Quantitative Easing:

A Rationale and Some Evidence from Japan*

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Abstract

This paper reviews the rationale for quantitative easing when central bank policy rates reach near zero levels in light of recent announcements regarding direct asset purchases by the Bank of England, the Bank of Japan, the U.S. Federal Reserve and the European Central Bank. Empirical evidence from the previous period of quantitative easing in Japan between 2001 and 2006 is presented. During this earlier period the Bank of Japan was able to expand the monetary base very quickly and significantly. Quantitative easing translated into a greater and more lasting expansion of M1 relative to nominal GDP. Deflation subsided by 2005. As soon as inflation appeared to stabilize near a rate of zero, the Bank of Japan rapidly reduced the monetary base as a share of nominal income as it had announced in 2001. The Bank was able to exit from extensive quantitative easing within less than a year. Some implications for the current situation in Europe and the United States are discussed.

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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 ½ percent and announced that it would "*undertake a programme of asset purchases of £75 billion financed by the issuance of central bank reserves.*" Shortly thereafter, on March 18, the Federal Reserve anticipated publicly that economic conditions would require keeping the policy rate at 0 to ¼ percent for an extended period of time and announced additional measures to increase its balance sheet. In particular, the 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*."

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 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 extensively used direct asset purchases to support the magnitude of its balance sheet.

The European Central Bank stayed on the sidelines for a bit longer, but eventually announced direct purchases of covered bonds on May 7, 2009. However, the extent of direct asset purchases was much smaller than in the case of the other central banks. Instead, the ECB relied more heavily on the effect of an expansion of its repo operations to a 1-year horizon.

For long-time observers of the Japanese economy such central bank announcements are very familiar. Japanese money market rates fell below 1 percent in 1995 and declined towards 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*". 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 (excl. 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 percent 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.[1] This model incorporates forward-looking behaviour 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 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

[1] The model was re-estimated and a revised, shortened version of the paper published as Coenen, Orphanides and Wieland (2004).

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:

$$i_t = r^* + \pi_t + \alpha_\pi(\pi_t - \pi^*) - \alpha_y(y_t - y_t^*) \quad (1)$$

Here, 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, while y_t and y^* denote current and potential output. 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 o 0.5 and sets the equilibrium real rate and inflation target both to 2 per cent.

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:

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

Here, 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 when the interest rate is near zero than in normal circumstances. The optimal policy expressed in base money exhibits a kink at the point when 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 pre-emptively, whenever it expects to enter a period of deflation.[2]

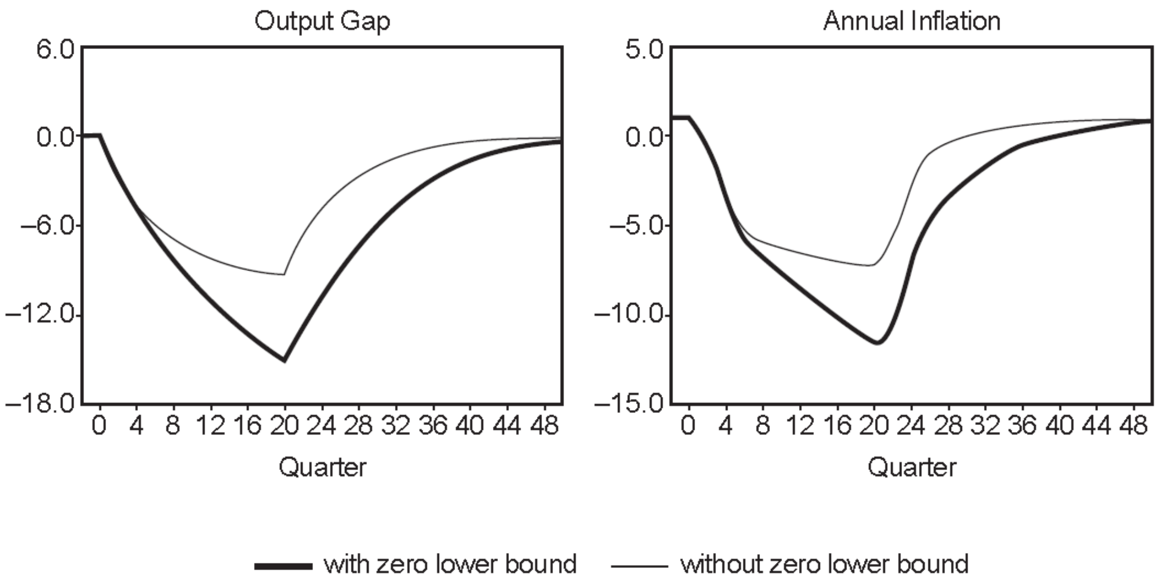
Coenen and Wieland (2003) estimate a dynamic, stochastic, three-country model of the United States, the Eurozone and Japan in order to assess the impact of the zero bound under alternative policies such as those proposed by Orphanides and Wieland (2000).[3] They investigate a scenario in which the Japanese economy is hit by a severe recession and deflation and compare Taylor's rule (i.e. equation (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.

