

# RESPONDING to the GLOBAL FINANCIAL CRISIS What We Did and Why We Did It

## Monetary Policy during the Financial Crisis

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*Note: The views expressed in this draft are strictly those of the author(s).*

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<sup>1</sup> The authors would like to thank Ben Bernanke, Tim Geithner, David Wessel, Nellie Liang, David Wilcox, David Stockton, and Bob Tetlow for their comments, as well as Ankit Mital for his research support. All views expressed in this paper are those of the authors and do not represent the views of the D. E. Shaw Group.



## Introduction

The Federal Reserve's monetary policy was critical to the government's response to the financial crisis. Like other policymakers, Fed officials were required to come up with new, untested approaches when conventional policies were exhausted and more support for the economy was needed. Because there were no comparable precedents, policymakers operated under tremendous uncertainty—about the evolution of financial conditions, the impact of those conditions on the economy, and the efficacy of the tools at their disposal. The fog of war enveloped the Fed's monetary policy decision-making body, the Federal Open Market Committee (FOMC), just as it did other policymakers over that period.

Given the magnitude of the disruptions to the financial system, monetary policy easing was not, by itself, capable of preventing a recession or sparking a rapid rebound from the downturn once it occurred. The flight to liquidity and safety by investors led to sharp declines in asset prices, considerable pressure on many lenders, and a breakdown in the functioning of financial markets, causing credit to households, businesses, and state and local governments to become scarcer and more expensive, before drying up entirely in the fall of 2008. A self-reinforcing dynamic of tightening credit conditions and worsening economic outcomes emerged.

Stemming this dynamic required action across a broad front, as detailed in other chapters of this volume. The Fed and other arms of the federal government guaranteed debt, served as a lender of last resort, rebuilt capital in the financial system, and provided fiscal stimulus when private demand collapsed. Those efforts were all important for restoring confidence in financial firms, restarting markets, and getting credit flowing again. That said, monetary policy played an essential role, given that it is among the most visible policy actions with the widest effects on financial conditions. Financial markets, as well as businesses and households around the world, looked to the Fed to respond, and the central bank repeatedly pledged to employ all available tools to promote economic recovery and to preserve price stability.

The FOMC acted forcefully and creatively to the unfolding situation in ways that mitigated some of the detrimental consequences of the financial distress on household wealth and on the safety and soundness of banks and other intermediaries. In addition, the lower interest rates and higher asset prices that resulted from monetary policy actions were essential to encouraging a rebound in spending once the financial system had been stabilized.

None of the policymakers had ever experienced anything like the rolling crisis atmosphere that began in 2007, making it difficult to anticipate the severity of the disruptions that would take place and to project the extent of the damage to spending and employment that would result. Adding to the challenge, Fed officials at times were constrained by the perceived costs of the policy innovations they developed, even though, in hindsight, these costs turned out to be less serious than many feared at the time. Overall, the experience of setting monetary policy through this period provides some important lessons for future officials should they ever find themselves in a remotely similar situation.

## **I. A Crisis-Driven Environment for Monetary Policy Decisions**

We begin with a narrative of monetary policy decisions over the financial crisis period, focusing on information that was available to policymakers in real time. It is helpful to break this history into two periods. The first ran from August 2007 through August 2008, when the primary challenge was calibrating the negative effects of the crisis on the economy and the appropriate degree to which the federal funds rate—the overnight interest rate that is the traditional policy instrument of the Fed—should respond. The second began in September 2008, when the trajectory of market disruption and recession steepened and the nominal federal funds rate fell to almost zero, so that policy was constrained by the so-called zero lower bound, and the FOMC had to innovate to stimulate economic activity.

### *August 2007 to August 2008*

Over the spring and early summer of 2007, financial markets began to feel the tremors of the oncoming financial crisis. House prices were declining, and the prices of securities tied to subprime loans were plummeting. Markets for those securities became illiquid, and they were hard to value, making it difficult to judge the credit worthiness of those holding them. Nonetheless, the broader economy was doing reasonably well. The unemployment rate was a little below the level the Fed staff and many others thought sustainable over the long run, and headline and core inflation were running just above two percent.

The financial tremors intensified in August 2007, when a French bank, BNP Paribas, suspended redemptions in three investment funds holding US subprime mortgage securities. That news fed already-rising doubts about the health of banks and nonbanks with similar exposures. Lenders of unsecured funding for banks began to demand larger risk premiums, especially for loans extending beyond a few days. Other funding sources for holders of subprime-related assets, such as commercial paper backed by these assets, began to dry up.

Through the late summer and fall, credit conditions deteriorated further as lenders witnessed escalating risks and became far less willing to take those risks. The effects were particularly acute in mortgage markets, but banks were tightening terms and conditions across a broad swathe of credit, and spreads on both investment-grade and below-investment grade corporate bonds widened substantially.

Much of the Fed's focus over the rest of 2007 was on supplying liquidity to the financial sector to counter the effects of impaired funding markets. Open market operations to supply reserves to banks had to become more active and more generous to hold the federal funds rate at the FOMC's target, given strong demand for short-term dollar liquidity, especially from foreign banks that had become quite dependent on borrowing dollars. To supplement market sources of funding, the Fed took steps to increase dollar liquidity directly to domestic and foreign banks through US and foreign central bank discount windows, as detailed in other chapters in this volume.

Still, it was clear that those lending operations could not counter entirely the growing credit stringency, which at some point would begin to constrain spending. Both FOMC participants and Board staff wrestled with the extent to which their growth forecasts should be revised lower. Models provided limited guidance because they had elementary financial sectors. Moreover, history pointed to examples in which financial headwinds had held back growth (the 1990–91 credit crunch) but also to circumstances in which sharp financial market corrections had little effect on spending in the U.S. (the 1998–99 Asian financial crisis and failure of the hedge fund Long Term Capital Management).

Incoming data on aggregate spending and employment showed little sign of weakening over the second half of 2007. The economy continued to operate near its potential, while upside inflation and inflation risks persisted from increases in energy and food prices as well as high levels of employment. Nonetheless, the FOMC grew worried about the effects of increased credit stringency on the path of spending, leading to a cut the federal funds rate target by a percentage point to 4.25 percent between August and the end of the year. We on the FOMC saw this response as adequate to keep the economy on track, with unemployment low and inflation expected to settle near 2 percent. Board staff concurred. By December, however, market participants had priced in considerably more easing of monetary policy than assumed in the staff forecast presented in the Greenbook, reflecting a darker assessment of the market turmoil and its effects.<sup>2</sup>

In early 2008, it became clear to Fed officials that the disruption in financial markets was becoming far more severe and was feeding through more decisively to the economy. Many banks and other intermediaries were facing greater resistance in funding markets, and they cut back on lending and market-making activity. The cost of credit for households and businesses rose, and it became increasingly difficult to tap. House prices continued to decline rapidly, equity prices fell, and credit spreads widened. The contraction in housing construction deepened, and the effects of tighter credit and lower wealth on spending became considerably more widespread, with production and employment starting to decline. By March, the Fed staff forecast had switched to a “recession-like” scenario in which spending forecasts were weakened to reflect some of the negative dynamics typical of recessionary periods.

The FOMC’s discussion focused increasingly on an adverse feedback loop between financial markets and the real economy, and the Board staff presented estimates of losses on mortgages under a variety of house price scenarios and the feedback of those developments on the economy. But anticipating the evolution of the financial stress and its impact on the economy proved difficult; with no comparable experience to guide them, the projections failed to capture the severe, discontinuous disruptions to market functioning and credit flows that came to prevail over 2008. Financial difficulties intensified in mid-March, when the failure of Bear Stearns demonstrated the fragility of even collateralized sources of funds, intensifying the deleveraging pressures across a broad range of intermediaries. In securities markets, yield spreads jumped and equity prices fell substantially further.

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<sup>2</sup> The Greenbook is a document prepared for the FOMC by the Federal Reserve Board staff ahead of each policy meeting. It includes the staff forecast of the economy and analysis of various issues affecting the economic outlook.

