



Bank of Japan Working Paper Series

Supplementary Paper Series for the "Comprehensive Assessment" (4)

Why Did the BOJ Not Achieve
the 2 Percent Inflation Target
with a Time Horizon of About Two Years?
— Examination by Time Series Analysis —

Takuji Kawamoto^{*}
takuji.kawamoto@boj.or.jp

Moe Nakahama^{**}
moe.nakahama@boj.or.jp

No.17-E-10
July 2017

Bank of Japan
2-1-1 Nihonbashi-Hongokucho, Chuo-ku, Tokyo 103-0021, Japan

^{*} Research and Statistics Department (currently at the Financial System and Bank Examination Department)

^{**} Research and Statistics Department

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**Why Did the BOJ Not Achieve the 2 Percent Inflation Target
with a Time Horizon of About Two Years?
— Examination by Time Series Analysis —**

Takuji Kawamoto and Moe Nakahama
Bank of Japan

Abstract: This paper explores why the inflation rate of CPI – which excludes volatile fresh foods – failed to reach the 2 percent “price stability target” even after more than three years had passed since the Bank of Japan (BOJ) introduced the Quantitative and Qualitative Monetary Easing (QQE) in April 2013. Specifically, we provide empirical evidence for what factors caused the actual CPI inflation rate to fall short of the BOJ’s original forecast made in April 2013, by using historical decomposition technique of simple VAR analysis. The empirical results show that among the deviation of the CPI inflation rate for fiscal 2015 from the original forecast of minus 1.9 percentage points – the difference between the forecast of 1.9 percent and the actual result of 0.0 percent – about 50 percent (minus 1.0 percentage points) can be attributed to the unexpected decline in oil prices. A little more than 10 percent (minus 0.3 percentage points) can be explained by the unexpected slump in output gap and a little more than 30 percent (minus 0.7 percentage points) by inflation-specific negative shocks. These inflation-specific negative shocks are measured as declines in the inflation rate which cannot be explained by fluctuations in the output gap, oil prices, and the nominal exchange rate, and thus imply that inflation expectations did not rise as much as originally anticipated by the BOJ.

This paper is a supplement to “Comprehensive Assessment: Developments in Economic Activity and Prices as well as Policy Effects since the Introduction of Quantitative and Qualitative Monetary Easing (QQE)” released by the Bank of Japan in September 2016. We are grateful to Toshitaka Sekine, Koji Nakamura, Yoshihiko Hogen and other BOJ staff for helpful comments and suggestions. Special thanks to Hiroshi Kawata for his data support. All remaining errors are, of course, our own.

1. Introduction

In April 2013, the Bank of Japan (BOJ) introduced the “Quantitative and Qualitative Monetary Easing” (QQE), making a strong and clear commitment to achieve the “price stability target” of 2 percent at the earliest possible time, with a time horizon of about two years. Thereafter, the performance of Japan’s economy has improved significantly, and it is no longer in deflation, which is generally defined as a sustained decline in general prices. However, the price stability target of 2 percent was not achieved in September 2016, when the BOJ made “comprehensive assessment” of its massive monetary easing more than three years after its introduction of the QQE. In this respect, the BOJ’s outlook report released in April 2013 showed that inflation forecast (median of the policy board members’ forecasts) measured by the year-on-year inflation rate of the CPI excluding volatile fresh foods was 0.7 percent, 1.4 percent and 1.9 percent for fiscal 2013, 2014, and 2015 respectively. Thus the BOJ expected to achieve its price stability target of 2 percent in fiscal 2015 when it embarked on the QQE (Chart 1).¹ Thereafter, CPI inflation rate registered 0.8 percent on a year-on-year basis for fiscal 2013 in line with the outlook report. For fiscal 2014 and 2015, however, CPI inflation rate was 0.8 percent and 0.0 percent respectively, significantly falling short of the inflation forecast made in April 2013.

Why did the BOJ not achieve the price stability target of 2 percent for fiscal 2015, despite the bold monetary easing unprecedented in the world? This paper attempts to answer this question by providing empirical evidence as objectively and quantitatively as possible, avoiding narrative comments. In particular, we estimate simple VAR (vector-auto-regressive) model of four macroeconomic variables – inflation, output gap, exchange rate and oil prices – and then

¹ The outlook report released in April 2013 stated that “*the year-on-year rate of change in the CPI is likely to reach around 2 percent – the price stability target – toward the latter half of the projection period.*”

examine what factors contributed to the failure of CPI inflation rate to reach around 2 percent, by using historical decomposition of this estimated VAR.

We opt to use a time series VAR model as an empirical method for the following two reasons. First, it is possible to carry out “data-oriented” empirical analysis without making few restrictions on the potentially complicated interdependence among macroeconomic variables,² as we do not rely on a particular theoretical model. It is well-known among academics and economists that there is no consensus view on the inflation dynamics, including inflation-output gap relation, inflation expectations formation, and the pass-through mechanism of exchange rate and oil price fluctuations into general prices. Therefore it is more desirable to utilize a time-series model such as a restriction-free VAR than to draw on a particular theoretical model, in light of our purpose of providing empirical evidence as objectively as possible, which is widely useful for policy discussion.

