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Quantitative and Qualitative Monetary Easing: Assessment of Its Effects in the Two Years since Its Introduction

Monetary Affairs Department

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Two years have passed since the Bank of Japan introduced quantitative and qualitative monetary easing (QQE) in April 2013. This article considers attempts to assess the effects of QQE on Japan's economic and financial developments during this period. The start of the transmission mechanism of QQE is as follows: (1) inflation expectations will be raised through a strong and clear commitment to the price stability target of 2 percent and large-scale monetary expansion to underpin the commitment; and concurrently, (2) downward pressure will be put on the entire yield curve through the Bank's massive purchases of Japanese government bonds (JGBs); thereby (3) decreasing real interest rates. On that basis, the assessment of QQE's effects was made in the following two stages: in the first stage, the degree of the decline in real interest rates was gauged; and in the second stage, the extent to which the decline in real interest rates affected economic activity and prices was assessed. The results of the assessment could be judged to be that (a) QQE lowered real interest rates by slightly less than 1 percentage point and (b) the actual improvement in economic activity and prices was mostly in line with the mechanism anticipated by QQE. Recently, however, the year-on-year rate of increase in the consumer price index slowed, mainly due to the effects of the decline in crude oil prices. Looking ahead, due attention needs to be paid to how the decline in the actual inflation rate will affect inflation expectation formation.

Introduction

Two years have passed since the Bank introduced QQE in April 2013. This article considers attempts to assess the effects of QQE on Japan's economic and financial developments. The start of the transmission mechanism of QQE is as follows: (1) inflation expectations will be raised through a strong and clear commitment to the price stability target of 2 percent and large-scale monetary expansion to underpin the commitment; and concurrently, (2) downward pressure will be put on the entire yield curve through the Bank's massive purchases of JGBs; thereby (3) decreasing real interest rates. According to this mechanism, the assessment of QQE's effects was made in two stages. In the first stage, the degree of the decline in real interest rates was gauged. Next, in the second stage, the extent to which the decline in real interest rates affected economic activity and prices was assessed. In principle, the period in which the effects were assessed was from the January-March quarter of 2013 to the October-December quarter of 2014.[1]

In the following, the transmission mechanism of QQE will be explained and then the developments in major economic indicators over the past two years will be outlined.

The Mechanism of QQE

The Bank envisioned the following mechanism of QQE when it was introduced (Chart 1).

(1) Conversion of the deflationary mindset and a rise in people's inflation expectations will be realized through the Bank's implementation of large-scale monetary expansion under two types of its commitments; namely, a strong and clear commitment to achieving the price stability target of 2 percent at the earliest possible time, with a time horizon of about two years, and a commitment to continue with QQE as long as it is necessary for maintaining that target in a stable manner.

(2) Downward pressure will be put on nominal interest

rates across the entire yield curve through massive purchases of JGBs.

(3) Real interest rates will be lowered due to the effects of (1) and (2).[2]

(4) The decline in real interest rates will stimulate private demand, which will lead to an upturn in the economy and to an improvement in the output gap.

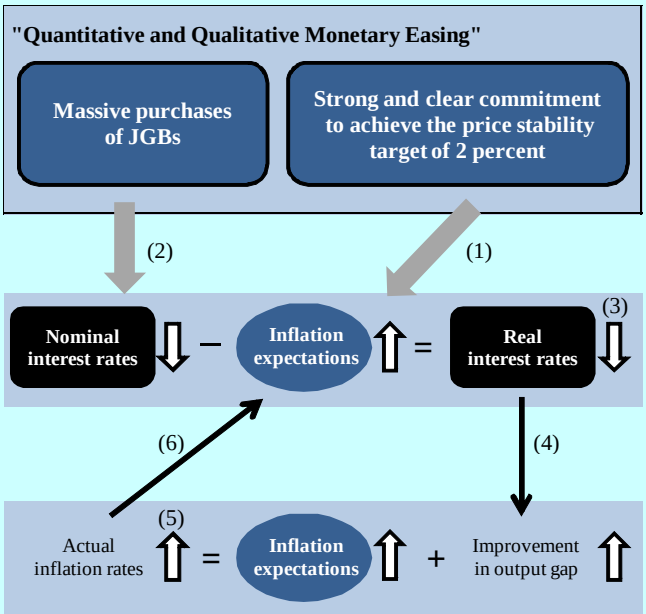
(5) With the output gap improving, together with a rise in people's inflation expectations as described in (1), actual inflation rates will rise.