The FOMC reacted to the deteriorating situation by easing policy aggressively, beginning with a 75-basis-point cut in its federal funds rate target in mid-January before its scheduled meeting, followed by an additional 50-basis-point reduction at the scheduled meeting at the end of the month. The funds rate was reduced a further 75 basis points in March after the Bear Stearns collapse, and another 25 basis points in April. Altogether, over the first four months of 2008, the target was cut by 225 basis points, to 2 percent. Those declines were seen as enough to prevent a substantial deterioration in employment—though not enough to hold the economy at full employment. The staff forecast in April predicted an unemployment rate of 5.75 percent at the end of 2008 and 5.5 percent at the end of 2009, under an assumption that policy would ease another 25 basis points in June and then hold at that lower rate through the end of 2009. FOMC participants’ projections of the unemployment rate clustered around the same level as the staff projection.

The behavior of inflation and inflation expectations undoubtedly influenced policy decisions not to ease more aggressively to reduce unemployment. Oil and other commodity prices spiked over the second half of 2007 and first half of 2008, boosting headline inflation to over 4 percent in July 2008. Core inflation measures were not immune to spillovers from commodities and a weaker dollar, remaining over 2 percent through the first half of 2008. In response, some measures of inflation expectations moved higher, adding to the FOMC’s concerns about achieving its price stability objective. Although commodity prices fell sharply beginning in July 2008, inflation and inflation expectations remained a focus for the FOMC through the summer.

Moreover, economic activity in the first half of 2008 turned out to be substantially stronger than it had seemed earlier in the year. Viewed with the data in hand for the August FOMC meeting, not only had there been no recession, but growth was estimated to have been solidly positive in the first half of 2008, at 1.75 percent, with upside surprises in many spending categories. The economic expansion was expected to continue in the second half, albeit at an anemic pace of under 1 percent. Indeed, at the Jackson Hole conference in August 2008, Stan Fischer (then governor of the Bank of Israel) mused: “The disconnect between the seriousness of the financial crisis and the impact—so far—on the real economy is striking.”

In this environment, the FOMC kept its policy rate at 2 percent at its June and August meetings and cited upside risks to inflation along with downside risks to growth in its announcements.

As the FOMC wrestled with the appropriate path of the federal funds rate, the Open Market Desk at the New York Fed (the Desk) faced challenges related to the implementation of policy decisions. Achieving the FOMC’s federal funds rate target on a consistent basis was proving difficult, given the considerable volume of reserves flowing into the system from borrowing under the various new liquidity facilities. Those facilities were intended to address problems in various funding markets, but they also created a degree of liquidity in the overnight funding market that threatened to undermine the Desk’s control of the federal funds rate.

At the time, the Federal Reserve was not permitted to pay interest on those reserve balances, and banks’ efforts to shed reserves and invest in interest-earning assets would

have reduced the federal funds rate to well below the FOMC target.<sup>3</sup> To hold the funds rate to the target, the Desk attempted to absorb the extra reserves by selling assets; it redeemed and sold \$275 billion of Treasury securities over the first eight and a half months of 2008. But the System's supply of Treasuries was limited, potentially constraining the Desk's capacity to drain reserves.<sup>4</sup> Facing such constraints, Bill Dudley (then the head of the Desk) at the August meeting announced that an agreement had been reached with the Treasury for it to issue special bills and to deposit the proceeds in its Federal Reserve account to absorb reserves (the Supplementary Financing Program, or SFP), and that the Federal Reserve was trying to gain congressional approval to accelerate its ability to pay interest on reserves to help set a floor for the federal funds rate. These steps would be activated after the collapse of Lehman Brothers in mid-September.

In financial markets, the actions around Bear Stearns—the resolution of the firm, the capital raised by the private sector, the liquidity provision to broker dealers, and monetary policy easing—appeared to stabilize the situation and even spark a bit of a recovery in the spring. But the underlying weaknesses at a number of intermediaries, including large commercial banks and thrifts, investment banks, and Fannie and Freddie, once again led to rising funding pressures and sharply falling equity prices by the summer, which in turn caused credit to households and businesses to become even more expensive and less available. And we now know, after many data revisions, that the economy was already in decline. The stage was set for the events of September 2008.

### *September 2008 to June 2010*

The failure of Lehman on September 15, 2008, occurred one day before a scheduled FOMC meeting. When the FOMC gathered that Tuesday morning, the attention of Fed officials was fully occupied by the spreading strains in financial markets in the aftermath of the Lehman failure and the potential failure of another important institution, AIG. These were immediate and severe threats to the financial system, and the implications for the economy and for monetary policy temporarily took a backseat. Indeed, with senior officials focused on the emerging crisis, the meeting began late and was shortened. New York Fed President Tim Geithner (vice chairman of the FOMC) stayed in New York. In the meeting, Chairman Bernanke highlighted both the underlying weakness in the economic outlook and the huge uncertainty from the market disruptions. Yet the FOMC felt that it did not have enough information at that time to adjust policy, and it left the funds rate unchanged at 2 percent.

Over the second half of September and into October, the severe stresses in a broad range of financial markets dominated the attention of the FOMC and the Fed staff. The resulting sharp reduction in business and household spending quickly became apparent.

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<sup>3</sup> Another challenge was the volatility of the demand for reserves, even on an intraday basis. The funds rate often traded firm to the target in the morning amid strong demand from European banks but then dropped precipitously in the afternoon reflecting the Desk's provision of extra reserves to lean against the earlier tightness, leaving considerable uncertainty about the amount of reserves that needed to be injected on any given day.

<sup>4</sup> In addition, some amount of Treasuries was required to operate the Treasury Securities Lending Facility (TSLF), which was aimed at supporting market functioning by exchanging Treasury securities for less liquid assets on the balance sheets of the broker-dealers.

The financial panic was global, with the viability of major financial institutions everywhere called into question. All of those institutions strove to protect themselves by hoarding liquidity and curtailing lending, propelling the global economy into a deep recession. In the United States, employment entered a freefall; the economy was shedding jobs at a pace of over 500,000 per month by the end of the year, with no end in sight.

As with the earlier phases of the financial crisis, efforts to stem the panic and limit the damage to the economy involved a broad array of policy innovations. The FOMC cut its interest rate target by 50 basis points in early October in an action coordinated among major central banks. That action, discussed in more detail in Chapter 14, was important in making the move toward monetary accommodation global in scope, and we hoped that the sight of the key central banks working together would bolster confidence.

But that wasn't enough to counter the fear gripping the economic system and meaningfully limit the sharp declines in output and employment that were taking place. The FOMC took another 50 basis points off its federal funds target at its October meeting three weeks later, lowering it to 1 percent. Nonetheless, many of us recognized that even more monetary policy action would be required to combat the deepening recession. Despite the easing, households and businesses were looking at sharp increases in the cost of credit and steep declines in wealth, and contacts in the business community in every Federal Reserve district expressed great concern. The projections of FOMC participants for the unemployment rate centered at just over 7 percent in the fourth quarter of 2009, with only modest improvement to just under 7 percent at the end of 2010. By any reasonable estimate, this was well above full employment.

An optimal control exercise in the Bluebook—a simulation designed to indicate the policy that had the best chances of minimizing deviations from the FOMC's employment and inflation objectives—indicated that, if it were unconstrained by the lower bound, the federal funds rate should fall to negative 3 percent.<sup>5</sup> Some FOMC participants wondered about the efficacy of additional policy easing when many transmission channels appeared clogged, but the Chairman and others argued that reductions in actual and expected interest rates would help to lower the cost of credit—even if it remained elevated—and to stabilize asset prices.

At the end of the meeting, the Chairman instructed the staff to update the analysis of monetary policy near the zero lower bound it had done in 2003, when the policy rate last got to 1 percent. That work would review the costs and benefits of reducing the target rate even further—to near zero—and assess the other policy tools that might be available when the federal funds rate was at its minimum.

