that private yields – including on corporate bonds, mortgages, and consumer loans -- fall 50 basis points.<sup>4</sup> We also assume that the nominal federal funds rate is held at zero through 2010 and then rises as prescribed by the estimated policy rule. As reported in table 2, this additional stimulus lowers the unemployment rate by ¼ percentage point or slightly more over 2009-10; inflation is boosted only a bit relative to baseline.

An alternative approach to quantitative easing through Treasury purchases is the purchase of large quantities of agency MBS. This approach, which is already in the process of implementation, would likely lower private yields by more than an equivalent volume of purchases of Treasury securities. In this simulation, we assume that the FOMC engages in \$750 billion of purchases of Agency MBS, which are held through 2010. The staff estimates that such a program may lower mortgage rates by 125 basis points, yields on corporate bonds and consumer loans by 75 basis points, and Treasury yields by 50 basis points through 2010.<sup>5</sup> We assume that the nominal federal funds rate is held at zero through 2010 and then rises as prescribed by the estimated policy rule. This additional stimulus lowers the unemployment rate by ¼ percentage point or slightly more over 2009-10; inflation is boosted by only 0.2 percentage points in 2012-13 relative to baseline.<sup>6</sup>

Some caveats are important in considering the simulations related to nontraditional policies. First, the FRB/US model does not have a role for the quantities of various assets held by the private sector, and as a result, the simulations are implemented via changes in long-term interest rates. Second, as discussed in Notes 16 and 17, there is considerable uncertainty about the reduction in interest rates that would occur in response to any given-sized asset purchase;

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<sup>4</sup> For a discussion of the evidence, see Note 16.

<sup>5</sup> See Note 17. These estimates are somewhat larger than would be implied by historical studies, reflecting an assumption that substantial purchases of these assets in the current environment of elevated yield spreads and strained market conditions would have a positive impact on market sentiment and would take the securities out of the hands of investors who demand the highest yield premium.

<sup>6</sup> The macroeconomic impact of these shifts may seem small relative to those in the previous simulation with purchases of Treasury securities given the larger impact on private term and risk premiums. Some of this is due to rounding. In addition, some of the additional impetus from larger effects on private term and risk premiums is offset by an increase in expected short rates at far horizons, which trims the decline in long-term rates that would accompany the fall in term and risk premiums. Finally, a portion of the smaller effect stems from a smaller depreciation of the dollar in second scenario: In the FRB/US model, the exchange value of the dollar is tied to yields on Treasury securities, not private yields.

thus, it is possible that much larger purchases would be required to elicit the interest rate responses assumed in our simulations. Lastly, other indirect effects of quantitative easing would possibly magnify its stimulus to aggregate demand. For example, lower long-term interest rates may lead to refinancing activity that boosts consumer demand more than assumed in these simulations; alternatively, the FRB/US model does not account for potentially beneficial effects on house prices and hence household wealth.<sup>7</sup>

Finally, a second round of fiscal stimulus is under active discussion and appears likely; indeed, the staff projection under preparation for the December Greenbook assumes that a substantial stimulus package will be enacted. In this scenario, we consider a \$300 billion program that delivers stimulus over 2009-10; the package is identical to the “bigger fiscal stimulus” package presented in the October Greenbook and includes tax cuts, increases in transfer payments, and federal aid to state and local governments.<sup>8</sup> Relative to baseline, the unemployment rate in this scenario is about  $\frac{1}{4}$  percentage point below baseline in 2010; however, the expiration of the stimulus package after 2010 implies a weakening of demand at that point, and both the unemployment rate and inflation differ little from baseline after 2010. (A larger package, especially targeted in areas likely to boost spending, would prove more stimulative and at this point appears likely to be enacted; however, we do not yet have many details regarding the plans of the incoming Administration and Congress.)

### *Combination of Policies*

Each of the policy strategies outlined above, except for the commitment to an inflation objective of  $2\frac{3}{4}$  percent, fails to bring inflation to  $1\frac{3}{4}$  percent in 2012-13 because each policy alternative, taken alone, only partly ameliorates the poor outlook for demand. As a result, policymakers may wish to pursue a multi-pronged strategy. In this simulation, we assume that the Committee makes an unconditional commitment to hold the federal funds rate at zero through 2011, and engages in large purchases of Treasury securities through 2010 in order to lower term and risk premiums on government and private yields as outlined above, while fiscal policy implements the package assumed in the previous scenario. As reported in the last line of table 2, this combination proves effective, lowering the unemployment rate  $\frac{3}{4}$  percentage point relative to baseline in 2011 and boosting inflation about  $\frac{1}{2}$  to  $\frac{3}{4}$  percentage point relative to baseline.

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<sup>7</sup> Although households who refinance their mortgages at an appreciably lower mortgage rate might see a substantial increase in their discretionary income, that gain to the household sector as a whole would be offset by a reduction in aggregate interest income. For this reason, refinancings sparked by lower mortgage rates may not have a large a stimulative effect on household spending.

<sup>8</sup> Specifically, the package consists of a \$160 billion reduction in individual income taxes for 2009 through 2010, a \$50 billion increase in transfer payments spread over two years, and a \$90 billion increase in federal aid to state and local governments.

**Table 2: Nonconventional Policies and Fiscal Stimulus**

Measure and scenario	2009	2010	2011	2012-13
<i>Real GDP</i>				
Estimated policy rule	-0.2	2.4	4.8	4.8
Quantitative easing in Treasury debt	0.1	2.9	4.9	4.4
Quantitative easing in GSE debt	0.2	3.0	5.0	4.4
Fiscal stimulus	0.4	2.7	4.0	4.7
Combination of policies	1.3	3.5	4.4	4.4
<i>Unemployment rate</i>				
Estimated policy rule	7.3	7.2	6.3	4.4
Quantitative easing in Treasury debt	7.2	6.9	5.9	4.3
Quantitative easing in GSE debt	7.2	6.9	5.9	4.3
Fiscal stimulus	7.1	6.9	6.2	4.4
Combination of policies	6.8	6.3	5.5	4.0
<i>Core PCE inflation</i>				
Estimated policy rule	1.5	1.4	1.2	1.0
Quantitative easing in Treasury debt	1.6	1.5	1.2	1.1
Quantitative easing in GSE debt	1.6	1.5	1.3	1.2
Fiscal stimulus	1.5	1.6	1.4	1.1
Combination of policies	1.8	1.7	1.6	1.8
<i>Federal funds rate</i>				
Estimated policy rule	0.0	0.0	1.4	4.7
Quantitative easing in Treasury debt	0.0	0.0	2.2	4.9
Quantitative easing in GSE debt	0.0	0.0	2.3	4.9
Fiscal stimulus	0.0	0.0	1.5	4.9
Combination of policies	0.1	0.0	0.1	4.3

*Note:* The values for real GDP and core PCE inflation refer to percent changes from the fourth quarter of the preceding year. The unemployment rate and the federal funds rate are reported in percentage points for the final quarter of the specified year.