Second, it is possible to attribute the unexpected declines in CPI inflation rate to “intrinsic shocks” in the VAR system, properly keeping the second-round effects of these shocks in mind. Taking the effects of an exchange rate shock (yen’s depreciation shock) as an example, it has the second-round effect on inflation of improving the output gap and raising inflation expectations, as well as the first-round effect on inflation of directly making import prices higher. Therefore, for estimating the impact on inflation of yen’s significant depreciation observed following the introduction of the QQE, we need to take into account not only its first-round effect but also its second-round one. We could readily carry out such a comprehensive analysis by using VAR which treats all variables in a system as endogenous.

² In the actual VAR analysis below, we impose short-run minimum restrictions by using Cholesky decomposition.

This paper has the following structure. Section 2 describes estimation method and data. Section 3 presents the empirical results and some interpretation. Section 4 concludes.

2. Empirical Method and Data

This paper examines what factors made the actual CPI inflation rate fall short of the BOJ's original forecast in the following steps. First, we estimate the VAR model, which includes the BOJ's forecasts made in April 2013 as sample data by treating these forecasts as "actual" data, and then perform a historical decomposition based on the estimation results of this VAR. Thereby, we could quantitatively show what factors were expected to contribute to the rise in the inflation rate toward 2 percent in the BOJ's outlook report. Second, we estimate the VAR model with the same specification but by using all the realized data, and do the same exercise of historical decomposition. Finally, by comparing these two historical decompositions, we could quantitatively identify what factors led the actual CPI inflation rate to fall short of the BOJ's original forecast.

The VAR models are estimated by using four macroeconomic variables: oil prices, exchange rate, output gap, and inflation rate of CPI. The structural shocks would be identified by using Cholesky decomposition in the above-mentioned ordering.³ Specifically, oil prices are placed first in the VAR ordering as the most exogenous variable, as these are determined by the demand-supply conditions in the global commodity market and, to a lesser extent, affected by economic and monetary developments in Japan.⁴ Next, the exchange rate is placed as the second

³ As a robustness check, we also estimate "generalized impulse responses" for the VAR, but these are almost identical to the impulse responses generated by the Cholesky decomposition.

⁴ However, we do not treat oil prices as a *perfectly* exogenous variable in our VAR system, because (i) these are endogenously affected by fluctuations in the exchange rate (e.g., U.S. dollar appreciation tends

variable in the VAR ordering, as it could be regarded as a predetermined variable, which has a relatively prompt impact on the output gap and inflation rate. The output gap is placed as the third variable, as it varies over the business cycle affected by oil prices and exchange rate. Finally, CPI inflation rate is the last variable in the ordering, as it could be regarded as the most endogenous variable significantly influenced by the three variables above mentioned. The estimation frequency is quarterly and the sample period ranges from the first quarter in 1984, when the effects of the second oil price shock almost vanished, to the first quarter in 2016, which is the last quarter for fiscal 2015.⁵ We choose three lags of the VAR based on the AIC criteria.

The data used in the estimation are as follows. For oil prices, we use WTI (West-Texas intermediate) prices deflated by the U.S. headline CPI as in the previous studies (e.g., Baumeister and Kilian 2016).⁶ For the exchange rate, we use the nominal effective exchange rate of the yen. For the output gap, we use the BOJ's estimates, which are regularly released as research data on the BOJ's website (See Hara et al. 2006 for its detail). For CPI excluding volatile fresh foods, we exclude the effects of the consumption tax hikes and then make seasonal adjustments. In estimating the VAR, we use log-differenced series for oil prices, the exchange rate, and the CPI, and level series for the output gap.

The BOJ's outlook report publishes board members' forecasts for only the growth rate of real GDP and inflation rate of CPI on an annualized basis for each fiscal year during the

to exert downward pressure on oil prices as denominated in the U.S. dollar) and (ii) these are partly influenced by the demand situation in Japan's economy (Japan's oil consumption accounts for 6-7 percent of global consumption during the sample period). As a robustness check, we estimate the VAR model, where oil prices are treated as a perfectly exogenous variable and the parameters are restricted not to allow for the feedback from other variables to oil prices. We then found the main results to be intact.

⁵ This sample period is identical to the one for which the Phillips curves are regularly depicted in the BOJ's outlook report.

⁶ As a robustness check we also estimate the VAR by using *nominal* WTI prices, and the estimation results remain almost unchanged.

projection period. Therefore, we need to construct quarterly data for the four variables which are used in the forecast-based VAR. For oil prices (WTI) and the exchange rate (nominal effective exchange rate of the yen), we assume that the BOJ's policy board members expected these variables to remain constant from April 2013 throughout the projection period.⁷ For the output gap, the BOJ does not publish its forecast in the outlook report. We thus make the output gap forecasts by interpolating the annual forecast GDP growth rates to quarterly ones and then cumulating the differences between the GDP growth rate and potential growth rate. To obtain the BOJ's forecasts of CPI inflation rate on a quarterly basis, we interpolate the yearly inflation forecasts.