(6) As the actual inflation rate increases, people's inflation expectations will increase further.

(7) Meanwhile, on the financial front, asset prices such as stock prices and exchange rates will be formed reflecting, or in anticipation of, the aforementioned movements in the economy and prices.

(8) Moreover, due to the strengthening of investors' preference for risky assets -- portfolio rebalancing effects -- not only positive effects on the prices of such assets but also those on the quantitative side of finance, including an increase in lending, can be expected.[3]

[Chart 1] Mechanism of QQE



Economic and Financial Developments after the Introduction of QQE

Since the introduction of QQE, substantial changes have been observed in developments in the financial market, the real economy, and prices. Based on the aforementioned eight steps of the mechanism, it can be confirmed from various indicators and economic phenomena that, at least qualitatively, QQE has brought some changes. For example, expected inflation rates that can be assessed from surveys and market-based indicators have been increasing; in addition, firms' wage- and price-setting behavior has been changing, as seen in an increase in wages for two consecutive years. Moreover, it is obvious from the developments in market interest rates that strong downward pressure has been exerted on the entire yield curve; thus, it is likely that real interest rates have declined considerably and have been in negative territory. In this situation, the improvement in the output gap has been widely acknowledged in view of the labor shortage and other episodes. On the price front, the year-on-year rate of change in the consumer price index (CPI, for all items less fresh food and excluding the direct effects of the consumption tax hikes), which had been in negative territory, has turned positive and registered positive figures for 20 consecutive months until January 2015 (the rate has recently been about 0 percent due to the effects of the sharp decline in crude oil prices). Turning to financial developments, stock prices have increased significantly and the yen has depreciated. The year-on-year rate of change in the amount outstanding of bank lending had been in negative territory or slightly positive before the introduction of QQE. However, the rate of increase in bank lending has recently been accelerating, including the lending to small and medium-sized firms. In the following, this article assesses these changes that took place in the economy and the financial market.

Assessment of QQE's Effects on Real Interest Rates

As the first stage of the assessment, the degree of decline in real interest rates will be measured. This corresponds to a quantification of the effects of steps (1) to (3) in the aforementioned mechanism, and allows for gauging the degree of decline in nominal interest rates and the degree of increase in inflation expectations. As for the nominal interest rate in step (2), this is observable as market data. By contrast, the size of changes in the inflation expectations in step (1) is mooted in terms of quantification. The reason for the dispersion in estimates of the degree of decline in real interest rates is because developments in inflation expectations cannot be observed in reality. In this article, a multifaceted assessment will be conducted for estimation of the degree of decline in real interest rates by adopting four approaches: (i)

calculating changes in inflation expectations by using observable data, such as surveys; (ii) estimating the trend inflation from changes in the shape of the Phillips curve, and interpreting such changes as those in medium- to long-term inflation expectations; (iii) estimating the effects of the Bank's JGB purchases by performing a regression analysis and estimating the downward effects on real interest rates; and (iv) measuring the equilibrium yield curve by using a term structure model of interest rates, and with the changes in "real interest rate gaps" obtained from the calculation (the differences between the equilibrium interest rates and (survey data based) actual real interest rates for each maturity), computing the downward effects of QQE on real interest rates.

Observational Approach

The degree of decline in nominal long-term interest rates is about 0.3 percentage point for 10-year yields. The degree of change in inflation expectations differs largely depending on survey results used, and is within the range of about 0-5 percent (Chart 2). If figures for long-term inflation expectations obtained from surveys conducted of economists (the ESP Forecast) and market participants (the QUICK Survey) are used (the degree of increase is in the range of 0.4-0.5 percentage point), the degree of decline in real interest rates is in the range of around 0.7-0.8 percentage point.

[Chart 2] Nominal Interest Rates and Inflation Expectations

(a) Nominal Interest Rates

%, % points

I. 2013/Q1	II. 2014/Q4	Difference: II - I
0.7	0.4	- 0.3

Note: Figures are quarterly averages of 10-year JGB yields.