Meanwhile, the sharp increase in the use of Fed liquidity facilities after the Lehman failure—by banks, nonbanks, and foreign central banks—outran the Desk's capacity to drain reserves, and the federal funds rate began to trade notably soft to the Committee's target, even with the additional tool to sterilize reserves provided by the SFP. Congress

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<sup>5</sup> The Bluebook is a document focused on policy issues and alternative policy choices for the FOMC that was written by the Board staff and circulated to the FOMC in conjunction with the Greenbook. The Greenbook and the Bluebook were combined into a single document called the Tealbook beginning at the June 2010 FOMC meeting.

had accelerated the Fed's ability to pay interest on reserves, and that authority was implemented in early October. But interest on reserves did not provide the floor to federal funds trading that had been anticipated. Interest on excess reserves (IOER) was initially set at 75 basis points under the FOMC's funds rate target, and that spread was narrowed in two steps until the rate was made equal to the target in early November. Still, the balance sheet pressure on banks made them unwilling to arbitrage between the low rate in the market and the higher rate offered by the Fed, and the daily effective funds rate was persistently 50 basis points or more below the Committee's target between mid-September and the December FOMC meeting.

The market dysfunction over this period also extended to government agency and agency-guaranteed mortgage-backed securities, despite the explicit Treasury support for Fannie and Freddie. Higher rates for these agency securities fed through to mortgage rates, impeding efforts to stabilize the residential real estate market. To address these issues, on November 25, the Federal Reserve announced that it would purchase up to \$100 billion of agency direct obligations and up to \$500 billion of agency guaranteed mortgage-backed securities for the System Open Market Account (SOMA). The announcement led to a decline in 30-year mortgage rates of more than 50 basis points.

As the FOMC gathered for its December meeting, it found itself facing dire circumstances: an economy falling further into recession, with both employment and production in steep decline, and financial markets that remained under severe strain, despite an alphabet soup of Fed facilities and additional capital from the Congressionally-authorized TARP. In addition, the settings of the FOMC's policy instruments had been moving over the intermeeting period in ways not anticipated at its October meeting: The Fed's securities portfolio was expanding, and the fed funds rate was trading close to zero, well below the Committee's target of 1 percent.

The discussion at the meeting was wide ranging and intense. The Committee was provided 21 memos from the staff on various aspects of moving the policy rate close to the zero lower bound and additional steps that could be taken. A consensus developed to act across many fronts: The FOMC needed to be aggressive in lowering the funds rate; its communications should provide some guidance about the future path of the funds rate target; it should give serious consideration to setting an explicit inflation target; and it should consider additional purchases of mortgage backed securities and agency debt and expanding such purchases into longer-term Treasury securities.

Asset purchases were a new policy instrument with uncertain effects, leading to considerable debate about their use. An important point of disagreement was the relative emphasis on the asset and liability sides of the Fed's balance sheet. Many, including the Chairman, thought their stimulative effects derived primarily from the effects of securities purchases driving down mortgage and other longer-term rates (and of lending programs reducing the cost of funding). At the meeting, he stated, "In this case, rather than being a target of policy, the quantity of excess reserves in the system is a byproduct of the decisions to make these various types of credit available."<sup>6</sup>

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<sup>6</sup> December 2008 transcript p 26.

Several participants, however, focused on the liability side of the balance sheet—bank reserves or the monetary base (bank deposits at the Federal Reserve plus currency)—in judging policy. They stressed the importance of expanding these measures to protect against deflationary psychology gaining traction. For example, at the meeting Richmond Fed President Jeff Lacker argued, “At the end of the day, monetary policy is about controlling the monetary base or bank reserves.... What is important about the nonstandard tools and credit market programs is their effect on the monetary base.” Although most of the Committee shared Chairman Bernanke’s perspective, the other viewpoint was part of the policy debate. It also played a role in the public discussion of asset purchases, including the moniker of “QE” for quantitative easing, rather than the term “LSAPs” for large scale asset purchases that was used internally, or the Chairman’s preferred “credit easing.”

As for the stance of policy, the FOMC reduced the target range for the federal funds rate to 0 to 25 basis points, effectively adopting the level that the market already had reached. We endorsed the purchases of MBS and agency debt that had already been announced. At the same time, we indicated that we were giving serious consideration to additional easing by announcing our readiness to expand such purchases “as conditions warrant” and that we were “evaluating the potential benefits of purchasing longer-term Treasury securities.” Moreover, we announced that we saw near zero interest rates persisting “for some time” to head off any market expectations that the sharp easing of policy would soon be followed by a tightening, as had often occurred after more garden variety recessions.<sup>7</sup>

By the time of the March FOMC meeting, the Obama administration had come into office, and its plans for shoring up the banking system and providing fiscal stimulus were becoming clearer. It was also evident, however, that the economy was in an even steeper decline than the very serious recession that had been foreseen at recent FOMC meetings. In addition, there were still grave concerns globally about the viability of many large financial institutions, despite government capital injections and declarations that systemically important institutions would not be allowed to fail. Fighting for their lives, banks continued to tighten their loans to households and businesses; securities and securitization markets remained badly impaired.

The adverse feedback loop between the real economy and financial markets was on vivid display. The Greenbook made major downward revisions to its forecast of GDP growth, upward revisions to expected unemployment, and downward revisions to projected inflation. The unemployment rate was expected to peak at 9-1/2 percent in 2010 and core inflation to drop to one-half percent that year. Recovery would be painfully slow, with the unemployment rate expected to only slowly decline to 5.6 percent by 2013, while inflation was expected to remain below 1 percent. Reflecting these revisions, another optimal control exercise for the Committee now suggested that, if it were unconstrained, the federal funds rate should be reduced to negative 6.5 percent to promote timely recovery. More monetary accommodation was desperately needed. With short-term rates at zero, we were left with two instruments—asset purchases and forward guidance. We deployed both at the March meeting.

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<sup>7</sup> December 2008 FOMC announcement.

On asset purchases, the FOMC extended the horizon and increased the pace meaningfully, promising to buy up to an additional \$1.150 trillion by year-end—\$750 billion of MBS, \$100 billion of agency debt, and \$300 billion of Treasuries. The staff forecast, the discussion at the meeting, and the reports from the Fed districts were so downbeat that we readily reached agreement to do even more than the most accommodative policy option (Alternative A) included in the set of options circulated before the meeting, a distinct break from FOMC tradition. At the same time, we firmed up our forward guidance by noting that the near-zero rates were likely to persist “for an extended period.” In the ritualized communication between the FOMC and market participants, an “extended period” was intended to be, and was interpreted as, longer than “some time.”

These were the last substantial policy actions taken until the fall of 2010, when disappointing economic growth would lead the Committee toward another round of asset purchases. From the spring of 2009 through spring of 2010, incoming data on the economy and financial markets indicated that the recovery broadly was following the path expected: GDP growth recovered, and the unemployment rate leveled out and showed signs of turning lower; core inflation, though not falling as far as feared, remained quite low; and financial conditions stopped tightening and began to improve.

But that outcome was hardly satisfactory: in its projections made over that period, the FOMC expected to undershoot both its employment and price stability objectives for many years to come. The staff estimated that the economic effects of the negative 6 percent funds rate level from the March exercise could be roughly replicated by additional asset purchases of about \$2 trillion—much more than the \$1.150 trillion undertaken. Yet, we took no further steps until the outlook deteriorated further.