Chart 2 shows the actual and forecast values for the four variables used in our VAR estimation on a quarterly basis. Oil prices rose above the original forecast for some time following the introduction of the QQE, but plunged significantly below the forecast after August 2014. The exchange rate of the yen depreciated from the start of the QQE toward the mid-2015 compared to the original forecast, but thereafter appreciated somewhat, partially offsetting the initial depreciation. The output gap improved in line with the original forecast around until the beginning of 2014, but thereafter leveled off, gradually falling short of the original forecast. The year-over-year CPI inflation rate rose noticeably until around the summer in 2014 in line with the original forecast, but declined afterward deviating downward from the original forecast.

⁷ In this respect, the BOJ's outlook report in April 2013 stated that "*import prices are expected to continue rising during the projection period, assuming that international commodity prices will follow a moderate rising trend in line with global economic growth.*" However, there is no further information on the projected path of oil prices that were kept in mind by the BOJ's policy board members. Thus in estimating VAR, we assume for simplicity that it would remain constant from April 2013 over the entire projected period. As a consequence, we might underestimate the effects of the unexpected decline in oil prices on CPI inflation rates.

Chart 3 shows the correlation between output gap and CPI inflation rate, i.e., Phillips Curve, using the forecast and realized values of these variables on a quarterly basis. For the forecast-based Phillips curve, the CPI inflation rate was expected to rise well above the pace indicated by a simple regression result using the previous data, which means that the Phillips curve itself was expected to shift upward in tandem with the rise in inflation expectations.⁸ On the other hand, for the actual-value-based Phillips curve, CPI inflation rate rose until the first half of 2014 above the pace indicated by previous simple regression. However, it declined thereafter mainly due to a sharp drop in oil prices, moving against the upward-sloping Phillips curve.

3. Empirical Results

3.1 Impulse Responses

We derive impulse response functions from the estimated VAR. Specifically, Chart 4 shows the dynamic responses of the four variables to the oil price shock; Chart 5 shows responses to the exchange rate shock; Chart 6 shows responses to the output gap shock; and Chart 7 shows responses to the inflation-specific shock. The size of each shock is normalized to be one standard deviation. The dynamic responses of oil prices, the exchange rate, and the output gap are all expressed in levels, and inflation responses are on a year-on-year basis. The solid lines and shaded areas indicate estimated responses and 90-percent confidence intervals, respectively.

Chart 4 shows that an increase in oil prices leads to an improvement in the output gap; it also generates a rise in the CPI inflation rate for roughly two years and the impact is statistically significant. It should be noted that in the estimated VAR we do not distinguish between demand

⁸ In this respect, the BOJ's outlook report as of April 2013 stated that "*the year-on-year rate of change in the CPI is projected to rise in line with the previous correlation, accompanied by improvement in the supply and demand balance; at the same time, the Phillips curve itself is projected to gradually shift upward due to the rise in expected inflation rates.*"

and supply shocks that cause oil price fluctuations. Suppose that a rise in oil prices is driven by demand factors such as a boost in oil demand in emerging market economies. Then it would not only push up oil prices directly, but also improve the output gap through an increase in exports to these economies, putting upward pressure on inflation indirectly. On the other hand, if the rise in oil prices is driven by supply factors such as coordinated production cuts by the OPEC, it would negatively affect the output gap by worsening the terms of trade since Japan is an oil-importing country, exerting downward pressure on the country's inflation in the longer run. In the VAR impulse responses in Chart 4, an oil price hike leads to a statistically significant improvement in the output gap, suggesting that demand-driven fluctuations have been dominant over the sample period as a whole. The historical decomposition presented in the next section is carried out based on this impulse response function.⁹

Chart 5 demonstrates that the yen depreciation shock leads not only to an output gap improvement, but also to a statistically significant and persistent rise in the CPI inflation rate. Chart 6 shows that a positive output gap shock results in a statistically significant increase in the CPI inflation rate as predicted by the Phillips Curve. Specifically, the year-over-year inflation rate of the CPI gradually rises and reaches the peak level with a lag of 5-6 quarters after the positive output gap shock, which is known as a “hump-shaped” response of inflation typically found in a large body of literature.

Chart 7 shows that after a positive inflation-specific shock, the annual CPI inflation rate would remain statistically significantly positive for about one year, and then converge to zero at

⁹ Whether the sharp drop in oil prices after the summer 2014 was mainly due to demand or supply factors is a very interesting empirical question, but is unfortunately beyond the scope of this paper. See Baumeister and Kilian (2016) for such empirical analysis.

a relatively fast pace.¹⁰ In the estimated VAR, the inflation-specific shocks are measured as movements in the inflation rate which cannot be explained by fluctuations in oil prices, the output gap, and the exchange rate of the yen. These shocks reflect various factors such as an exogenous shift in inflation expectations – that is an increase in the forward-looking expected inflation rate as a result of the raised inflation target – in addition to institutional changes in utility charges.

3.2 Identified Shocks and Historical Decomposition

Chart 8 compares identified shocks in the estimated VAR using the BOJ’s forecast and those in the estimated VAR using the realized values. First, looking at the identified oil price shocks, we confirm that the BOJ’s outlook report assumed only a few shocks for the entire forecast period, whereas materially, a large number of negative shocks occurred in the phase when oil prices dropped sharply following the summer of 2014. The size of negative oil price shocks observed during this period seems to be much larger than previously seen. Furthermore, such large shocks also appear to have occurred in higher frequency than in any other periods.