(b) Inflation Expectations [1]

%, % points

	2013/Q1 I.	2014/Q4 II.	Difference II - I
ESP Forecast[2]			
1 year ahead	0.2	1.1	+ 1.0
2 to 6 years ahead[3]	0.7	1.4	+ 0.7
7 to 11 years ahead[3]	1.0	1.5	+ 0.5
QUICK Survey			
Over the next year	0.1	1.9	+ 1.7
Over the next 2 years	0.6	1.7	+ 1.1
Over the next 10 years	1.1	1.5	+ 0.4
BEI for inflation-indexed JGBs (10 years)	-	1.1	-
Inflation swap rate (10 years)	0.8	1.1	+ 0.2
"Tankan"[4] (outlook for general prices)			
1 year ahead	-	1.4	-
3 years ahead	-	1.6	-
5 years ahead	-	1.7	-
Consumer Confidence Survey[5] (1 year from now)	1.9	3.0	+ 1.2
Opinion Survey on the General Public's Views and Behavior[6]			
From the previous year	0.2	5.0	+ 4.8
Over the next year	3.0	3.0	+ 0.0
Over the next 5 years	2.0	2.0	+ 0.0

Notes: 1. Figures for daily and monthly indexes are quarterly averages.
2. Figures exclude the effects of the consumption tax hikes.
3. Figures for 2013/Q1 are based on the December 2012 survey.
4. Figures are averages of all industries and enterprises.
5. Figures are for all households and are weighted averages. The weighted average is calculated based on the assumption described in the notes to Chart 43 of the April 2015 *Outlook for Economic Activity and Prices*.
6. Figures are medians.

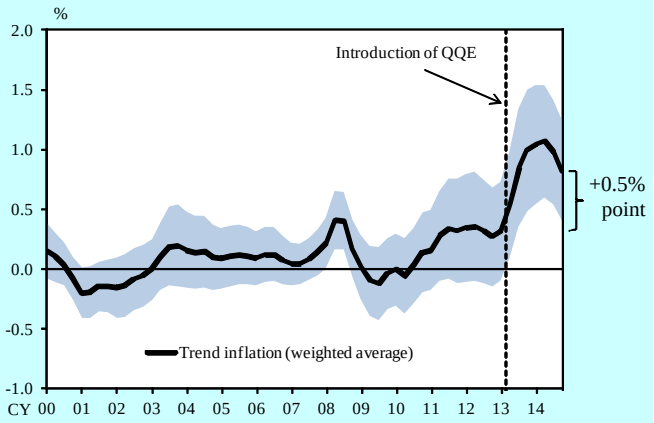
Sources: JCER, QUICK, Bloomberg, Bank of Japan, Cabinet Office

Trend Inflation Approach

The relationship between the CPI and the output gap was decomposed into changes in the trend inflation and changes in the slope of the Phillips curve. Specifically, on the assumption that the trend inflation transits at a certain probability between regimes for the trend inflation at one-percent intervals, the probability of the trend inflation being in each regime at each point of time was estimated. Accordingly, the weighted average of the trend inflation was 0.3 percent for the January-March quarter of 2013 (before the introduction of QQE), and 0.8 percent for the

October-December quarter of 2014, marking an increase of 0.5 percentage point (Chart 3).[4]

[Chart 3] Trend Inflation



Note: The shaded area indicates the one-standard-deviation band.

Regression Approach

Downward effects of the Bank's JGB purchases on real interest rates were estimated by performing a regression analysis in which a dependent variable of 10-year yields was used. The estimation results indicate that the accumulated effect of the purchases was minus 0.8 percentage point in terms of 10-year yields (Chart 4).[5]

[Chart 4] Downward Pressure on Long-Term Yields through Bank's JGB Purchases

Changes from the end of Mar. 2013 to the end of Dec. 2014

Increase in the amount outstanding of the Bank's JGB holdings	Increase in the share of the Bank's JGB holdings[1]	Downward pressure on long-term yields
+110 tril. yen	+19.3% points	-0.8% points