The decision not to take even larger policy actions reflected the perception that the benefits and costs associated with additional asset purchases appeared to be roughly balanced, even with those unsatisfactory economic outcomes. The benefits were seen as highly uncertain, with some FOMC members expecting a limited effect on long rates once market liquidity had been restored. On the cost side, various Committee members continued to worry about exit, about affecting the allocation of capital in the economy by purchasing mortgage-backed securities, and about risking un-anchoring inflation expectations by being perceived as “monetizing the debt” in our purchases of Treasury securities.<sup>8</sup>

The policy that was in place felt extreme, and while most saw it as clearly warranted by the dire circumstances, it also prompted a sense of unease among some participants and outside observers. Indeed, a substantial portion of each FOMC meeting over this

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<sup>8</sup> Concerns about the fuzzier borders between monetary and fiscal policy that had developed in the crisis response were widely enough held in the Committee that the Chairman negotiated a published understanding with the Treasury department on respective roles. It emphasized the importance of the independence of the Federal Reserve in the conduct of monetary policy. It noted that the Federal Reserve was to avoid credit risk and credit allocation—government influence over credit allocation was “the province of the fiscal authorities.” And it emphasized that purchases of securities and other actions to establish financial stability must not interfere with the FOMC’s ability to accomplish its legislative objectives for monetary stability—the Treasury would work with the Fed to assure it had the tools to absorb reserves and roll back accommodation at the appropriate time. This issue is also discussed in Chapter 2.

period was devoted to discussing how to exit from the unusually accommodative policy. Term deposits and reverse repurchase agreements with an expanded group of counterparties were developed to absorb excess reserves, and the sequencing of exit steps was debated. This discussion was pursued not because we were thinking of a near-term policy tightening. Rather, it was intended to make the Committee and the public more comfortable with the steps we had already taken and more accepting should additional accommodation need to be considered.

## II. Policy Challenges Encountered during the Crisis

As noted in the narrative above, the FOMC had difficulty anticipating the severity of the financial crisis and its consequences for the economy, and it wrestled over the appropriate response of the federal funds rate, the use of asset purchases as an alternative policy instrument, and the role of central bank communications in shaping expectations. This section takes a deeper dive into each of these issues.

### *The Difficulty of Anticipating the Effects of the Financial Crisis*

The primary responsibility of the FOMC during normal periods is to adjust the federal funds rate to the level that is appropriate given the outlook for economic conditions in order to achieve the mandate of full employment and stable prices. Making effective policy requires an assessment of the likely evolution of economic conditions—an exercise in which the Board staff's forecast plays a key role. Unfortunately, through much of the crisis period economic projections dramatically underestimated the intensity of the financial crisis and the severity of its negative effects on the economy. The forecast errors on output and employment that were made by the Fed staff, by FOMC participants, and by nearly all economic forecasters in the profession were massive by historical standards.

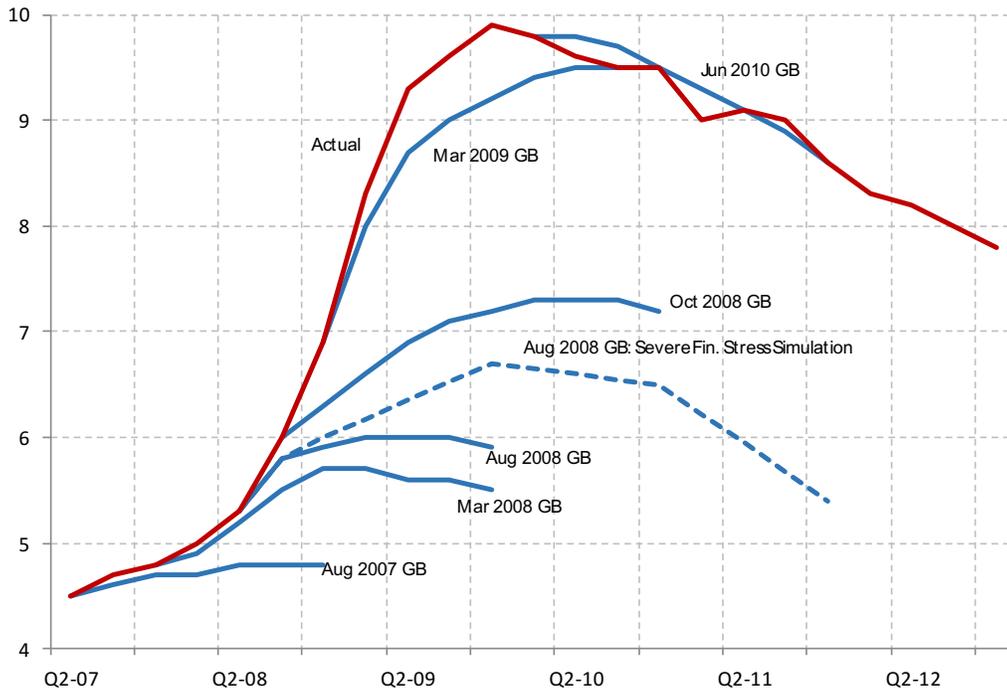
This pattern is clear in Figure 1, which shows the actual path of the unemployment rate compared to the paths forecasted by the Fed staff at various points in time. In December 2007, despite the financial strains that had been witnessed for months and that had prompted the launch of the TAF and the foreign swap lines, the Board staff was forecasting only a modest rise in the unemployment rate to 4.9 percent. For the March 2008 Greenbook, after Bear Stearns had failed and the Fed had launched the TSLF and the PDCF, the Fed staff included only a mild and short-lived recession in the forecast. The unemployment rate expected for the end of 2009 was just over 5.5 percent—about 4.5 percentage points below the level that would be realized.

Forecast errors of this magnitude are rare. Indeed, the FOMC minutes now report a measure of the amount of uncertainty that has typically surrounded economic forecasts over the past several decades. Based on that metric, the standard deviation of forecast errors for the unemployment rate at this horizon is just over 1 percentage point, implying that the error that took place in March 2008 was roughly a 4-standard-deviation outcome.

Not only was the baseline forecast too optimistic, but the Fed staff was not able to conceive how damaging the financial crisis could become even when it explicitly set out to do so. The August 2008 Greenbook presented an alternative simulation to capture “severe financial stress,” which it described as a severe deterioration in financial conditions and the emergence of solvency concerns for many institutions. This Greenbook was published amid mounting concern about Fannie and Freddie and other large financial institutions, so the possibility of further stress was not an unrealistic scenario. Nonetheless, the staff estimated that the unemployment rate would reach only 6.7 percent, just 0.2 percentage points worse than the “typical recession” scenario.

Why were economic forecasts so far off? One reason is that forecasters were not able to imagine just how stressed financial markets would become, as no one making forecasts had lived through anything like the tsunami that was overtaking the financial system. Another reason was that it was very difficult to calibrate the economic consequences of those developments, even had we known them, in part because they went beyond the scope of what was captured in our models. Indeed, although our economic models included several key variables that describe broad financial conditions, they did not contain enough detail about the financial sector to capture many critical aspects of the disruption to credit intermediation and market functioning that played out over this period. Moreover, those models were calibrated based on linear relationships estimated from moderate, more continuous adjustments in financial prices, whereas the economy was experiencing very abrupt changes and nonlinear adjustments arising from market dysfunction.

**Figure 1: Path of Unemployment Rate Compared to Greenbook Forecasts**



Source: Federal Reserve Board of Governors, Bureau of Labor Statistics.

The difficulty of calibrating the effects of financial market developments is highlighted by the following exercise.<sup>9</sup> We took the forecast from the December 2006 vintage of the staff's primary macroeconomic model (FRB/US), adjusted to be consistent with the Greenbook forecast at the time, and we computed how the forecast would have changed in the FRB/US model if the financial sector shocks that occurred over the subsequent several years had been known in advance.<sup>10</sup> Many of the financial variables in the model, such as credit spreads and equity prices, moved dramatically in a direction that would restrain economic growth. This exercise captures the extent to which the evolution of those financial variables explain the forecast misses described above. The portion that cannot be explained by these financial sector shocks is arguably a measure of how much of the financial crisis effects were "outside the model."<sup>11</sup>

The results, shown in Figure 2, indicate that the financial variables in the model would have produced a meaningful weakening of the economy, with the unemployment rate rising more than 2 percentage points. But this simulation still falls well short of capturing the magnitude and speed of the rise in the unemployment rate. That is, much of the weakening in the economy reflected the effects of financial sector developments not captured by the major financial variables included in FRB/US in 2006 and the measured sensitivities of economic conditions to those variables in that model.