Second, looking at the identified exchange rate shocks the BOJ’s outlook report assumed only a few significant shocks for the forecast period. Actual results show that there was a sizeable number of shocks throughout the period from the introduction of the QQE to the middle of 2014, but relatively large yen depreciation shocks were observed following the expansion of the QQE in October 2014. However, since the summer of 2015 onward, sizeable yen

¹⁰ After a positive inflation-specific shock, the exchange rate of the yen appreciates while the output gap worsens, though the latter is not statistically significant. This suggests that over the sample period, as a whole, monetary policy might have responded to an exogenous boost in inflation in a tightening way.

appreciation shocks continued to hit the Japanese economy amid the slump in emerging market economies and the turbulence of global financial markets.

Third, we see from the identified output gap shocks that the BOJ's outlook report projected relatively large positive and negative shocks. The reason for this is that these "anticipated" shocks correspond to the front-loaded increases in demand and their subsequent declines associated with the two rounds of consumption tax hikes that were scheduled to take place in April 2014 and October 2015 at the time when the BOJ made its original forecast. The realized output gap had been broadly in line with the BOJ's forecast until the beginning of 2014, but its recovery in the latter half of 2014 following the first round of the consumption tax hike was somewhat weaker than what the BOJ had anticipated. Moreover, in 2015, relatively large negative shocks to the output gap occurred, despite the government's decision to postpone the second round of the consumption tax hike.

Finally, the identified inflation-specific shocks show that the BOJ assumes positive shocks to occur continuously toward the end of fiscal 2015. This fact could be interpreted as follows: the BOJ policy board members expected forward-looking inflation expectations to increase steadily over the projection period, taking into account the "regime change" effect of monetary policy associated with the introduction of the QQE.¹¹ Taking a look at the actual data, the inflation-specific component generated positive shocks during 2013, which seems to be broadly in line with the BOJ's outlook. However, after the beginning of 2014, large negative shocks –

¹¹ If inflation expectations had shifted upward permanently on the back of the "regime change" in monetary policy and enough time had since passed, we need to set the constant term of the inflation equation when estimating the VAR to show a structural upward shift after a particular point of time over the sample period. However, the data was not enough to detect such a possible break point because only a few years had passed since the QQE was first introduced. If inflation expectations had shifted upward after the BOJ employed its policy tool of the QQE, it would emerge as continuous positive shocks of the inflation-specific component in our estimated VAR system.

that the BOJ did not anticipate – actually occurred. In the first half of 2015, positive shocks emerged again, but large negative shocks hit the economy in the latter half of that year.

Now we perform a historical decomposition for the CPI inflation rate based on the VAR that are estimated using the BOJ's forecast. This decomposition quantitatively illustrates how the BOJ policy board members expected the CPI inflation rate to rise to 2 percent when they decided to embark on the QQE. Chart 9 (1) (a) tells us the following story. First, improvement in the output gap was expected to gradually push inflation upward; second, oil prices were projected to have somewhat negative effects on inflation due to their earlier decline in the first half of the forecast period, but these effects were anticipated to fade afterwards; third, the sharp depreciation of the yen that occurred from the end of 2012 toward the beginning of 2013 was expected to push up inflation in a considerably persistent way; and lastly but not least, positive shocks to the inflation-specific component were also expected to generate persistent upward pressure on inflation, in addition to the yen's depreciation.¹² As mentioned earlier on, inflation-specific shocks represent autonomous inflation fluctuations that cannot be explained by oil prices, the output gap, and the exchange rate. Therefore, the identified positive shocks to the inflation-specific component could suggest that the BOJ policy board members expected a substantial increase in people's inflation expectations over the projection period.

Next, we describe a historical decomposition for the CPI inflation rate in the same way based on the VAR that are estimated using the actual data. As shown in Chart 9 (1) (b), we find the following facts. First, the exchange rate of the yen expanded its positive contribution to inflation, broadly in line with the BOJ's forecast; second, oil prices generated quite a large

¹² Relatively large positive contributions from inflation-specific shocks were seen around 2011 as well. This reflects idiosyncratic shocks from disability insurance and car insurance premium increased substantially in that year. At the same time, the negative contribution from television sets diminished markedly due to a change in the surveyed price in the CPI statistics.

amount of downward pressure on inflation after the latter half of fiscal 2014, which substantially differ from the BOJ's original forecast; third, the positive contribution of the output gap was somewhat smaller than what the BOJ had anticipated; and finally, the inflation-specific component substantially shrank its positive contribution to inflation since the end of 2014, falling short of the BOJ's original forecast.