[2] Bernanke (2002) referred to this rationale for pre-emptive interest rate easing.
[3] 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.

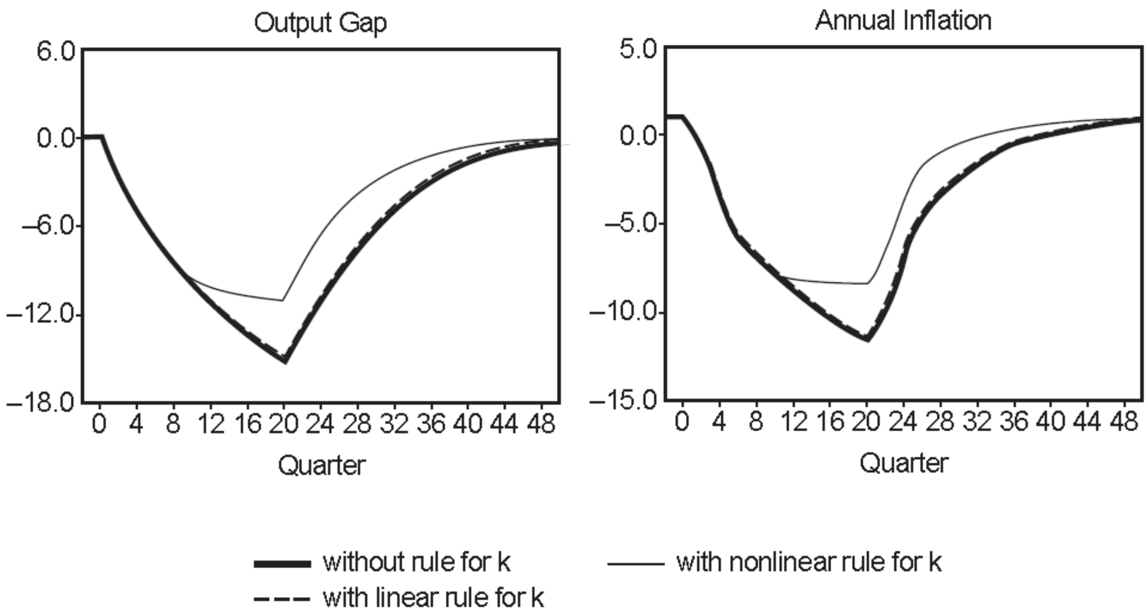
With the nominal rate bounded at zero, deflationary shocks increase the real interest rate and exchange rate and thereby worsen the recession and deflation. This mechanism is potentially self-reinforcing and suggests the possibility of a deflationary spiral and collapse of the economy. In the simulation, 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.