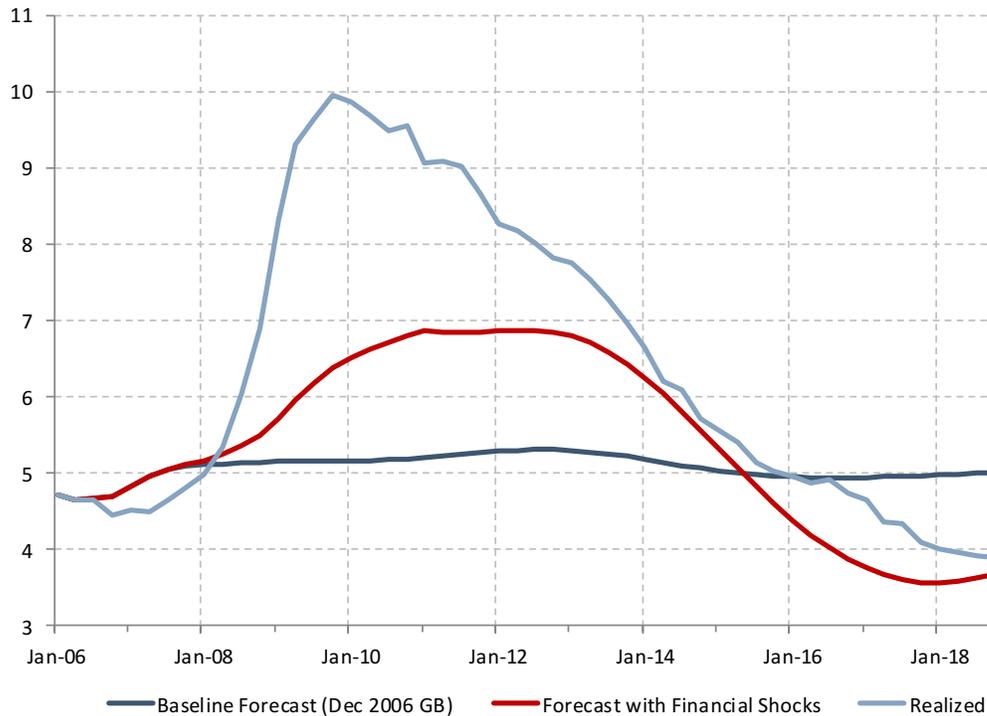
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<sup>9</sup> We thank Bob Tetlow from the Federal Reserve Board staff for conducting this exercise for us. His expertise with the FRB/US model was critical for implementing this analysis.

<sup>10</sup> More specifically, we take the realized residuals for seven financial variables relative to the values of those residuals that could be considered normal based on their history from 2003 to 2006. We then apply those shocks to the December 2006 extended Greenbook forecast, to calculate how the forecast would have evolved with knowledge of those realized residuals. The variables included were the 5-year Treasury term premium, the 10-year Treasury term premium, the BAA corporate spread over Treasuries, the mortgage rate spread, the spread of the lending rate for consumer durable goods, the equity premium, and the non-equity wealth capital gain residual.

<sup>11</sup> According to the FRB/US model, there were, of course, shocks other than financial market shocks that contributed to the great recession, including negative "demand" shocks and reductions in productivity. Whether these shocks are truly autonomous disturbances to the economy or were fundamentally induced by financial factors that are not incorporated within the model is a matter of debate.

**Figure 2: Path of Unemployment Rate Compared to FRB/US Simulations**



Source: Federal Reserve Board of Governors, Bureau of Labor Statistics.

This exercise, although focused specifically on FRB/US, is representative of the challenges that faced FOMC members and Fed staff as they tried to assess the path of the economy over this period. The Fed staff was certainly aware of these shortcomings of economic models, and it made sizable adjustments around its models to account for the additional restraint coming from financial strains. In the September 2008 Greenbook, for example, the staff included a box on how it was incorporating judgmental effects of the financial turmoil by assuming deviations from the model's equations based on new financial stress indicators. These adjustments were enough to reduce GDP growth in 2008 by 1.8 percentage points—a substantial effect. But the box also reflects how challenging it was to incorporate these effects into the forecast, as the judgmental adjustment only lowered projected GDP growth in 2009 by 0.2 percentage point.

Based on the information available at the time, policymakers faced a substantial challenge in assessing what was taking place in financial markets and their effects on the economy. Moreover, they had to formulate their decisions amid considerable uncertainty, relying on economic projections that chronically underestimated the extent of the financial disruptions and their consequences.

## *Calibrating the Appropriate Response for the Federal Funds Rate*

Monetary policy eased aggressively in response to the deteriorating economic outlook, with the FOMC cutting the federal funds rate 325 basis points by the middle of 2008. The willingness of the FOMC to act so forcefully, by historical standards, helped mitigate the negative effects of the financial crisis. The easing was not sufficient to prevent the sharp downturn in the economy, but the situation would have been even worse absent the aggressive easing.

The decline in the federal funds rate before September 2008 was about in line with what the Board staff assessed was needed to keep pace with the deterioration in the economic outlook. That pattern can be seen by looking at a policy benchmark computed by the Fed staff—the short-term equilibrium real federal funds rate ( $r^*$ ) consistent with the Greenbook. This measure represents the level of the real funds rate that, if maintained, would be expected to close the output gap within three years, taking into account all of the information incorporated into the staff forecast.

Figure 3 shows what this  $r^*$  measure was reported to be in real time in the Bluebook, along with a range of similar measures computed under alternative models. The realized path for the real federal funds rate roughly kept pace with the  $r^*$  measure through September 2008.

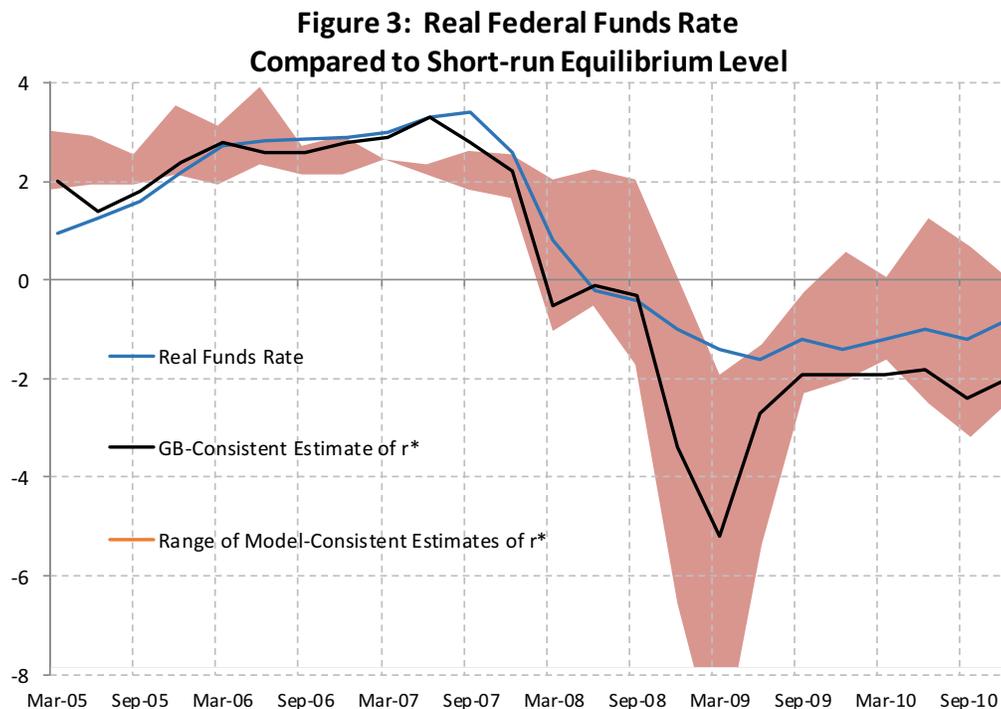
An important question is why the FOMC did not ease even more aggressively over this period. Indeed, some members of the FOMC and the staff have argued that, in the presence of the zero lower bound (ZLB) on the policy rate, the Fed should ease more aggressively than normal, in order to achieve a greater amount of accommodation and to limit the chances of getting stuck at the lower bound with a subpar outlook for economic growth.<sup>12</sup> In those circumstances, negative surprises could be more damaging than positive surprises, and policymakers may want to ease by more than normal to take out “insurance” against those outcomes. Based on these considerations, one might have expected the federal funds rate to be cut more quickly than was needed to keep up with the deterioration of the economic outlook. Based on the  $r^*$  measure, however, it appears that the FOMC did not take this approach.<sup>13</sup>

In retrospect, two factors prevented a more aggressive policy response. The first was that the outlook was deteriorating so quickly that the FOMC likely already felt that it was acting quite aggressively. Indeed, just keeping pace with the deterioration in the outlook required actions that were far more extreme than the more deliberate and inertial approach pursued during normal periods. The second was that the FOMC had ongoing concerns about higher inflation over much of the period before September 2008.