Chart 9 (2) shows the difference between the two historical decompositions presented above. For fiscal 2015, the actual CPI inflation rate fell short of the original BOJ's forecast by 1.9 percentage points. About 50 percent of this (minus 1.0 percentage points) can be attributed to the unexpected plunge in oil prices. A little more than 10 percent (minus 0.3 percentage points) can be explained by the unexpected slump in the output gap and a little more than 30 percent (minus 0.7 percentage points) by inflation-specific negative shocks. The weaker-than-expected output gap was seen mainly after the latter half of 2014, suggesting that it reflects the consumption slump following the consumption tax hike. Meanwhile, the weaker-than-expected inflation-specific component could be interpreted as to reflect that inflation expectations did not rise as much as originally anticipated by the BOJ. Immediately after the introduction of the QQE, members of the BOJ policy board stated in the April 2013 outlook report that "*long-term inflation expectations are likely to continue on a rising trend under QQE, gradually converging to around 2 percent.*" Looking at the realized data, we find that a wide range of indicators for inflation expectations continued an increasing trend until the summer of 2014, but then reached a plateau and have weakened since the summer of 2015, as reviewed in detail in the "Comprehensive Assessment (BOJ 2016)."

Why did inflation expectations not rise as much as originally anticipated by the BOJ? Tackling this question is beyond the scope of this paper,¹³ but it is worth pointing out that the weaker-than-expected increase in the “base pay” played a crucial role in dampening people’s inflation expectations. The “zero-inflation norm” – people’s expectations that prices will not rise and continue to be so for the foreseeable future – has been deeply entrenched in Japan’s economic psyche amid the two-decade-long deflation, and the mindset of the people could not be easily changed even by the “regime change” in monetary policy. Consequently, it turns out that aggressive monetary easing measures were not enough to support the base-pay increase – which is determined by the spring negotiation between firms and labor unions every year and could be interpreted as a good “proxy” of inflation expectations of these entities – as originally anticipated.

In this respect, De Michelis and Iacoviello (2016) emphasize the role of “imperfect credibility” of the inflation target to explain the observed stickiness of inflation expectations. In particular, they argue that the challenges faced by the BOJ to reflate Japan’s economy mirrors those faced by the Federal Reserve following high inflation during the 1970s, which is a well-known episode of the Volcker disinflation in which the Federal Reserve struggled with its imperfect credibility in the aftermath of high inflation in the 1970s. Building a new Keynesian DSGE model following Erceg and Levin (2003), they demonstrate that the Bank of Japan has been facing similar credibility issues given its long struggle with deflation. Hausman and Wieland (2015) also argue that Abenomics was expected to have the “regime change” effects that are comparable to the U.S. Roosevelt policy in the 1930s, as documented by Kuroda (2013) and Romer (2013). They conclude that these effects seem to be weaker than expected, and speculate that the reason lies in imperfect credibility of the BOJ’s monetary policy.

¹³ See BOJ (2016) and Nishino et al. (2016) for detailed analyses on this issue.

4. Conclusion

This paper explored why the inflation rate of CPI – which excludes volatile fresh foods – failed to reach the 2 percent “price stability target” even after more than three years had passed since the BOJ introduced the QQE in April 2013. Specifically, we provided empirical evidence for what factors caused the actual CPI inflation rate to fall short of the BOJ’s original forecast made in April 2013, by using historical decomposition technique of simple VAR analysis. The empirical results showed that among the deviation of the CPI inflation rate for fiscal 2015 from the original forecast of minus 1.9 percentage points – the difference between the forecast of 1.9 percent and the actual result of 0.0 percent – about 50 percent (minus 1.0 percentage points) could be attributed to the unexpected decline in oil prices. A little more than 10 percent (minus 0.3 percentage points) could be explained by the unexpected slump in output gap and a little more than 30 percent (minus 0.7 percentage points) by inflation-specific negative shocks. In our estimated VAR, these inflation-specific negative shocks were measured as the declines in the inflation rate which could not be explained by fluctuations in the output gap, oil prices, and the nominal exchange rate, and thus imply that inflation expectations did not rise as much as originally anticipated by the BOJ.

Our empirical model does not deal with inflation expectations themselves, as availability of these quarterly data is insufficient for time series analysis. Future research should empirically examine how much the regime change in monetary policy, such as the introduction of the QQE, affected the forward-looking inflation expectations and thereby wage-inflation dynamics in Japan’s economy.

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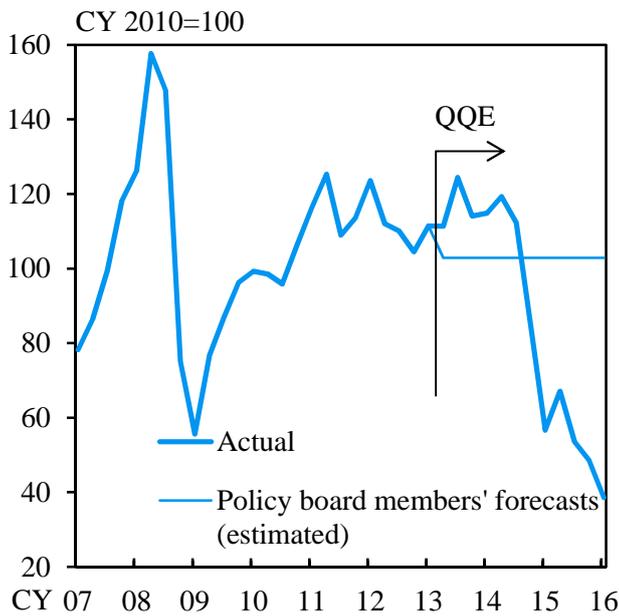
Chart 1. The Forecasts of Prices in the Outlook Report and Interim Assessment