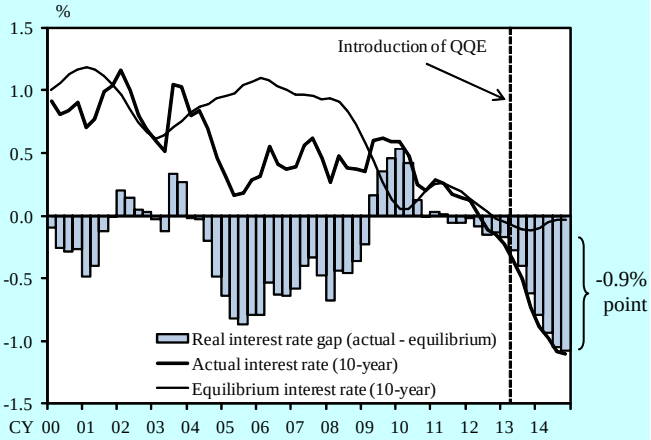
Note: 1. Ratio of the Bank's JGB holdings to the total amount outstanding of JGBs. Figures are calculated taking into account changes in the average remaining maturity of the Bank's amount outstanding of JGBs (excluding floating-rate JGBs and inflation-indexed JGBs).

Sources: Consensus Economics Inc., QUICK, Bank of Japan, Bloomberg, etc.

Equilibrium Interest Rates Approach

In order to grasp the effects of an unconventional monetary policy like QQE exerting downward pressure on the entire yield curve, the "equilibrium real yield curve" was estimated from the information obtained from the entire yield curve by expanding the concept of the "equilibrium real interest rates." Real interest rate gaps (in other words, the degree of monetary easing) are the differences between the equilibrium real interest rates and real interest rates, which are calculated by subtracting inflation expectations obtained from surveys, for each maturity. In this way, the changes in real interest rate gaps before and after the introduction of QQE were measured. Consequently, a change of about minus 0.9 percentage point (an increased degree of monetary easing) was estimated in the 10-year zone of the yield curve. This was regarded as the downward effects on real interest rates brought by QQE (Chart 5).[6]

[Chart 5] Real Interest Rate Gap



All the results obtained from these different approaches suggest that the estimated downward effects of QQE on real interest rates (in terms of 10-year yields) on a cumulative basis up through the October-December quarter of 2014 are slightly less than 1 percentage point.

Simulations of Financial and Economic Indicators

This section provides results of simulations run by using the Bank's macroeconometric model, the Quarterly Japanese Economic Model (Q-JEM)[7], based on the assumption that real interest rates have declined by slightly less than 1 percentage point accompanied by an increase in medium- to long-term inflation expectations as suggested by the results of the assessment in the first stage. The second stage of the assessment considers attempts to estimate the extent to which actual developments in the economy could be explained by the effects of QQE replicated by the Q-JEM. Accordingly, an assessment can be made by comparing the simulation results of the Q-JEM with actual changes in various financial economic indicators for the period from that immediately before the introduction of QQE (January-March quarter of 2013) to the recent quarter (October-December quarter of 2014).

Simulation 1 provides a result of the simulation -- using the Q-JEM -- regarding changes in major economic indicators based on the assumption that real interest rates have declined (expediently set at minus 0.8 percentage point) accompanied by an increase in medium- to long-term inflation expectations (an increase of 0.5 percentage point in the trend inflation at a steady state in the model). Simulation 2 provides a result of the simulation based on another assumption -- that both stock prices and the yen's exchange rates moved mostly in line with the actual developments -- in addition to the assumption regarding the above changes in medium- to long-term inflation expectations and in real interest rates (Chart 6).

Simulation 2 was run because actual changes in stock prices and the yen's exchange rates were far greater than those predicted in the Q-JEM, which was based only on the assumption in simulation 1. As seen in Chart 6, the degree of rise in stock prices was actually twice as much as that accounted for by simulation 1, and the degree of depreciation of the yen was actually three times larger than that accounted for by simulation 1. One factor behind these discrepancies could be that, of the effects of QQE, there could be additional policy effects that cannot be gauged by changes in real interest rates replicated in the Q-JEM. [8] Moreover, the effects of the government's economic stimulus measures, as well as external factors -- such as developments in global financial markets -- could also be applicable as contributing factors to the discrepancies. This means that, while the effects of QQE have partly been reflected on the actual developments in the economy, other factors have also given a boost.

Therefore, the result of simulation 1 could be somewhat underestimating the effects of QQE while that of simulation 2 could be somewhat overestimating those effects.