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<sup>12</sup> This argument has been made by Reifschneider and Williams (2000), among others.

<sup>13</sup> This point was noted by some policymakers in real time. In January 2008, for example, Chairman Bernanke noted that the policy setting was “making little or no allowance for risk-management considerations” and that insurance could be taken out by easing by more than seemed necessary based on the baseline economic outlook.



Source: Federal Reserve Board of Governors.

Another important consideration was just how low the FOMC could take the federal funds rate. The FOMC stopped at a target range of 0-25 basis points, but that decision was questioned by some FOMC members at the time, and this topic continued to be discussed into 2010. The arguments against moving overnight interest rates into negative territory, as presented in a staff memo in August 2010, were that it could impede the functioning of money markets (including strains on money market funds) and raise a variety of operational challenges. Yet several major central banks since then have taken rates into modestly negative territory, suggesting that the FOMC may wish to revisit this issue in the future.

Overall, it is clear that more aggressive policy easing would not have prevented a deep recession, as the negative effects from financial stress were too rapid and powerful to be fully offset by a lower rate path. Nevertheless, we believe implementing additional policy easing earlier in 2008, in a manner consistent with guarding against downside risks, would have reduced the peak level of the unemployment rate to some degree.

### *Assessing the Benefits and Costs of Asset Purchases*

After the failure of Lehman, as financial conditions tightened dramatically and market functioning became impaired, the issue of calibrating the appropriate response of the federal funds rate became moot. Clearly the federal funds rate should move to the lowest

level possible, which was reached in December 2008. At that point, the policy discussion turned to finding other instruments and measures that could be used to create more accommodative financial conditions and support the economy. Those included the launch of the Fed’s first asset purchases, which ultimately led to a \$1.75 trillion program that market participants now refer to as “QE1.”<sup>14</sup>

The FOMC’s use of asset purchases was nothing less than the creation of a new policy instrument. While asset purchases had been used by other central banks, the scale and the channels through which the purchases initiated by the FOMC were expected to support the economy were novel.

Given this novelty, the FOMC entered into asset purchases with considerable debate. The considerations can be grouped into two categories—uncertainty about the effects and concerns about the associated costs. Both the benefits and costs would have to be learned over time through experience. This section takes a look back and discusses what we now know, with the benefit of hindsight.

On the benefits of asset purchases, it is important to recognize that they can serve two distinct functions. The first is to help restore market functioning, and the second is to affect interest rates and asset prices even in well-functioning markets. These are both aimed at making financial conditions more supportive of economic activity.

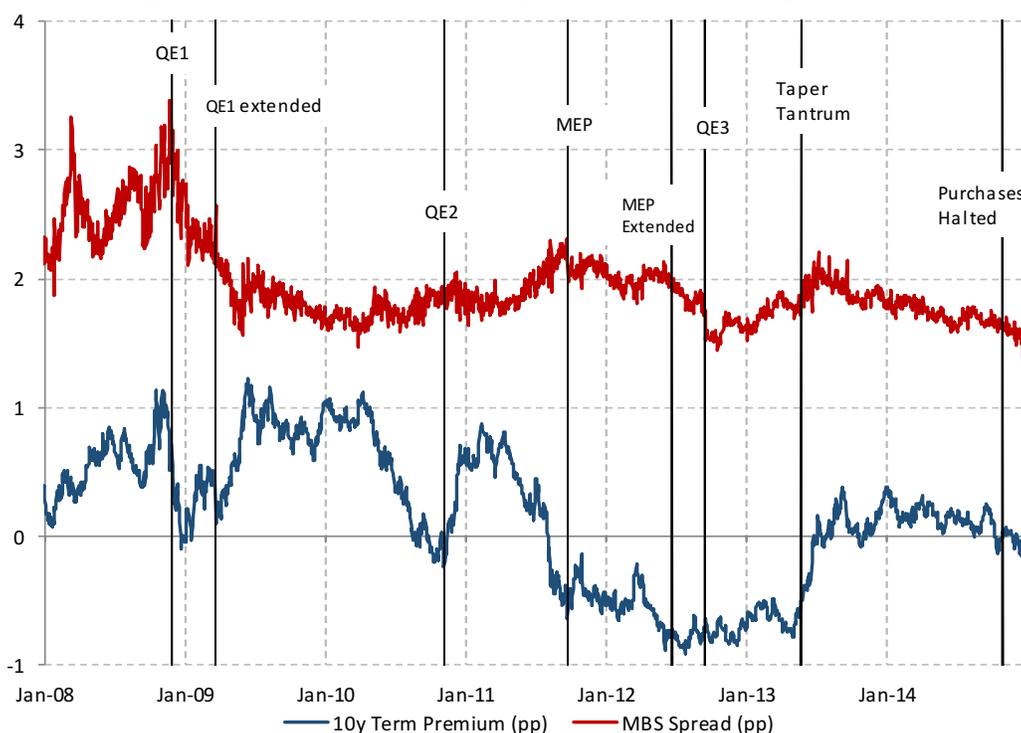
The first part of QE1 was largely aimed at restoring market functioning in the housing agency and agency-backed MBS markets, and it was successful in that regard. Spreads in those markets had become unusually wide, as many investors were shedding their holdings of those assets, even though the government had taken the GSEs into receivership by that time.<sup>15</sup> With the introduction of QE1, spreads collapsed over the first half of 2009, market functioning and liquidity improved notably, and mortgage rates fell.

This outcome was consistent with our intentions. Chairman Bernanke gave several speeches describing the asset purchase program as part of a broader package aimed at “credit easing.” In October 2009, for example, he described asset purchases as part of a package (which included the numerous liquidity facilities that had been launched) “to address dysfunction in specific credit markets” and said that “the effectiveness of policy support is measured by indicators of market functioning, such as interest rate spreads, volatility, and market liquidity.” Through the narrow lens of MBS market functioning, QE1 was a success.

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<sup>14</sup> The actual amount of securities purchases in QE1 ended up being \$1.725 trillion. The Fed’s balance sheet expanded considerably over the next six years through a variety of additional asset purchase programs, including a second round of asset purchases launched in November 2010, the maturity extension program launched in September 2011, and a third round of asset purchases launched in September and December 2012 (for MBS and Treasury securities, respectively). When all of the programs were concluded, the Fed’s securities holdings would stand more than \$3.5 trillion above the levels in place before the financial crisis.

<sup>15</sup> Before the announcement of the asset purchase program in November, the Desk of the New York Fed had already initiated a program to purchase agency discount notes to try to support that market. However, the initial announcement of QE1 brought considerably stronger support to the agency debt and agency-sponsored MBS markets.

**Figure 4: Risk Premiums during Asset Purchase Programs**

Source: Bloomberg, Federal Reserve Board of Governors (Kim-Wright model).

