

(Box 4) Inflation Expectations Formation and the Phillips Curve

Although considerable uncertainties remain regarding the pace of increase in forward-looking inflation expectations, it would be highly problematic to disregard the forward-looking inflation expectations in projecting price developments and focus only on the adaptive or backward-looking inflation expectations.

In this respect, as an example, a simple comparison was made to examine the extent to which the performance of the Phillips curve differs depending on the specifications of inflation expectations, by focusing on the inflation rates since the introduction of QQE (Box Chart 7). Specifically, a dynamic simulation was conducted of inflation developments since the introduction of QQE using the following two types of Phillips curves: (1) a hybrid one, which takes into consideration both the forward-looking and adaptive inflation expectations formation, and (2) a purely backward-looking one, in which only the adaptive inflation expectations formation is taken into account. It should be noted that both of these Phillips curves include a foreign exchange rate as an explanatory variable.

Simulation results indicate that, as the forward-looking inflation expectations have risen clearly in a period of over one year from the introduction of QQE in April 2013 through summer 2014 -- referred to as "Phase 1" in the Bank's Comprehensive Assessment -- the performance of the Phillips curve with purely backward-looking inflation expectations formation is significantly lower than that of the one with the hybrid inflation expectations formation.²⁸ These results suggest that, in a phase where the forward-looking inflation expectations change significantly -- as in the period since the introduction of QQE -- there is a risk of misperception regarding the change in the underlying trend in the inflation rate if projections are made based only on the adaptive inflation expectations while disregarding the forward-looking inflation expectations. As the environment at present -- in which the yen is depreciating and government spending is expanding -- resembles that of Phase 1, it is

²⁸ For details of the division of inflation expectations into phases, see the Bank's *Comprehensive Assessment: Developments in Economic Activity and Prices as well as Policy Effects since the Introduction of Quantitative and Qualitative Monetary Easing (QQE)* released in September 2016.

especially important to take into account the forward-looking inflation expectations in making the projections in this Outlook Report.

Inflation Expectations Formation and the Phillips Curve

(1) Phillips Curve Specifications

(a) Hybrid Inflation Expectations Formation

$$\begin{aligned} \pi_t = & \beta_0 + \beta_1 \times \pi_t^e + \beta_2 \times \pi_{t-1} + (1 - \beta_1 - \beta_2) \times \pi_{t-2} \\ & + \beta_3 \times \text{GAP}_t \\ & + \beta_4 \times (\text{NEER}_{t-1} + \text{NEER}_{t-2} + \text{NEER}_{t-3})/3 \\ & + \Omega \times (\text{dummy variables for special factors}) \end{aligned}$$

β_0	-0.32 ***
β_1	0.29 ***
β_2	0.49 ***
β_3	0.07 ***
β_4	-0.06 ***
Adj. R ²	0.80
S.E.	0.27

(b) Purely Backward Looking Inflation Expectations Formation

$$\begin{aligned} \pi_t = & \beta_1 \times \pi_{t-1} + \beta_2 \times (\pi_{t-2} + \pi_{t-3} + \pi_{t-4})/3 \\ & + \beta_3 \times \text{GAP}_t \\ & + \beta_4 \times (\text{NEER}_{t-1} + \text{NEER}_{t-2} + \text{NEER}_{t-3})/3 \\ & + \Omega \times (\text{dummy variables for special factors}) \end{aligned}$$

β_1	0.52 ***
β_2	0.28 ***
β_3	0.09 ***
β_4	-0.07 ***
Adj. R ²	0.79
S.E.	0.27

* π : CPI less fresh food, energy, and house rent (seasonally adjusted q/q % changes, annualized).

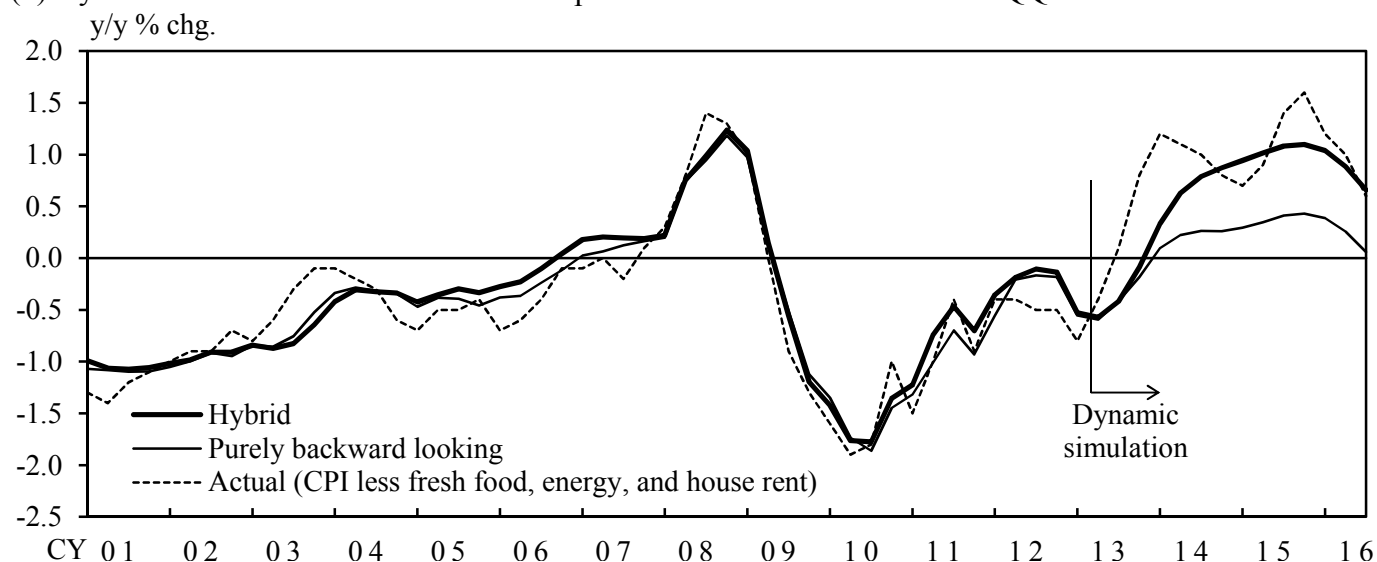
π^e : medium- to long-term inflation expectations (%).

GAP: output gap (%). NEER: yen's nominal effective exchange rate (q/q % changes).

* The estimation period is 1990/Q1-2016/Q3. *** denotes statistical significance at the 1% level.

S.E. represents the standard errors for the estimated y/y % changes.

(2) Dynamic Simulation of Inflation Developments Since the Introduction of QQE



- Notes: 1. Figures for the CPI (less fresh food, energy, and house rent) are calculated by the Research and Statistics Department, Bank of Japan. Figures for the CPI are adjusted to exclude the estimated effects of changes in the consumption tax rate.
2. The output gap is estimated by the Research and Statistics Department, Bank of Japan.
3. Figures for medium- to long-term inflation expectations are the expectations for the CPI 6 to 10 years ahead and are based on the "Consensus Forecasts." In the estimations, dummy variables are included in order to control for the estimated effects of special factors such as the introduction of a subsidy for high school tuition.
4. In the dynamic simulation, the CPI is recursively estimated using only the backward-looking inflation expectations terms. With regard to medium- to long-term inflation expectations, the output gap, and the nominal effective exchange rate of the yen perfect foresight is assumed.

Sources: Ministry of Internal Affairs and Communications; Cabinet Office; BIS; Consensus Economics Inc., "Consensus Forecasts," etc.