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



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 policy response the real interest rate rises during the deflation (thick solid line). The expansion in base money reduces

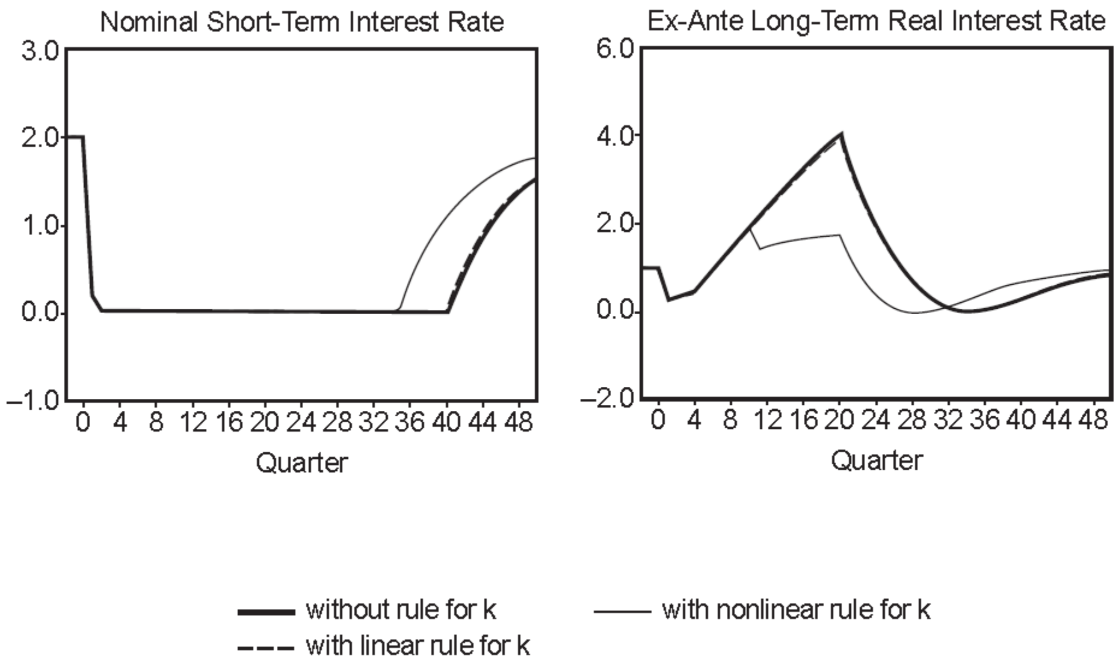
Figure 2. Base money expansion ameliorates the effect of the zero bound (from Coenen and Wieland (2003)).



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.

Figure 3. The effect of base money expansion on nominal and real interest rates (from Coenen and Wieland (2003)).

