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***“Lessons from the U.S. Experience
with Quantitative Easing”***

Eric S. Rosengren
President & Chief Executive Officer
Federal Reserve Bank of Boston

*The Peterson Institute for International
Economics and Moody’s Investors Service’s 8th
Joint Event on Sovereign Risk and
Macroeconomics*

Frankfurt, Germany
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I would like to thank Adam Posen, President of the Peterson Institute for International Economics, for inviting me here to provide my perspective on the quantitative easing programs in the United States.

As I begin, I would note as I always do that the views I will express today are my own, not necessarily those of my colleagues at the Federal Reserve’s Board of Governors or on the Federal Open Market Committee (the FOMC).

The expansion of the Federal Reserve’s balance sheet ended with the completion of the tapering process last October, but we still are a long way from normalizing either short-term interest rates or our balance sheet. As a result, it may be some time before a full assessment of the effects of our quantitative easing policies can be made, since a full evaluation will require a successful return to a normalized monetary policy. Nonetheless, I think it is quite possible and appropriate at this point to consider which design features of the Federal Reserve’s asset-purchase program were effective, and which were less successful, in achieving our monetary policy goals.

In addition to considering the design features, I will also consider the equally important communications strategy. Communications, often referred to as forward guidance, are an increasingly important component of monetary policy, especially when short-term interest rates are at the zero lower bound.

An important caveat here is that institutional, structural, and governance differences across the world’s central banks can make comparisons of policy actions (and their efficacy) quite difficult. Perhaps the most important difference between the Fed in the United States and most central banks in developed countries is that Congress assigned the Federal Reserve a “dual mandate” – the twin goals of achieving maximum sustainable employment as well as stable prices – rather than a single mandate related only to inflation.

However, another important difference involves the restrictions on securities that the Fed can purchase for its open market account. We are limited to securities that have the full backing of the U.S. government, and thus have purchased government-guaranteed

mortgage-backed securities (MBS) and U.S. Treasury securities. Such restrictions vary significantly across the world's central banks.

Reflecting on the financial crisis and its aftermath, I have become convinced that the dual mandate is one reason why the U.S. Federal Reserve moved more aggressively than many other central banks to address the significant undershooting of inflation that we saw in the U.S., and that many other countries have experienced. Given the imperfect understanding of inflation dynamics, even a string of quarters in which inflation significantly undershoots its target may be reasonably interpreted as a temporary shortfall, since deviations of this magnitude and persistence still lie well within the accuracy of current inflation forecasting models. However, the substantial increase in *unemployment* throughout the developed world, in combination with the below-target inflation rates, indicates that significant output gaps do exist. How aggressively a central bank reacts to this situation depends on whether that central bank's mandated goals involve inflation alone, or as in the U.S., a dual mandate that includes employment.

However, I would argue that regardless of mandate, delays by central banks in moving to address the undershooting on inflation can be costly – especially if such delays lead households and firms to *expect* very low inflation rates.

In the United States, the decline in inflation during the recession afforded us more latitude to aggressively focus on the employment side of our dual mandate. Given the painful disruptions in labor markets that the U.S. experienced, this emphasis seemed appropriate, and does so with hindsight, and with all due consideration to the possibility of structural shifts in labor markets. I felt it was important that the focus on weak labor markets, as well as the undershooting of inflation, together provided important support

for U.S. monetary policymakers to decide to move aggressively during the financial crisis, and indeed its long aftermath.

Of course today, after significant labor market improvement, and with the horizon over which inflation will return to its target being uncertain, inflation has taken on a more prominent role in our deliberations.

Currently, an obvious caveat in interpreting the low inflation rate in the U.S. is the supporting role played by the recent decline in energy prices. Oil shocks have been associated with major changes in monetary policy before. The failure to control inflation in the United States during the 1970s, in the presence of an adverse oil supply shock, highlighted a serious dilemma facing monetary policy at that time. Importantly in that case, what might have been a *temporary* pass-through of oil to non-oil prices turned into a more lasting problem with overall inflation, as wage and price dynamics at that time helped turn increases in oil prices into fairly protracted increases in overall inflation. Former Federal Reserve Board Chairman Volcker is rightfully recognized for taking forceful action to address the situation and ultimately tame inflation in the United States.

Currently, a concern is that central banks are facing the mirror image of the problem in the 1970s. The problem of significantly *undershooting* inflation – a dynamic which could well keep interest rates at the zero lower bound – is likely to be a key challenge to central bankers in the first two decades of the 21st century. And I would say that as with the oil shock in the 1970s, the current shock has served to accentuate a potential monetary policy pitfall – in this case, the failure to quickly and vigorously address a significant undershooting of inflation targets, potentially leaving economies stagnant at the zero lower bound.