Interpretation of the Assessment Result

Looking at the two simulation results in light of the examination so far, that of simulation 1 indicated that the output gap has been pushed up by 1.1 percentage points and that the year-on-year rate of increase in the CPI has increased by 0.6 percentage point. The result of simulation 2 indicated that the output gap has improved by about 3.0 percentage points and that the year-on-year rate of increase in the CPI has increased by 1.0 percentage point (Chart 6).

[Chart 6] Estimated Transmission Effects

Changes in Economic and Financial Indicators from 2013/Q1 to 2014/Q4

	Estimations using macroeconomic model[1,2]		Actual
	Simulation 1	Simulation 2	
Real interest rates	-0.8% points	-0.8% points	slightly less than -1% point
Medium- to long-term inflation expectations	+0.5% points	+0.5% points	-
Stock prices (TOPIX)	+18%	+40%	+40%
Exchange rates (yen/U.S. dollar)	+8%	+25%	+24%
Output gap[3]	+1.1% points	+3.0% points	+2.0% points
CPI[4] (all items less fresh food, y/y % chg.)	+0.6% points	+1.0% points	+1.0% points
Real GDP	+6 tril. yen	+16 tril. yen	+1 tril. yen
Private consumption	+2 tril. yen	+5 tril. yen	-4 tril. yen
Private non-resi. investment	+3 tril. yen	+7 tril. yen	+3 tril. yen
Nominal compensation of employees	+2 tril. yen	+5 tril. yen	+6 tril. yen
Corporate profits[5]	+4 tril. yen	+9 tril. yen	+12 tril. yen

Notes: 1. The simulations are run by adopting the Quarterly Japanese Economic Model (Q-JEM) developed by the Bank of Japan.
2. Shaded areas indicate assumptions on the simulations. Figures for medium- to long-term inflation expectations are those at the steady state in the model.
3. The output gap is estimated by the Research and Statistics Department, Bank of Japan. For the estimation procedures, see "The New Estimates of Output Gap and Potential Growth Rate," Bank of Japan Review Series, 2006-E-3.
4. Figures are adjusted to exclude the estimated effect of changes in the consumption tax rate.
5. Figures for estimations are based on the operating surplus as the residual of SNA. Figures for actual are based on operating profits of "Financial Statements Statistics of Corporations by Industry, Quarterly" and are the total for enterprises of all sizes and in all industries. The finance and insurance industry is excluded.

Sources: Cabinet Office, Ministry of Internal Affairs and Communications, Bloomberg, Ministry of Finance, etc.

Meanwhile, the actual degree of improvement in the output gap was 2.0 percentage points, an increase from minus 2.1 percent to minus 0.1 percent, and the rate of change in the CPI increased by 1.0 percentage point, from minus 0.3 percent to 0.7 percent. These figures sit within the ranges of the results obtained from the two simulations. From the comparison between the results of these simulations and the actual degree of improvement in economic activity and prices, it could be judged that such improvement was mostly in line with the mechanism anticipated by QQE.

Looking at these comparisons between the actual figures and simulated figures in greater detail, as for actual indicators of the real economy, there were both stronger and weaker data relative to the predicted improvement in the output gap in the two simulations. On the one hand, demand component data for real GDP -- particularly private consumption -- point to considerably weaker improvements than predicted in simulation 1. On the other hand, actual increases in corporate profits and employee income -- both of which correspond to the distribution components of real GDP -- noticeably exceed the model's prediction in simulation 2.

It is obvious that QQE is just one factor that has affected Japan's financial and economic developments during the past two years. The following major factors other than QQE could be noted: developments in stock prices and foreign exchange rates (other than those brought about by QQE); the government's high spending, such as that on public investment; the consumption tax hike; and developments in crude oil prices.[9]

Even with such major factors underway, overall improvement in the economy and prices was only slightly stronger compared to the result in simulation 1, perhaps because the above factors exerted either upward or downward effects, broadly offsetting each other. It cannot be stated for certain without quantitatively assessing these factors individually, but saying this in a reverse manner, it can be considered that the above assessment made in a two-stage approach does not deviate substantially from reality.

Caveats to this assessment include that there are large differences in the results depending on which indicators are used, as seen in the aforementioned differences in indicators for the real economy, and that data -- typified by those on inflation expectations -- are subject to a substantial margin of error in the estimation. It is necessary to consider these caveats and limitations to the assessment. However, providing a certain quantitative analysis regarding the transmission mechanism of and effects of QQE could contribute to stimulating future discussions on this subject.