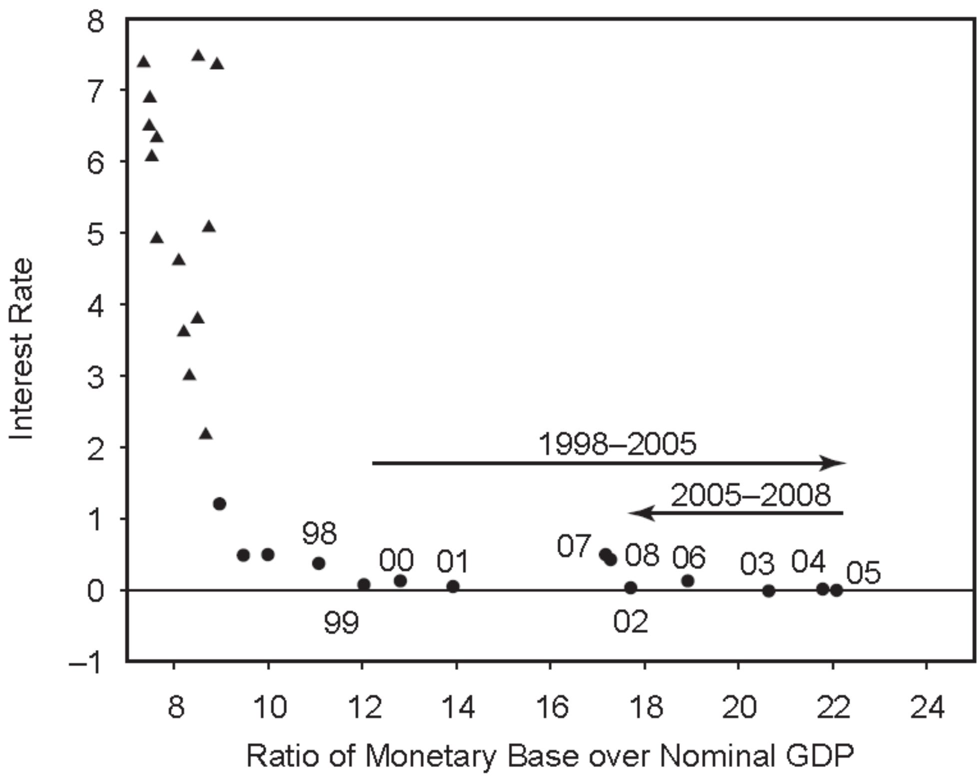


II. The Impact of Quantitative Easing on Money Growth and Inflation in Japan

Having established the case for quantitative easing 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 typically varied inversely with the money market rate as suggested by standard money demand theory.

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



From 1998 onwards 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 percent of nominal income and averaged 20 percent 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 percent by 2007 and averaged near that level in 2008.

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

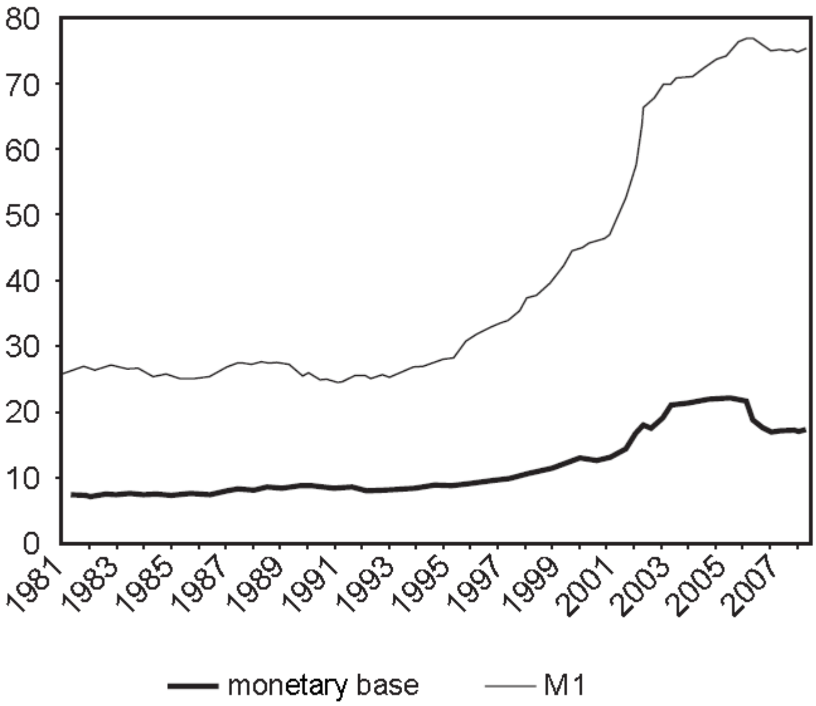
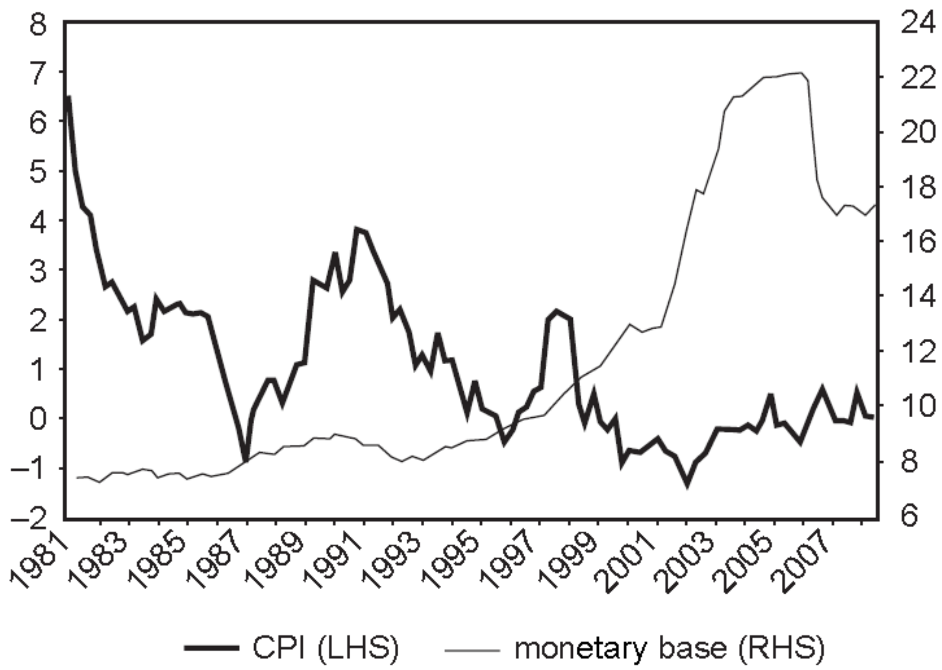