There are three observations I will make today. First, that a significant *undershooting* of the inflation target should be treated with the same policy urgency as a significant *overshooting* of the inflation target. Second, that *open-ended* quantitative easing tied to policy goals is likely to be much more effective than limited quantitative-easing programs. Third, that clarity on monetary policy communications is difficult to achieve, but critically important for the success of the program. I would add that this final point is as critical to how we *normalize* policy as it is to how we *initiate* quantitative easing policies.

The Design of Large-Scale Asset Purchases in the United States

While there were three separate large-scale asset purchase programs in the United States, I will only briefly focus on the first one, since it was at least partly designed to address dysfunctional markets during the height of the financial crisis. In addition to addressing the shortfall in macroeconomic goals, this program was focused on purchases of mortgage securities, and sought to relieve the weak demand for mortgage-backed securities when markets became quite illiquid and risked becoming much more so. This program has generally been viewed as a successful way to stabilize markets, but isolating its effects is complicated because it occurred in the midst of the financial crisis.

Figure 1 provides details of the large-scale asset purchase programs commonly referred to as “QE1,” “QE2,” and “QE3.” QE1 was announced on November 25, 2008, with purchases beginning shortly thereafter.¹ Initial purchases were of agency debt and agency mortgage-backed securities (MBS), “to provide support to the mortgage and housing markets.”² Additional agency debt and MBS purchases were announced in

March 2009, along with the purchase of longer-term Treasury securities, all to “provide greater support to mortgage lending and housing markets” and “to help improve conditions in private credit markets.”³ The program concluded in March 2010.

Purchases totaled \$1.25 trillion in agency MBS, \$175 billion in agency debt, and \$300 billion in longer-term Treasury securities.⁴

QE2 began in November 2010, and ended in June 2011. The program committed to purchase \$600 billion of longer-term securities by the middle of 2011.⁵ Unlike QE1, it was focused solely on purchasing long-term Treasury securities, and did not include the purchase of mortgage securities – which had been the focus of that first large-scale asset purchase program.

The purchase program did not fully meet expectations in terms of achieving monetary policy goals. As a result, in September of 2011 – only three months after the end of QE2 – the Federal Reserve announced the Maturity Extension Program (commonly referred to as “Operation Twist”). This program was designed to lengthen the average maturity of the Fed’s Treasury securities portfolio, by purchasing long-term securities and selling an equal amount of short-term securities. The program removed duration from private holdings of Treasury securities, but did not increase the overall amount of the securities portfolio held by the Federal Reserve. The goal was to decrease the longer-term rates that tend to affect the real economy; in fact the FOMC statement at the time highlighted that the program should “put downward pressure on longer-term interest rates.”⁶

The initial program was a purchase of \$400 billion in long-term Treasury securities, and clearly had the intended effect on long term rates. The program was

extended in June 2012, at which point the program was limited by the lack of short-term securities to sell, and ended in December 2012.⁷ At the time this eliminated our holdings of T-bills and very short term notes.

The third quantitative easing program began in September 2012.⁸ The program began as a monthly purchase of \$40 billion in agency mortgage-backed securities, in addition to the Treasury securities that were being purchased (or swapped) under the “Twist” program. Unlike QE2, QE3 was an open-ended program. The continuation of the program was tied to substantial improvement in labor markets, consistent with price stability. In this way the communication emphasized the need to achieve the policy goals rather than a given size of the program. Communications also emphasized that the program would “put downward pressure on longer-term interest rates” and “support mortgage markets.” When the Maturity Extension Program ended in December 2012 because of a lack of short-term Treasury securities remaining in the portfolio, the program was adjusted to the outright purchase (rather than exchange or swap) of \$45 billion per month in longer-term Treasury securities, in addition to the purchase of \$40 billion per month in mortgage-backed securities.⁹

Figure 2 shows the growth of the Federal Reserve’s balance sheet over this period. QE2 expanded the Federal Reserve’s balance sheet by \$600 billion, to a little below \$3 trillion. Operation Twist did not influence the overall size of the balance sheet. QE3 significantly increased the balance sheet to the current size of approximately \$4.5 trillion.

Figure 3 shows the composition of the Fed’s balance sheet. It shows the progression from QE2 – where the expansion primarily involved Treasury securities with

a 5 to 10 year maturity – to a balance sheet with much larger holdings of mortgage-backed securities, and Treasury securities with more than 10 years to maturity.

Impact of Programs

A number of good event studies have attempted to evaluate the impact of the purchase programs in a narrow time window around the program-announcement dates.¹⁰ In general, the studies find roughly a 20 to 25 basis point reduction in long-term rates associated with a purchase of \$500 billion in long-term assets, although there is a high degree of imprecision involved.

In particular, with numerous Federal Reserve officials publicly discussing possible policy options, the timing of *exactly when the market came to expect* a new program is hard to pinpoint. It is very difficult to isolate the extent of the “news” contained in any announcement – news about either the timing or magnitude of a program.