	Expression about the timing of reaching the 2 percent price stability target	The median of the CPI forecasts (excludes volatile fresh foods, y/y % chg.)		
		FY13	FY14	FY15
April 2013 Outlook Report	The year-on-year rate of change in the CPI is likely to reach around 2 percent -- the price stability target -- toward the latter half of the projection period.	0.7	1.4	1.9
July 2013 Interim Assessments	-	0.6	1.3	1.9
October 2013 Outlook Report	The year-on-year rate of change in the CPI is likely to reach around 2 percent -- the price stability target -- toward the latter half of the projection period.	0.7	1.3	1.9
January 2014 Interim Assessments	-	0.7	1.3	1.9
April 2014 Outlook Report	The year-on-year rate of change in the CPI is likely to reach around 2 percent -- the price stability target -- around the middle of the projection period.	0.8 (actual)	1.3	1.9
July 2014 Interim Assessments	-	-	1.3	1.9
October 2014 Outlook Report	The year-on-year rate of change in the CPI is likely to reach around 2 percent -- the price stability target -- around the middle of the projection period; that is, in or around fiscal 2015.	-	1.2	1.7
January 2015 Interim Assessments	-	-	0.9	1.0
April 2015 Outlook Report	The timing of reaching around 2 percent is projected to be around the first half of fiscal 2016.	-	0.8 (actual)	0.8
July 2015 Interim Assessments	-	-	-	0.7
October 2015 Outlook Report	The timing of reaching around 2 percent is projected to be around the second half of fiscal 2016.	-	-	0.1
January 2016 Outlook Report	The timing of reaching around 2 percent -- the price stability target -- is projected to be around the first half of fiscal 2017.	-	-	0.1
April 2016 Outlook Report	The timing of reaching around 2 percent -- the price stability target -- is projected to be during fiscal 2017.	-	-	0.0 (actual)

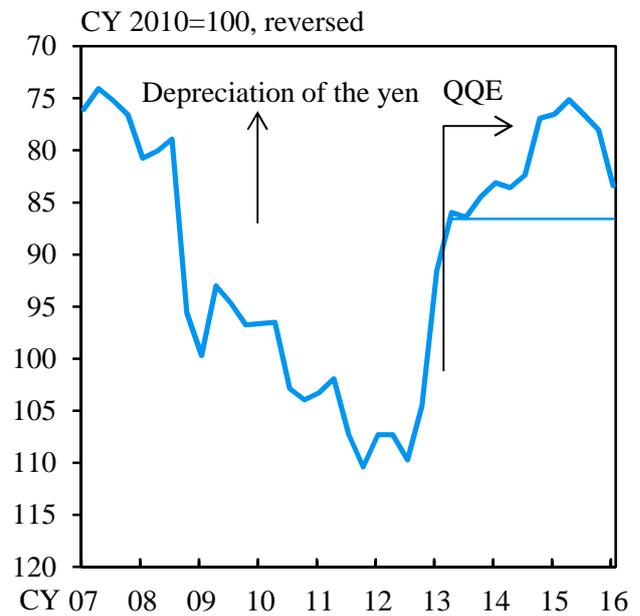
Note: The median of the CPI forecasts exclude the effects of the consumption tax hikes.

