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Quantitative Easing: A Rationale and Some Evidence from Japan

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Following the dramatic worsening of the global financial crisis in the fall of 2008, many central banks in leading industrial economies quickly moved to slash the policy rate on overnight repurchasing agreements and ease credit for liquidity-hungry banks. As policy rates reached near-zero levels, central banks proceeded to provide further monetary accommodation. On March 5, 2009, for example, the Bank of England reduced its policy rate to 0.5% and announced that it would "undertake a programme of asset purchases of £75 billion financed by the issuance of central bank reserves."[1] Shortly thereafter, on March 18, the Federal Reserve anticipated publicly that economic conditions would require keeping the policy rate at 0%–0.25% for an extended period of time and announced additional measures to increase its balance sheet. In particular, the Federal Open Market Committee (FOMC) announced that it would "purchase an additional $750 billion of agency mortgage-backed securities, bringing its total purchases of these securities to up to $1.25 trillion this year, and increase its purchases of agency debt this year by up to $100 billion to a total of up to $200 billion. Moreover, to help improve conditions in private credit markets, the Committee decided to purchase up to $300 billion of longer-term Treasury securities over the next six months."[2]

The Bank of England referred to its policy as *quantitative easing*, noting that it simply shifted the instrument of monetary policy from the policy rate, which is the price of money, to the quantity of money provided. It also clarified that its policy objective remained unchanged and that it considered influencing the quantity of money directly as a different means of reaching the same end. The Federal Reserve continued to use the term *credit easing* to describe its collection of measures and emphasized the effects that the composition of its balance sheet would have on credit availability. Even so, it used direct asset purchases extensively to support the magnitude of its balance sheet.

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The European Central Bank stayed on the sidelines for a bit longer but eventually also announced "unconvential measures" on May 7, 2009. Its preferred mix of such measures included 1-year repo operations with full allotment at a rate equal to the overnight policy rate of 1% and direct purchases of covered bonds.

For long-time observers of the Japanese economy, such central bank announcements are very familiar. Japanese money market rates fell below 1% in 1995 and declined toward zero by 1999. As the economy continued to experience severe recessionary and deflationary pressures, the Bank of Japan ventured into new territory. On March 19, 2001, it announced "New Procedures for Money Market Operations and Monetary Easing."[3] These procedures included a number of measures targeted at the price of money, the quantity of money provided, and the composition of assets purchased by the central bank. The main operating target for money market operations was changed from the current uncollateralized overnight call rate to the outstanding balance of the current accounts at the Bank of Japan. The Bank informed the public that it anticipated the policy rate to stay close to zero for an extended period. Furthermore, it announced that it would increase its balance sheet and purchase assets directly, including outright purchases of government bonds. Importantly, the Bank of Japan made clear that "the new procedures for money market operations continue to be in place until the consumer price index (excluding perishables, on a nationwide statistics) registers stably at zero percent or an increase year on year."

I. The Rationale for Quantitative Easing

The implications of near-zero nominal interest rates for monetary policy effectiveness, the dangers of deflation, and the resulting rationale for quantitative easing were laid out and analyzed in Orphanides and Wieland (1998, 2000) and Coenen and Wieland (2003, 2004). As long as savers have the option to choose cash—a zero-interest-bearing asset—as a store of value, a rate of zero constitutes an important speed limit for monetary policy. In severe recessions that are accompanied by low inflation or deflation, a central bank would like to engineer a reduction of the real interest rate in order to boost aggregate demand. However, it may not be able to accomplish this objective, because it cannot lower the nominal interest rate below zero. Orphanides and Wieland (1998) evaluated the impact of the zero bound in an empirically estimated dynamic and stochastic macroeconomic model.[4] This model incorporates forward-looking behavior by consumers and price setters but also allows for the

existence of price rigidities and inflation stickiness. Orphanides and Wieland (1998) then showed that the zero bound represents a quantitatively important constraint on monetary policy in an environment of near-zero steady state inflation. Recessions and deflationary episodes would be significantly deeper than in the absence of such a floor on nominal interest rates.