Figure 4 shows 10-year Treasury yields around the time of announcements related to the three quantitative easing programs. QE1 was announced on November 25, 2008, with the announcement reiterated in the FOMC statement on December 16, 2008. Additional purchases were announced in the FOMC statement released on March 18, 2009. The 10-year Treasury yield fell 24 basis points on the day of the November announcement, and an additional 12 basis points on the following day. On the day of the March announcement of additional purchases, the 10-year Treasury rate fell 51 basis points.

Treasury yields, at much lower levels by the November 3, 2010 announcement of QE2, fell by 14 basis points the day following the announcement, but drifted slightly upward over the next couple of weeks.

As QE3 was contemplated, 10-year Treasury yields hovered at historic lows well under 2 percent. (Because of the low levels, please note that the scale on the chart for QE3 is different than the scale for the QE1 and QE2 charts.) QE3 was announced in the FOMC statement on September 13, 2012. However, shortly prior to the announcement, on August 31, 2012, Chairman Bernanke spoke at the annual Jackson Hole symposium hosted by the Federal Reserve Bank of Kansas City.¹¹

On the day of Bernanke's speech, the 10-year Treasury yield declined by 6 basis points. However, on the day after the QE3 announcement, the 10-year Treasury yield rose 13 basis points but then adopted a downward trend, falling over 20 basis points over the next two weeks, easing the initial jump. Through the announcement of QE3, 10-year Treasury rates had fallen approximately 200 basis points, which was the immediate goal of the program.

While measuring the reduction in rates is one way to capture the impact of the program, the real goal is to have a significant impact on economic variables more generally. QE1 was meant to stem the tide of the deepening recession; the economy's momentum was highly contractionary and QE1 was meant to moderate the resulting decline in output. On the other hand, the later two QEs were meant to stimulate the economy.

The FOMC statement announcing QE3 highlighted the desire to support mortgage markets. **Figure 5** shows that there was no notable change in housing starts during the

period of QE2. However, housing starts did improve over the period of Operation Twist and QE3. After averaging 569,000 units during QE2, starts averaged 708,000 units from early on in Operation Twist through August 2012. During the past 6 months, starts have improved to averaging over 1 million units.

Figure 6 shows the path of housing prices. With housing prices declining, it was very hard to see or generate momentum in the housing market. Housing prices continued to decline during QE2, but began to rise somewhat steadily – albeit modestly – in late 2011, with Operation Twist underway for several months. Housing prices continued their upward trend during QE3.

Figure 7 shows that QE2 did not generate much momentum in auto and light-weight truck sales, which did pick up during Operation Twist and QE3. During QE2, auto and light truck sales were averaging 12.4 million units. Midway through Operation Twist, and as QE3 began, auto sales had risen to an average of nearly 15 million units, and over the past six months auto sales have averaged nearly 17 million units.

One of the transmission mechanisms is to alter asset prices other than interest rates. **Figure 8** illustrates that while there was not much momentum in stock prices from QE2, there was a substantial improvement over the period of Operation Twist and QE3.

Figures 9 and 10 illustrate what happened to measures of the two goals embedded in the Fed's dual mandate over this period. The unemployment rate fell appreciably over the period. Core PCE inflation reached 2 percent during Operation Twist, but has generally been persistently below the 2 percent target. In part, the presence of full employment in the mandate, and the pain being felt in U.S. labor markets – coupled with core inflation below 2 percent – provided plenty of support for aggressive

policy actions. The FOMC statements noted the need for substantial improvement in labor markets, and the statements related to QE3 eventually incorporated an unemployment threshold.

In sum, in the absence of the *dual* mandate, some significant and I would say needed policy actions may not have occurred – Operation Twist when core PCE was relatively close to the 2 percent target, and QE3 when core inflation trended at roughly 50 basis points below 2 percent. Had these policy actions not occurred, it would in my view have prevented what was ultimately important pre-emptive action against a persistent undershooting of the inflation target that could have become much worse, as in some other parts of the globe.

QE2 was limited in scope. It had a fixed purchase amount and was not communicated in a manner tied to goals. Moreover, it was focused on Treasury securities rather than on areas with larger spreads, such as mortgages. And there is little evidence it had the desired impact on rates or real variables.

In contrast, QE3 was limited only by the progress made against the goals. The purchases were open-ended, and the communication was firmly tied to goals. It included areas with larger spreads such as mortgages. And both financial variables and real variables showed improvement with this program.

In summary, program design, and communication, both matter. A program that is open-ended and focused on areas where spreads are large – in conjunction with a communication strategy tied to goals – seems to have made a material difference in outcomes. While the transmission channels of large-scale asset purchases are still not completely understood, it seems to me that the signaling and communication tied to a

large-scale asset purchase are an important channel – but one that unfortunately is hard to accurately quantify.