Chart 2. Actual and Forecasts Values for Each Variable

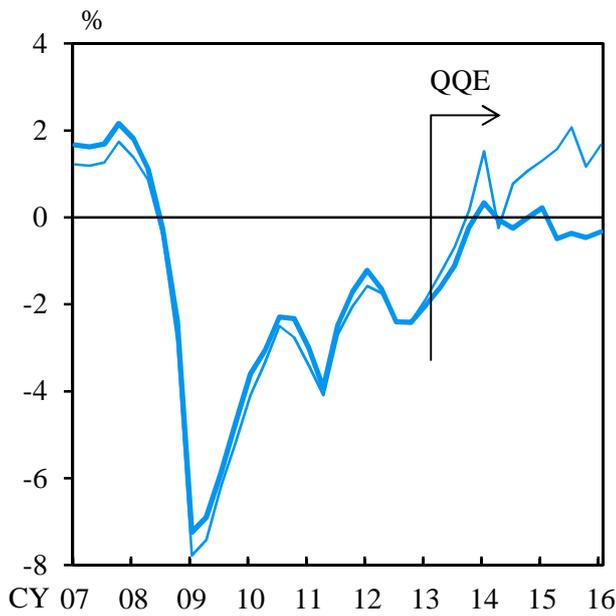
(1) Crude Oil Price



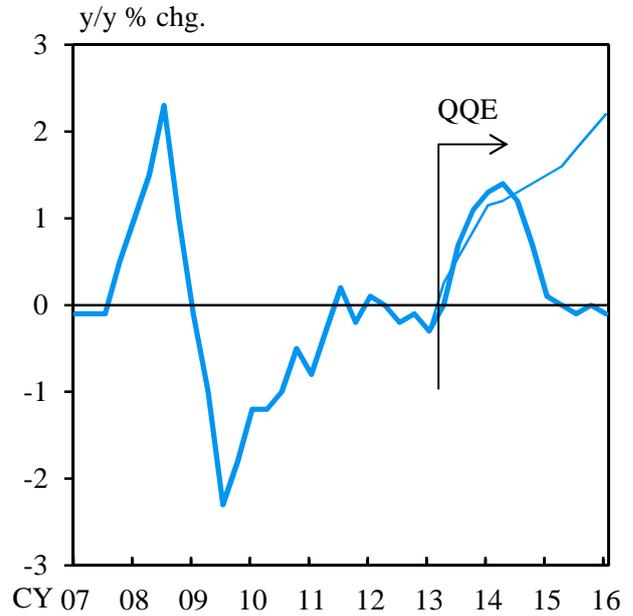
(2) Nominal Effective Exchange Rate of the Yen



(3) Output Gap



(4) CPI (Excludes Volatile Fresh Foods)



Notes: 1. Crude oil prices are obtained by deflating WTI prices by the U.S. headline CPI.

2. For the assumption of policy board members' forecasts, see Chart 9 (the same applies to the following charts).

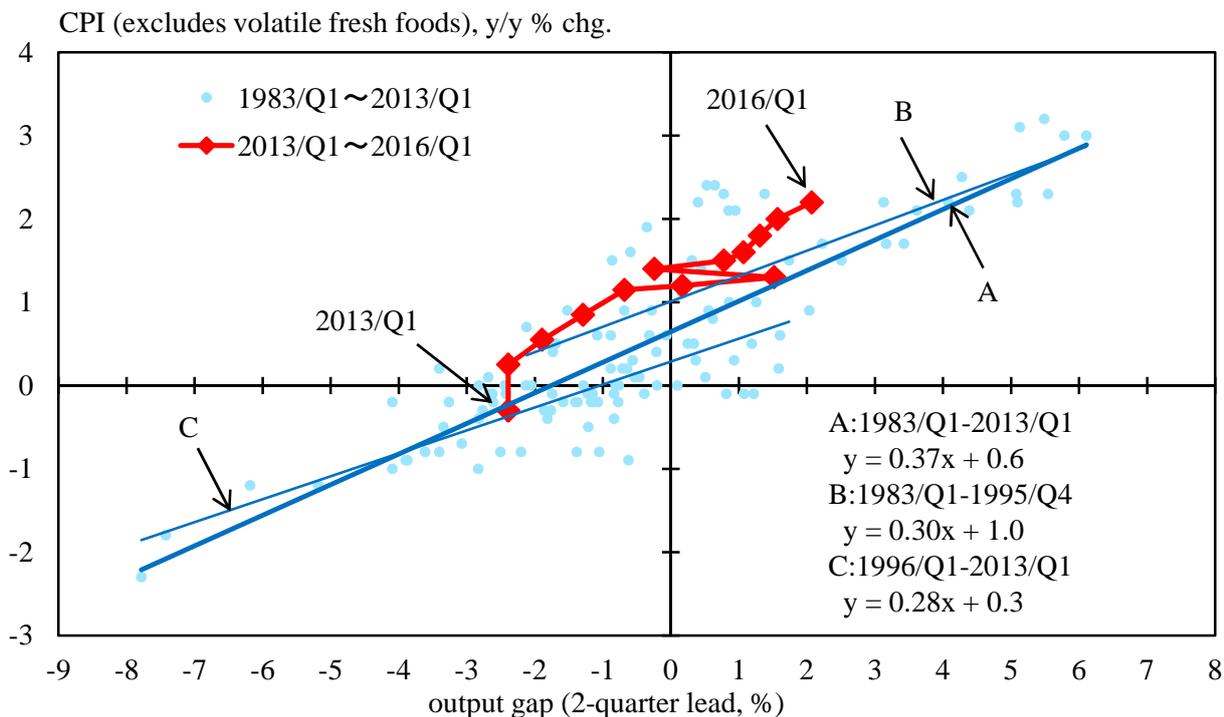
3. The output gap is estimated by the Research and Statistics Department, Bank of Japan.