Orphanides and Wieland (2000) study the optimal design of monetary policy in periods of near-zero interest rates using a simple stylized macroeconomic model. Their paper outlines a decision framework for quantitative monetary policy. Prescriptions for interest rate policy are translated into prescriptions for base money. Of course, in normal times, when the interest rate prescriptions are positive, central banks prefer to use an interest rate rather than a monetary quantity as the operating target. Interest rates are much easier to observe and control on a continuous basis than monetary quantities. However, in unusual times, when nominal rates are stuck at zero, the quantity of base money remains available as a tool for gauging the extent of monetary easing. Thus, Orphanides and Wieland propose that monetary policy operations be shifted to the quantity of money provided whenever overnight policy rates register near zero. They also illustrate the usefulness of a measure such as the Marshallian k that puts the quantity of nominal money into perspective relative to nominal income.

Orphanides and Wieland (2000) also note that interest rates for longer durations or the exchange rate could replace the overnight rate as a gauge of monetary operations. Quantity measures, however, remain of interest as they serve to highlight channels of monetary policy transmission that remain available when the interest rate channel is rendered inactive at the zero interest floor. For example, the central bank can steer the overall magnitude of real balances in the economy, as well as the relative magnitudes vis-à-vis other assets and currencies, by providing more base money. Thereby, it can still exert an influence on aggregate demand and inflation by exploiting real balance and portfolio balance effects. These effects work through overall wealth and the relative supplies of various assets or currencies.

To illustrate the procedure of shifting the central bank's operating target from a policy rate to a monetary quantity, consider a central bank that pursues a systematic interest rate policy similar to Taylor's rule:

$$i_t = r^* + \pi_t + \alpha_\pi(\pi_t - \pi^*) + \alpha_y(y_t - y_t^*), \tag{1}$$

where i_t stands for the policy rate in period t; π_t and π^* refer to the current rate of inflation and the inflation target, respectively; y_t and y^* denote

current and potential output, respectively; and r^* represents the long-run equilibrium real interest rate. Thus, the central bank raises or lowers the nominal interest rate in response to deviations of inflation from its target and output from potential. The extent of the policy response is governed by the coefficients α_π and α_y. Taylor (1993) chooses values of 0.5 and sets the equilibrium real rate and inflation target both to 2%.

To achieve the operating target for the policy rate defined by equation (1), the central bank conducts open market operations. These operations also influence the quantity of base money. Thus, in principle, the interest rate equation could be related to a policy prescription for the quantity of base money or a measure such as the Marshallian k. The relationship of this ratio to the inflation and output gaps may then be described as follows:

$$\frac{\text{base money}}{\text{nominal income}} = k_t = k^* - \kappa_\pi(\pi_t - \pi^*) - \kappa_y(y_t - y_t^*), \qquad (2)$$

where κ_π and κ_y constitute parameters governing the responsiveness of the Marshallian k that are consistent with the response coefficients in the interest rate rule. Of course, in normal times, equation (1) provides a much better guide for policy because the quantity of money will also fluctuate due to unforeseen demand shocks and policy control errors. When the interest rate is stuck at zero, however, equation (2) can still provide guidance for policy.

Orphanides and Wieland show that the optimal policy response is nonlinear because the effectiveness of policy is reduced with near-zero interest rates. Thus, optimal values of κ_π and κ_y are much bigger in a situation in which the interest rate is near zero than in normal circumstances. The optimal policy expressed in base money exhibits a kink at the point at which the interest rate reaches zero. It provides a motivation for more aggressive expansion of the central bank balance sheet in such circumstances. Orphanides and Wieland also identify a second source of nonlinearity, namely, the uncertainty about the magnitude of real balance and portfolio balance effects. If these remaining channels for monetary policy transmission are estimated with less precision than the usual interest rate channel, then it would be preferable for the central bank to use up the room for interest rate easing preemptively whenever it expects to enter a period of deflation.[5]

Coenen and Wieland (2003) estimate a dynamic, stochastic, three-country model of the United States, the Eurozone, and Japan in order to assess the impact of the zero bound under alternative policies, such as those proposed by Orphanides and Wieland (2000).[6] They investigate

a scenario in which the Japanese economy is hit by a severe recession and deflation and compare Taylor's rule (i.e., eq. [1] with Taylor's original coefficients) to a rule that shifts to the quantity of base money at the zero interest floor, such as equation (2).