Figure 5 compares the time path of base money (thick solid line) and M1 (thin solid line) relative to nominal income. As base money grew, so did M1. In fact, between 2001 and 2005 it increased by more than 30 percent of nominal income. Thus, the expansion of base money engineered by the central bank 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 (thick solid line) together with consumer price inflation (thin 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

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



consumer price inflation would register stably at zero percent or an increase year on year. In 2001 the cosumer price index continued to fall at a slowly increasing rate. By February 2002 it was at -1.6 percent. However, as the central bank continued to expand base money dramatically throughout 2002, the rate of price change moved back towards zero. By 2006 it appeared to have stabilized around zero percent 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 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 percent. Thus, exiting from a period of quantitative easing in time and preventing significant overshooting of inflation is possible. In light of the recent re-emergence of deflation in the course of the global financial crisis of 2007-09, 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 1997-98 commentators had proposed a positive inflation target for Japan. A much-cited example is Krugman (1998). Orphanides and Wieland (1998) suggested that a 2 percent inflation target would provide an appropriate buffer together with an equilibrium real interest rate of 1 to 2 percent.

III. Some Remarks on the Policy Measures of the ECB and the Fed 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 and the European Central Bank 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 ½ on the inflation and output gaps and values of the equilibrium real interest rate and the inflation target equal to 2 percent. While the Fed has not stated an explicit inflation target, the ECB's price stability objective is defined as close to but below 2 percent.

CPI inflation in the first quarter of 2009 was 0.9 percent in the euro area and -0.2 percent 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 PCE deflator which registered at 0.4 percent 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 percent in the United States and -4.3 percent in the euro area for the year of 2009. Using these estimates one can obtain interest rate prescriptions from Taylor's rule of 0.2 percent for the euro area and -1.3 percent for the United States (or -0.4 percent with the PCE deflator).

Against the background of such Taylor rule prescriptions it is not surprising that the Fed moved towards quantitative easing earlier than the ECB. Even so, the ECB's policy rate of 1 percent remained rather high in light of the Taylor rule prescription and the case for pre-emptive policy easing discussed in the preceding section. Technically, the ECB has let the market rate move in the band between its repo rate of one percent and the deposit rate of ¼ percent. 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 one percent 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 Federal Reserve 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 support the case for quantitative easing as a powerful tool for combating 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*". This warning is not without some relevance for the United States and other economies in the year 2009.

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