The positive effects on market functioning, however, had largely played out by mid-2009, when the Desk was only about 1/3 of the way through implementing the QE1 program. The simple narrative that QE1 was all about market functioning, and hence was entirely different from subsequent asset purchase programs, is not accurate. The FOMC had broader transmission channels in mind, especially when it expanded the program in March and included Treasury securities. Large-scale purchases, by taking duration risk out of the market, were intended to reduce the term premium, or the extra return demanded by investors for holding longer-term assets. The resulting reduction in longer-term interest rates would raise other asset prices as investors adjusted their portfolios to replace the purchased bonds and arbitrage across asset classes.<sup>16</sup>

At the time that the decisions were being made on asset purchases, we faced substantial uncertainty about the size of their effects, given that we had little historical

<sup>16</sup> It is also possible that asset purchases worked in part through the signals that they provided for the path of the policy rate. Several considerations would seem to reduce the importance of that signaling—including that the FOMC was offering explicit policy rate guidance during much of the asset purchase programs, and that the FOMC repeatedly argued that large asset holdings would not prevent it from tightening policy when necessary. However, the response of market interest rates, including at short- and intermediate-term maturities, to communications about the FOMC's intentions to taper purchases in 2013 suggest that some signaling effects were likely important.

experience. The Committee was provided with repeated rounds of staff analysis, but that work necessarily had to draw on scant experience with this type of instrument.<sup>17</sup>

Looking now at the full experience with asset purchases, the consensus view in the literature seems to be that the asset purchase programs put meaningful downward pressure on longer-term interest rates and created positive spillovers into other asset classes. (See Gagnon (2016) and Kuttner (2018) for useful summaries.<sup>18</sup>) These studies find that QE1 had the largest impact, but they also show that subsequent rounds in well-functioning markets also reduced longer-term interest rates. Achieving those effects in well-functioning markets, and particularly in ones with deep liquidity, required the asset purchases to be substantial.

The other major consideration was the potential costs associated with balance sheet expansion. Just as the FOMC would have to learn about the beneficial effects of asset purchases over time, it would also have to learn about undesirable side effects.

Some concerns that were forcefully voiced in the public debate were readily dismissed in internal policy discussions. The notion that a large expansion of the money base would, by itself, lead to considerable inflation and dollar weakness was largely rejected by the economic framework used by the staff and most of the Committee members.<sup>19</sup> In the event, undesirably low inflation persisted for years even after the extraordinarily build up in the Fed's balance sheet. Other concerns, however, were not easily dismissed at the time, including the potential consequences on market functioning should Fed purchases come to dominate transactions, and the potential complications with the Fed's eventual exit.

In general, the experience with asset purchase programs suggests that the potential costs involved were more limited than many on the FOMC feared. Markets continued to function well even with relatively large holdings by the Fed, especially given the transparency around purchases implemented by the Desk and other operational steps aimed at mitigating shortages of particular securities. Inflation and inflation expectations remained low—often too low relative to the FOMC's objective—rather than rising and becoming unanchored by the balance sheet expansion. And some of the most important concerns about the exit strategy have been largely put to rest; in particular, the Desk has demonstrated that, with IOER in place, it has sufficient control of the federal funds rate even in an environment of abundant reserves. This control suggests that the sterilization of reserves, which received extensive focus during the crisis, can be largely ignored in the future if the current framework is maintained.

On balance, concerns about the costs of balance sheet expansion did not prevent us from implementing the large asset purchase programs that were needed to support the recovery, but the sense of unease they fostered probably affected the magnitude and

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<sup>17</sup> It now appears that the Fed staff overestimated the effects of asset purchases to some degree at the beginning of QE1.

<sup>18</sup> The research literature continues to debate the magnitude of these effects, as highlighted in Greenlaw et al (2018) and Gagnon (2018).

<sup>19</sup> Interestingly, these issues were the focus of much of the negative reaction by politicians, the media, and some academic economists to the asset purchase programs implemented by the Federal Reserve.

design of asset purchase programs. Now that we have evidence that such costs were limited, policymakers should take that into account in designing and implementing future programs, should they be needed. Of course, the asset holdings accumulated during the crisis have not been completely unwound at this point, and hence we may continue to learn about the risks associated with this policy tool.<sup>20</sup>

### *Shaping Policy Expectations with Central Bank Communications*

The final aspect of the FOMC's response to the financial crisis was its use of policy guidance. The initial use of guidance took place in the December 2008 statement, which said that the FOMC anticipated "exceptionally low levels of the federal funds rate for some time." That language was strengthened somewhat in the March 2009 FOMC statement, which said that the FOMC anticipated "exceptionally low levels of the federal funds rate for an extended period." Over the next several years, the FOMC engaged in a number of innovations in providing guidance to markets and the public, including the introduction of calendar-based guidance in August 2011, revisions to the calendar guidance in January 2012 and September 2012, and the introduction of more specific economy-based guidance in December 2012. In early 2012 the FOMC also began to include the assumed path of "appropriate" monetary policy by FOMC participants in its Summary of Economic Projections.<sup>21</sup>

The general purpose of this guidance was to flatten the path of the federal funds rate expected by financial markets, with the goal of lowering long-term interest rates and making broader financial conditions more supportive of growth. In this regard, guidance was intended to operate in the same direction as the asset purchase programs, but it would achieve those effects through altering expectations about short-term rates rather than shifting the term premium.

The FOMC made clear it was not trying to implement a strategy of unconditional commitment where future decisions were set regardless of economic circumstances. We saw this approach as infeasible, as it both seemed too difficult to tie the hands of future policymakers and ran the risk that the committed path might prove inappropriate should economic developments fail to follow the FOMC's expectations. Nevertheless, the FOMC thought that it would be useful to use policy guidance to convey what it expected to happen, and to perhaps raise the threshold for deviating from that path.

The effectiveness of this type of communication depends on the information being conveyed. Indicating a more accommodative policy path could be counterproductive if it conveys a more pessimistic economic outlook. Alternatively, it could provide meaningful

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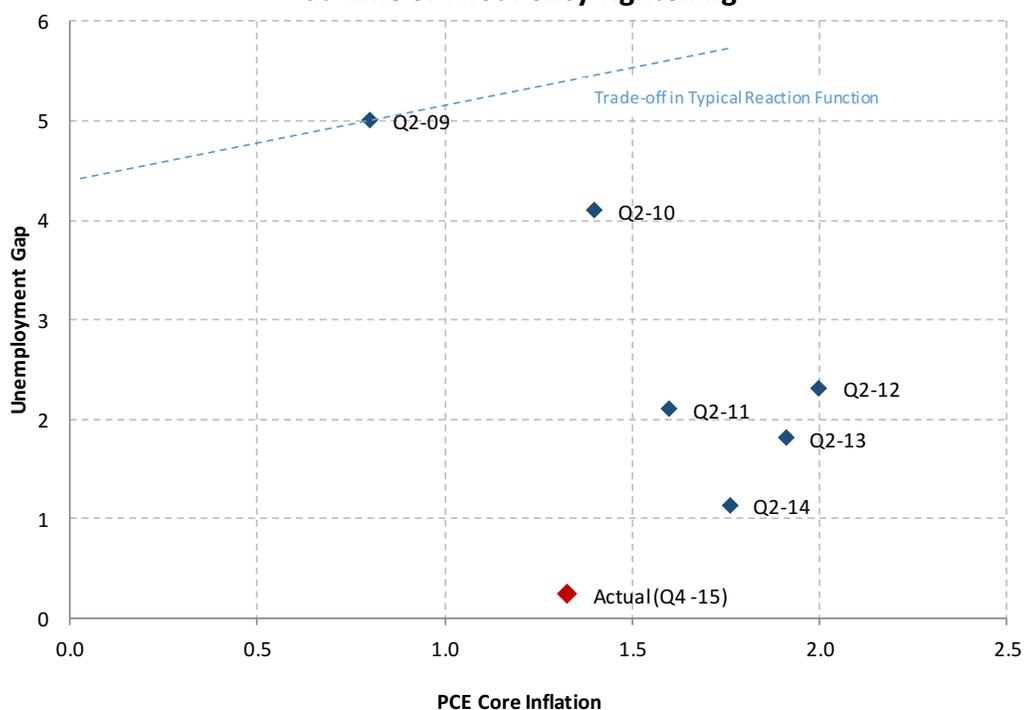
<sup>20</sup> An additional concern that has been raised about QE is that it could distort asset prices and hence create financial stability problems as it is unwound. However, such issues have not emerged to date. Moreover, it is unclear whether this concern applies only to QE, or also to conventional policy easing, as those concerned about this risk often refer to "reaching for yield" as a primary channel for such distortions.