Figure 1 compares the output gap and inflation in simulations with the zero bound (thick solid line) and in the absence of this constraint (thin solid line). The recession-cum-deflation episode is caused by an unfortunate sequence of negative demand and cost-push shocks. However, the inability of the central bank to lower nominal interest rates below zero renders the outcome considerably worse than it would have been without such a constraint. With the nominal rate bounded at zero, deflationary shocks increase the real interest rate and exchange rate and thereby worsen the recession and deflation. This mechanism is potentially self-reinforcing and suggests the possibility of a deflationary spiral and collapse of the economy. In the simulation, however, keeping the nominal interest rate at zero for 10 years is sufficient to return the economy to steady state eventually. This recovery may be accelerated substantially by a monetary policy that expands the central bank balance sheet aggressively.

As shown in figure 2, a policy rule such as equation (2), with a strengthened response of base money in a period with zero interest rates, improves outcomes and ameliorates the effect of the zero bound (thin solid line). The mechanism of recovery is apparent from the impact of base money creation on inflation expectations and real interest rates. Turning to figure 3, it can be seen that, in the absence of a quantitative

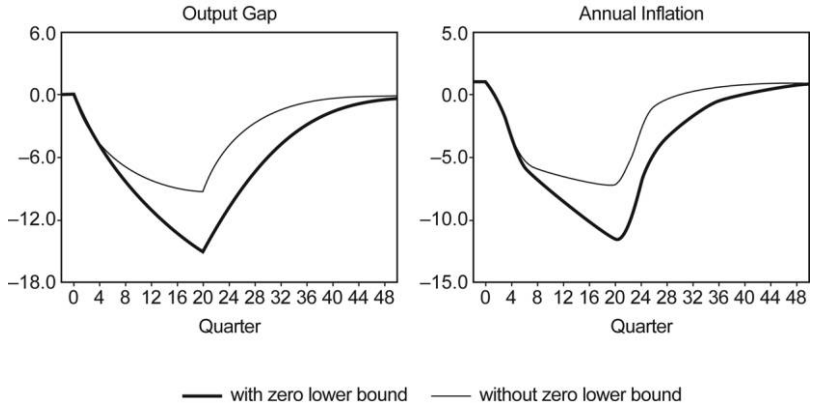

Fig. 1. Effect of the zero bound in a severe recession and deflation in the Japanese economy. Source: Coenen and Wieland (2003).

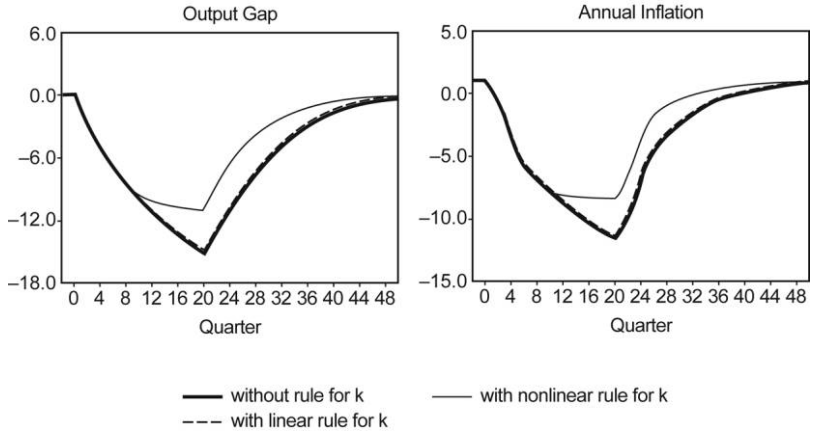

Fig. 2. Base money expansion ameliorates the effect of the zero bound. Source: Coenen and Wieland (2003).

policy response, the real interest rate rises during the deflation (thick solid line). The expansion in base money reduces deflationary expectations via real balance, portfolio balance, and expectations channels. Consequently, real interest rates remain more moderate (thin solid line). Inflation and positive nominal interest rates return more quickly.