Concluding Remarks

Although there are some caveats, it can be confirmed that changes in various economic and financial indicators have been in line with the mechanism anticipated by QQE. Looking at the developments after the period in which the effects were assessed (from the January-March quarter of 2013 to the October-December quarter of 2014), the year-on-year rate of increase in the CPI slowed and has recently been about 0 percent. While the slowdown was mainly due to the effects of the decline in crude oil prices observed after the second half of fiscal 2014, the basic transmission mechanism of QQE's effects, which has been explained above, can be considered as continuing to operate. Nevertheless, in order to achieve the price stability target of 2 percent in a stable manner, a further rise in inflation expectations is necessary. On this point, due attention needs to be paid to how the decline in the actual inflation rate due to the sharp fall in crude oil prices will affect the inflation expectation formation ((1) and (6) in Chart 1), particularly in relation to adaptive expectation formation ((6) in Chart 1).

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[1] Given that some indicators are updated only semiannually, figures for December 2012 are used for those for the January-March quarter of 2013.

[2] Under QQE, the Bank has also purchased exchange-traded funds (ETFs) and Japan real estate investment trusts (J-REITs). These purchases can be considered to be reinforcing the whole process of QQE mainly through the strengthening of steps (7) and (8). However, an analysis in this article mainly focuses on a quantification of the effects of decline in real interest rates.

[3] Among these steps, steps (1) through (6) in the mechanism of QQE can be rephrased by using terminologies for the standard framework of macroeconomics. Step (1) corresponds to a price stability target of the central bank, which normally refers to a situation where inflation is anchored to the target. Step (2) corresponds to monetary policy conduct, which normally refers to a monetary policy reaction function that controls short-term interest rates. Step (3) corresponds to the Fisher equation. Step (4) corresponds to the IS curve. Step (5) corresponds to the Phillips curve. Steps (1) and (6) correspond to inflation expectation formation.

[4] For details of the analysis, see: Sohei Kaihatsu and Jouchi Nakajima (2015), "Has Trend Inflation Shifted?: An Empirical Analysis with a Regime-Switching Model," Bank of Japan Working Paper Series, No.15-E-3.

[5] Explanatory variables are (1) ratio of the Bank's JGB holdings to the total amount outstanding of JGBs***, (2) U.S. treasury yields***, (3) inflation expectations*, and (4) expected real GDP growth rates**. The result of the statistical significance test for the coefficient of each explanatory variable indicates that asterisks denote statistical significance; namely, *** at 1 percent, ** at 5 percent, and * at 10 percent. The estimation period is from the October-December quarter of 2005 to the October-December quarter of 2014 (quarterly data). The estimation equation used is as follows.

JGB yields (10-year, %) = 0.197 - 0.042 × ratio of the Bank's JGB holdings to the total amount outstanding of JGBs (%) + 0.197 × U.S. treasury yields (10-year, %) + 0.212 × inflation expectations (over the next 10 years, %) + 0.422 × expected real GDP growth rates (over the next 10 years, %)

Data used for this regression analysis are obtained from the QUICK Survey for inflation expectations, and from the Consensus Forecasts for expected real GDP growth rates.

[6] For details of the analysis, see: Kei Imakubo, Haruki Kojima, and Jouchi Nakajima (2015), "The natural yield curve: its concept and developments in Japan," Bank of Japan Research Laboratory Series, No.15-E-3.

[7] Q-JEM is a large-scale macroeconometric model with over 200 variables that are essential for analyzing Japan's economy, including indicators of the real economy, financial indicators, and indicators of expectations. For details, see: Fukunaga et al. (2011), "The Quarterly Japanese Economic Model (Q-JEM): 2011 Version," Bank of Japan Working Paper Series, No.11-E-11.

[8] A simulation using a macroeconomic model based on past data cannot fully replicate recent (and/or ongoing) structural changes and changes in expectations of economic entities accompanying a policy regime change as well as resultant developments in stock prices and foreign exchange rates.

[9] Unquestionably, whether policy effects might materialize depends on the conditions and behavior of the private sector. In other words, with QQE, the government's various stimulus measures, and other external factors at work, private agents such as firms have become more proactive in their risk-taking and various cumulative efforts have borne fruit, which has led to the improvement in the economy and prices.

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