Exit Strategies

At this point no central bank has fully normalized its policy stance. However, as my discussion has highlighted, communication and actions around *exit* are likely to be as important as they were at *initiation*. I am pleased that the United States has experienced much improved labor markets and inflation rates that, while below target, are higher – less close to dangerously low or negative rates – than in some, if not many, developed countries.

Nonetheless, policy should not be focused on progress from where we have been, but should instead be focused on meeting the ultimate goals in a timely fashion. At this time, there is insufficient evidence that U.S. inflation is clearly trending toward the 2 percent goal. While labor markets have continued to improve, the employment cost index (ECI) overall, and the occupational breakdown of the ECI shown in **Figure 11**, show little evidence of trending to pre-crisis levels.

While disentangling the impact of positive energy shocks on prices will be difficult, we know that the PCE core inflation rate remains well below the Federal Reserve's 2 percent target. Given how low total and core inflation have fallen in most developed countries, a policy of patience in the United States continues to be appropriate. This is particularly true given the inherent asymmetry that we face at the zero lower bound – meaning, while we have all kinds of room to respond to an unexpectedly favorable shock, we remain quite limited in our ability to respond to negative shocks.

Concluding Observations

My remarks have focused on the United States experience. Given the different places central banks in developed countries are on policy at this time, it is likely premature to draw hard and fast conclusions for the global context. Certainly the Japanese experience of raising the rate of inflation with a broad open-ended program tied to its policy goal is encouraging. Similarly, we will all learn from recently announced programs being initiated in Europe.

The relatively recent focus among central banks around the world on addressing the problem of persistently low inflation rates is in my view very encouraging. Just as high inflation in the 1970s was a pernicious problem for central banks, the problems generated by low inflation and interest rates settling at the zero lower bound were underestimated by professional economists and central bankers alike. The broad focus on meeting central bank mandates is important, and actions being taken to achieve inflation targets should result in a more robust global economy.

Thank you.

¹ The Federal Reserve's press release announcing the action on November 25, 2008 stated "This action is being taken to reduce the cost and increase the availability of credit for the purchase of houses, which in turn should support housing markets and foster improved conditions in financial markets more generally." <http://www.federalreserve.gov/newsevents/press/monetary/20081125b.htm>

² See the statement from the December 16, 2008 FOMC meeting: <http://www.federalreserve.gov/newsevents/press/monetary/20081216b.htm>

³ See the statement from the March 18, 2009 FOMC meeting: <http://www.federalreserve.gov/newsevents/press/monetary/20090318a.htm>

⁴ See the statement from the March 16, 2010 FOMC meeting:
<http://www.federalreserve.gov/newsevents/press/monetary/20100316a.htm>

⁵ See the statement from the November 3, 2010 FOMC meeting:
<http://www.federalreserve.gov/newsevents/press/monetary/20101103a.htm>

⁶ See the statement from the September 21, 2011 FOMC meeting:
<http://www.federalreserve.gov/newsevents/press/monetary/20110921a.htm>

⁷ See the statement from the June 20, 2012 FOMC meeting:
<http://www.federalreserve.gov/newsevents/press/monetary/20120620a.htm>

⁸ See the statement from the September 13, 2012 FOMC meeting:
<http://www.federalreserve.gov/newsevents/press/monetary/20120913a.htm>

⁹ See the statement from the December 12, 2012 FOMC meeting:
<http://www.federalreserve.gov/newsevents/press/monetary/20121212a.htm>

¹⁰ See for example:

- Gagnon, Joseph, Matthew Raskin, Julie Remache and Brian Sack. 2011. "Large-Scale Asset Purchases by the Federal Reserve: Did They Work?" *Federal Reserve Bank of New York Economic Policy Review*, 17 (1), pp. 41-59.
- Hancock, Diana, and Wayne Passmore. 2011. "Did the Federal Reserve's MBS Purchase Program Lower Mortgage Rates?" *Journal of Monetary Economics*, 58 (5), pp. 498-514.
- Hamilton, James D., and Jing Wu. 2010. "The Effectiveness of Alternative Monetary Policy Tools in a Zero Lower Bound Environment," University of California, San Diego, working paper.
- Krishnamurthy, Arvind, and Annette Vissing-Jorgensen. 2011. "The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy," *Brookings Papers on Economic Activity*.
- Fuhrer, Jeffrey and Giovanni Olivei. 2011. "The Estimated Macroeconomic Effects of the Federal Reserve's Large-Scale Treasury Purchase Program." *Federal Reserve Bank of Boston Public Policy Brief* no. 11-2, (2011).

¹¹ See the full text of Chairman Bernanke's speech:
<http://www.federalreserve.gov/newsevents/speech/bernanke20120831a.htm>