The policy rule with base money ensures that self-fulfilling deflationary spirals do not emerge. A deflation scare would be met with an expansion of base money. The expansion of nominal money balances in conjunction with any expectations-induced drop in the price level would imply a rapid increase in real balances, which, in turn, would stabilize the economy and render the expectation of a deflationary spiral untenable.

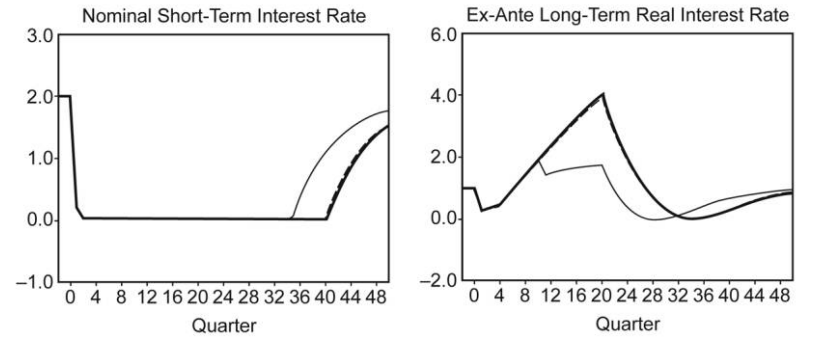

Fig. 3. The effect of base money expansion on nominal and real interest rates. Source: Coenen and Wieland (2003).

II. The Impact of Quantitative Easing on Money Growth and Inflation in Japan

Having established the circumstances under which quantitative easing can reduce the depth of an economic downturn in the presence of low interest rates and the use of such an approach by the Bank of Japan in 2001, it is of interest to investigate the Japanese experience. The following three questions are of immediate importance. Did the Bank of Japan increase base money sufficiently so that it implied an expansion relative to nominal income, that is, an expansion in the Marshallian *k*? Did it succeed in creating an overall greater supply of money as measured, for example, by M1, and was the quantitative monetary expansion ultimately followed by a return of inflation?

Figure 4 shows the relationship between the overnight money market rate (vertical axis) and the ratio of base money and nominal income (horizontal axis) in Japan from 1981 to 2008. The observations shown are annual averages. In the years prior to 1997, the Bank of Japan's policy is easily understood from the movements in the money market interest rate. In this period, the ratio of the monetary base to nominal income

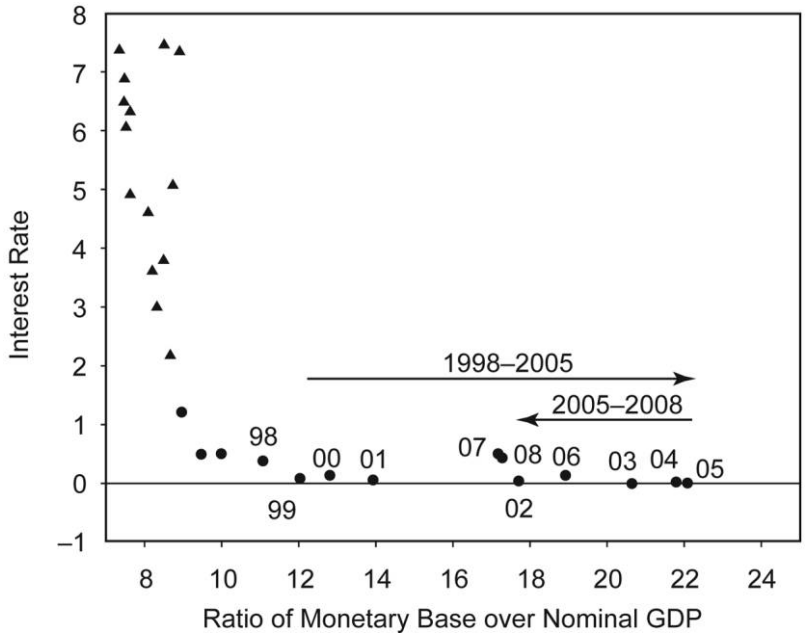

Fig. 4. The Marshallian *k* and the money market rate in Japan, 1981–2008, annual observations.