<sup>21</sup> The Summary of Economic Projections includes projections of individual FOMC participants for key economic variables for the next several years and for the longer-run. These projections are released quarterly.

support to the economy if it conveys a more aggressive policy approach than is anticipated by market participants.<sup>22</sup>

When we first used the “extended period” guidance, the markets had a surprisingly hawkish view on the economic conditions that would be present at the time of lift-off from the ZLB. This can be seen by the upper-most point in the following figure. Market participants at the time expected the Fed to lift off when the unemployment rate was still 5 percentage points above its equilibrium level and inflation was just below 1 percent. The most likely explanation for this perspective is that the policy stance was seen as unusual, and hence market participants thought that the FOMC would move away from it even when economic conditions were still challenging.

**Figure 5: Market Expectations of Economic Conditions at Time of First Policy Tightening**



Source: Federal Reserve Bank of Philadelphia, Bloomberg, Authors' calculations.

A typical policy reaction function that describes central bank behavior involves some trade-off between two variables, in that a central bank would usually be willing to wait for unemployment falling closer to its full employment level if the level of inflation is running lower. This trade-off is captured by the upward sloping line in the figure, which is drawn to reflect the responsiveness found in the “balanced-approach rule” contained in the Fed’s Monetary Policy Report (2018). Moving along the line reflects this trade-off under a given reaction function. Downward shifts in this line would instead convey a different, more accommodative reaction function.

<sup>22</sup> See Woodford (2012) for an extensive discussion.

The evolution of the points in the figure shows that there was an ongoing and meaningful shift of the perceived reaction function toward more accommodation—a process that was encouraged by the stronger use of guidance by the FOMC. These communication shifts were not taken as simple movements along a given reaction function, as would be the case if they simply conveyed pessimism about the state of the economy. Rather, the market was coming to the view that the reaction function itself was changing in a meaningful way.<sup>23</sup> That shift in perception could have been supported by a view that the guidance did involve some degree of commitment, as argued by Bernanke (2017).

In the event, the actual lift-off from the ZLB took place amid economic conditions consistent with a relatively dovish reaction function. Thus, the communications helped to move the perceived reaction function in the direction of what would ultimately be realized. This outcome implies that the central bank communications over this period managed to make markets both more efficient (moving them towards the realized outcome) and more supportive of the economy (moving them lower) at a time when that helped the FOMC meet its objectives.

The primary concern that we had with the use of this tool was the possibility that market participants could misinterpret our statements as unconditional commitments. That concern was largely addressed by the language that was used, as it made clear that the policy statements were conditional on the path of the economy. And while some were concerned that this conditionality might weaken the effects of the guidance, there still seemed to be considerable benefit.

The other issue widely discussed was the appropriate form of the guidance. Conditioning on economic variables rather than a calendar date was seen as a good practice, as it could make the policy information more consistent with how policy is formulated. It was not easy, however, to communicate about a complicated reaction function in a manner that was simple and easily understood.

Overall, the FOMC generally regarded any effects of guidance on the expected policy path as a powerful tool—and felt relatively comfortable with its usage, as shaping short rate expectations is a part of policymaking during normal times as well. As a result, we were able to use policy guidance in a productive way throughout this period.

### **III. Lessons for Monetary Policy during Crisis Periods**

The overriding theme of monetary policy through the financial crisis was one of innovation and aggressive action. We cut the federal funds rate at a rapid pace, to a lower bound that had not been previously reached in the U.S. We created a new policy

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<sup>23</sup> The largest leg down came in 2011, likely reflecting the initial use of calendar-based guidance. The introduction of economy-based threshold guidance did not prompt any notable market response, in part because the FOMC was careful to communicate that it should be seen as consistent with the previous date-based guidance.

instrument by initiating the use of large-scale asset purchases. And we used policy guidance more extensively than at any time in past. The FOMC was clearly in “uncharted waters.” As a result, we learned a great deal that could help monetary policy decisions during future periods of financial stress.

**LESSON 1: RECOGNIZE THE CONSIDERABLE EFFECTS THAT FINANCIAL DEVELOPMENTS CAN HAVE** on the economy, and the uncertainty that attends the economic outlook during periods of financial stress.

- Central banks need to have information and expertise about a wide range of financial markets and institutions to evaluate financial developments and their effects on the economy. This point is true at any time, but it becomes especially important during periods of financial stress, when problems can emerge in unexpected places and have more severe economic consequences.
- Policymakers must be aware of the potential for adverse feedback loops between financial developments and the economy. They should incorporate a broad range of financial effects into their economic models, but they should also be cognizant that models are not rich enough to incorporate all types of financial strains.
- Accordingly, policymakers have to be prepared to abandon those models and to make sizable adjustments to their forecasts, or at least take into account severe downside risks, as financial stress emerges.

**LESSON 2: BE SUFFICIENTLY AGGRESSIVE IN CUTTING THE FEDERAL FUNDS RATE** as financial conditions deteriorate.

- Central banks may need to adjust their policy rates quickly and forcefully just to keep up with the changing outlook when severe financial strains emerge.
- Principles of risk management suggest the need for policymakers to be even bolder at times. The zero lower bound on rates presents a substantial hurdle to achieving employment and price stability objectives, and the odds of a severely negative outcome for the economy are elevated in times of financial stress. Cutting rates further and faster can provide critical support to the economy in those circumstances.
- Having inflation expectations anchored at a reasonable level in the pre-crisis period is critical, both for allowing aggressive actions to be taken without fear of creating persistent inflationary pressures, and for having reductions in interest rates feed through to real interest rates.

**LESSON 3: USE ASSET PURCHASES TO ACHIEVE ADDITIONAL ACCOMMODATION** when the capacity to cut policy rates does not provide a sufficient response to economic conditions, and do so with less concern about the associated risks.

- Purchases of long-term assets do appear to reduce long-term interest rates to support economic recovery. The effects are especially large when the purchases can be used to restore the functioning of financial markets. But purchases also have beneficial effects in well-functioning markets.
- When operating in well-functioning markets, purchases of assets may need to be sizable to have meaningful effects.

- Asset purchases work through their effects on the prices of the assets acquired. The amount of high-powered money provided seems to, by itself, have little consequence for inflation or inflation expectations.
- The costs of implementing large-scale asset purchases are less severe than had been feared, and we can now be confident about the ability to raise the policy rate in a controlled manner even when the Fed’s balance sheet is still large.
- Given the ability to control the policy rate, policymakers have the flexibility to design future asset purchase programs in the manner that will most effectively deliver the intended effects on financial conditions and the economy. Policymakers should not feel constrained by sterilization concerns.

**LESSON 4: PROVIDE FORWARD GUIDANCE ON INTEREST RATES** in order to signal a policy reaction function that differs from history or market expectations.

- Communication to shape market expectations is a natural aspect of central bank practices, and the expected path of the policy rate is a component of monetary policy transmission that is already embodied in central bank thinking and models.
- Communicating about the path of policy is especially critical when the scope to move the policy rate further is constrained by the zero lower bound.
- Because of the considerable uncertainty that surrounds periods of financial stress, significant misperceptions about the central bank’s reaction function can emerge. Policy guidance can be effective at bringing market expectations more in line with central bank intentions.
- When possible, communications should focus on the policy reaction function—this is, on outcomes that are contingent on economic conditions. But experience suggests that date-based guidance can also be quite effective, especially if market expectations are stubbornly at odds with the intentions of policymakers.

Undoubtedly, the next financial crisis will differ in its origins, severity, and effects, and the policy response will have to differ in important dimensions. Still, we learned a great deal while implementing monetary policy through this crisis period, and those lessons should provide a useful compass when financial stresses emerge once again.

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