typically varied inversely with the money market rate, as suggested by standard money demand theory.

From 1998 onward, the money market rate remained constant near zero and uninformative with regard to the operations of the Bank of Japan. However, the impact of monetary policy measures is seen clearly from the Marshallian *k*. The Bank of Japan steadily expanded the monetary base relative to nominal income from 1998 to 2001. This expansion intensified dramatically with the announcement of the policy of quantitative easing. By 2002, base money jumped to 18% of nominal income, and it averaged 20% by 2005. The arrow pointing to the right in figure 4 indicates the extent of base money creation over the years from 1998 to 2005. Thus, the answer to the first question posed above is a resounding yes. Interestingly, the Bank of Japan was also able to exit from the period of quantitative monetary accommodation quite rapidly in 2006. As indicated by the lower arrow pointing to the left, the Marshallian *k* was reduced to around 17% by 2007 and averaged near that level in 2008.

Figure 5 compares the time path of base money (thick solid line) and M1 (thin solid line) relative to nominal income. As base money grew, so

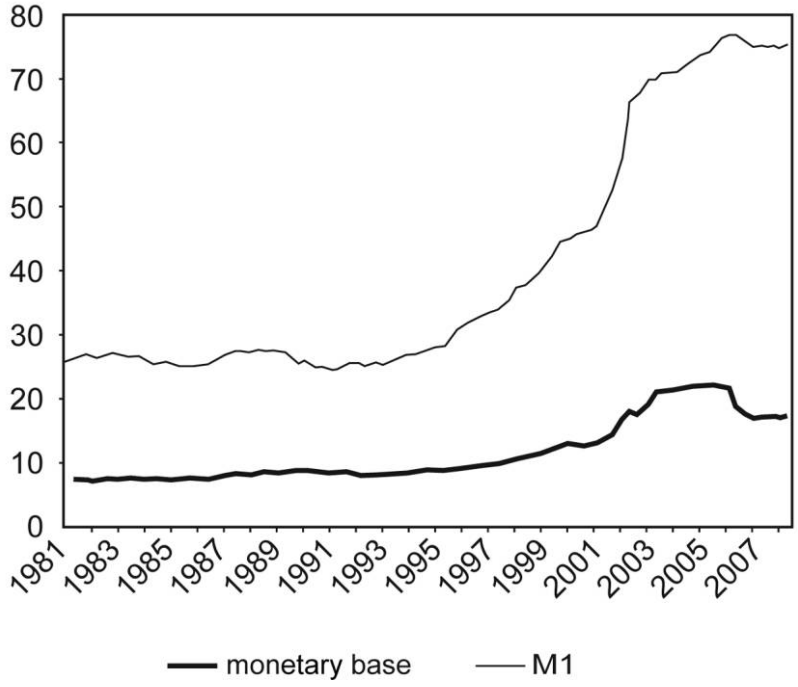

Fig. 5. Base money and M1 relative to nominal income in Japan, 1981–2008, quarterly observations.

did M1. In fact, between 2001 and 2005, it increased by more than 30% of nominal income. Thus, the expansion of base money engineered by the central bank induced additional deposit creation by banks and led to an even greater expansion in the broader monetary aggregate. This expansion came to a halt in 2006. However, the ratio of M1 to nominal income did not decline when the Bank of Japan reduced the monetary base in 2006 and 2007.

What about inflation? Figure 6 shows the time path of the ratio of base money to nominal income (thin solid line) together with consumer price inflation (thick solid line). Clearly, between 1999 and 2000, the rate of change in the price level had moved into negative territory. With its announcement in March 2001, the Bank of Japan attempted to influence longer-run inflation expectations by stating that it would stick with its new measures until consumer price inflation would register stably at zero or an increase year on year. In 2001, the consumer price index continued to fall at a slowly increasing rate. By February 2002, it was at −1.6%. However, as the central bank continued to expand base money dramatically throughout 2002, the rate of price change moved back toward zero. By 2006, it appeared to have stabilized around zero or a slightly positive rate. Thus, in 2006, the Bank of Japan removed the quantitative monetary stimulus, as announced, and it did so rather quickly. Clearly, Japan did not experience the self-reinforcing process of accelerating

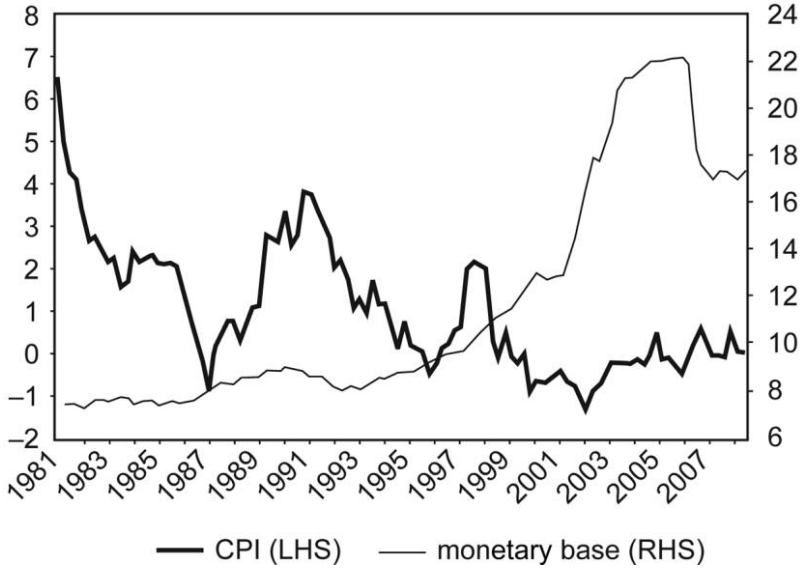

Fig. 6. Base money and CPI inflation in Japan, 1981–2008, quarterly observations

deflation and deepening recession that is typically associated with a liquidity trap. The return of price stability coincided with the sustained shift of the Bank of Japan to quantitative monetary policy and direct asset purchases.

Of course, establishing evidence of causality between quantitative easing and inflation would require further detailed empirical analysis. However, the following observations appear in order. The Bank of Japan's vigorous quantitative easing did not stimulate a dangerous surge of inflation beyond the announced objective of zero. Thus, exiting from a period of quantitative easing in time and preventing significant overshooting of inflation is possible. In light of the recent reemergence of deflation in the course of the global financial crisis of 2007 through 2009, however, one might have wished that the Bank of Japan would have allowed a greater increase in inflation and nominal interest rates so as to establish some buffer space for future deflationary shocks. In fact, already in 1997 and 1998, commentators had proposed a positive inflation target for Japan. A much-cited example is Krugman (1998). Orphanides and Wieland (1998) suggested that a 2% inflation target would provide an appropriate buffer together with an equilibrium real interest rate of 1%–2%.

III. Some Remarks on the Policy Measures of the European Central Bank and the Federal Reserve in Spring 2009

In the first half of 2009, many central banks around the world took steps to influence the quantity of money directly that were similar to those undertaken by the Bank of Japan in 2001. Focusing on two of these central banks, the Federal Reserve (Fed) and the European Central Bank (ECB), I will remark on some aspects of their decision making.

First, it is of interest to check what a standard benchmark such as Taylor's rule would prescribe with regard to the setting of the policy rate in the first quarter of 2009. This means using equation (1) with the original coefficients of 0.5 on the inflation and output gaps and values of the equilibrium real interest rate and the inflation target equal to 2%. While the Fed has not stated an explicit inflation target, the ECB's price stability objective is defined as close to but below 2%.

Consumer price index (CPI) inflation in the first quarter of 2009 was 0.9% in the euro area and −0.2% in the United States. While the ECB defines its price stability objective in terms of the overall CPI, the FOMC tends to focus on the personal consumption expenditures (PCE) deflator, which registered at 0.4% in the first quarter. With regard to the output

gap, neither the ECB nor the Fed publishes its estimate in real time. Comparable estimates of this gap are available from the International Monetary Fund (2009). In April, the IMF published output gap estimates of −4.1% in the United States and −4.3% in the euro area for the year 2009. Using these estimates, one can obtain interest rate prescriptions from Taylor's rule of 0.2% for the euro area and −1.3% for the United States (or −0.4% with the PCE deflator).

Against the background of such Taylor rule prescriptions, it is not surprising that the Fed moved toward quantitative easing earlier than the ECB. Even so, the ECB's policy rate of 1% remained rather high in light of the Taylor rule prescription and the case for preemptive policy easing discussed in the preceding section. Technically, the ECB has let the market rate move in the band between its repo rate of 1% and the deposit rate of 0.25%. This was accomplished by full allotment to banks demanding funds at the repo rate and by abstaining from fine-tuning liquidity-absorbing measures. Arguably, this approach induced some degree of uncertainty about the ECB's operating target in the money market compared to the past. Rather than using the remaining room for lowering the overnight policy rate, the ECB chose to offer 1-year repos at the same rate of 1% with full allotment starting in June. This measure added downward pressure to overnight money market rates within the corridor set by repo and deposit rates. Additional easing could have been provided by lowering the deposit rate and thereby raising the incentive for banks to lend to other banks in the interbank market. The ECB's direct asset purchases remained modest in magnitude. However, it was useful for market observers to learn that the ECB would have the instruments and willingness to engage in quantitative easing.

The Fed pursued its approach of credit or quantitative easing rather forcefully. In this regard, an important question for market observers concerns the appropriate magnitude of balance sheet expansion. The Fed has initiated a significant number of new tools and asset purchase programs. However, it has refrained from explaining what effect it would expect from a particular amount of direct asset purchases and what effect it would consider appropriate. In this manner, policy has shifted from rates to quantities but has abandoned the notion of a precisely quantified operating target. An operating target could in principle be stated for the overall quantity of base money. Consistent with the Fed's reliance on the effects of the composition of asset purchases in particular markets, such operating targets could also be stated with regard to the particular premia the Fed is hoping to influence.

The arguments and evidence presented in this note suggest that quantitative easing can be a powerful tool for avoiding deflation. A note of caution, however, is in order. In 2002, then-Governor Bernanke noted: "Japan's economy faces some significant barriers to growth besides deflation, including massive financial problems in the banking and corporate sectors and a large overhang of government debt" (Bernanke 2002). This warning is not without some relevance for the United States and other economies in the year 2009.

Endnotes

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1. Bank of England, news release, March 5, 2009, http://www.bankofengland.co.uk.

2. Board of Governors of the Federal Reserve System, press release, "FOMC Statement," March 18, 2009, http://www.federalreserve.gov.

3. Bank of Japan, news release, "New Procedures for Money Market Operations and Monetary Easing," March 19, 2001, http://www.boj.or.jp/en/type/release/zuiji/kako02/k010319a.htm.

4. The model was reestimated, and a revised, shortened version of the paper was published as Coenen, Orphanides, and Wieland (2004).

5. Bernanke (2002) referred to this rationale for preemptive interest rate easing.

6. Coenen and Wieland (2004) further study the relative benefits of exchange rate policy as suggested by Svensson (2001) and McCallum (2002) and price-level targeting as proposed by Eggertson and Woodford (2003) to avoid a deflationary trap and ameliorate the negative effects of the zero bound.

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