4. Figures for the CPI are adjusted to exclude the estimated effects of changes in the consumption tax rate.

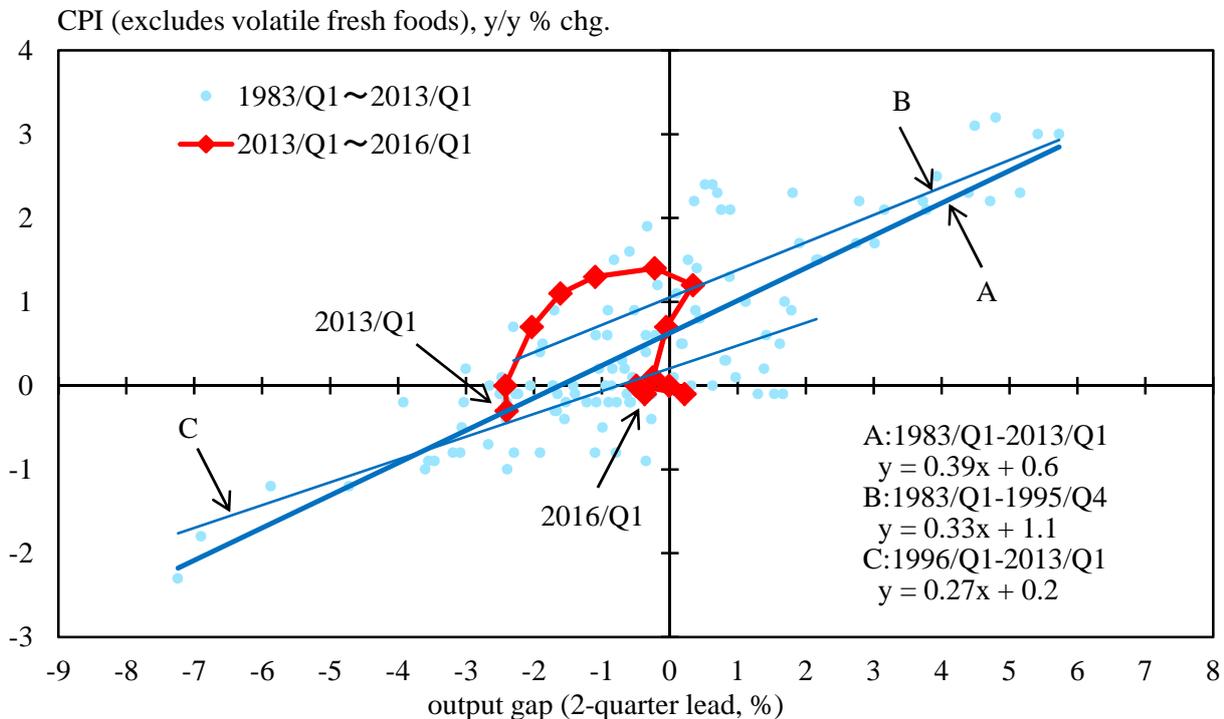
Sources: Ministry of Internal Affairs and Communications; Cabinet Office; BIS; Bloomberg, etc.

Chart 3. Output Gap and Inflation Rate

(1) Phillips Curve (Policy Board Members' Forecasts <Estimated>)



(2) Phillips Curve (Actual)



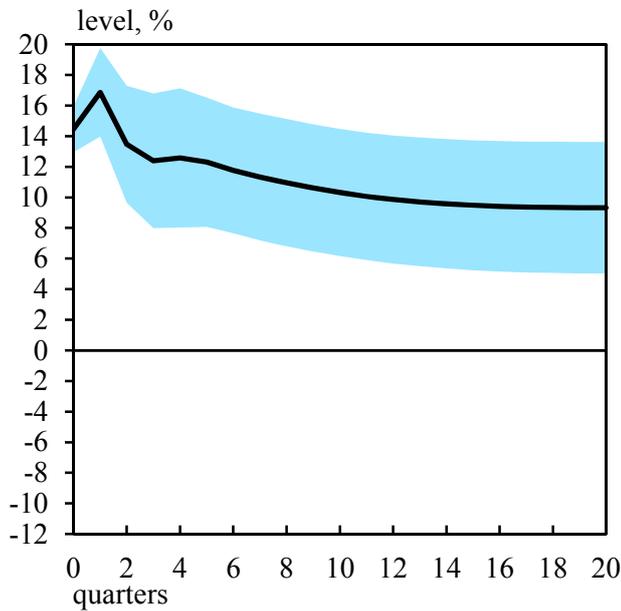
Notes: 1. The output gap is estimated by the Research and Statistics Department, Bank of Japan.

2. Figures for the CPI are adjusted to exclude the estimated effects of changes in the consumption tax rate.

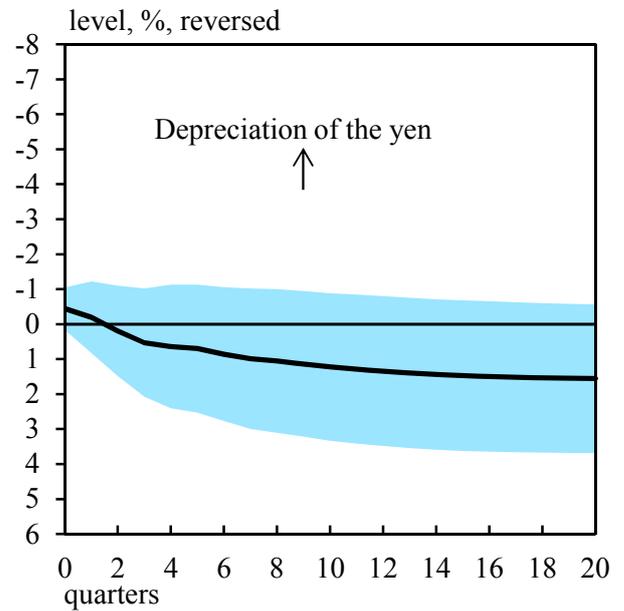
Sources: Ministry of Internal Affairs and Communications; Cabinet Office, etc.

Chart 4. Impulse Responses to the Crude Oil Price Shock ($1\sigma=14.5\%$)

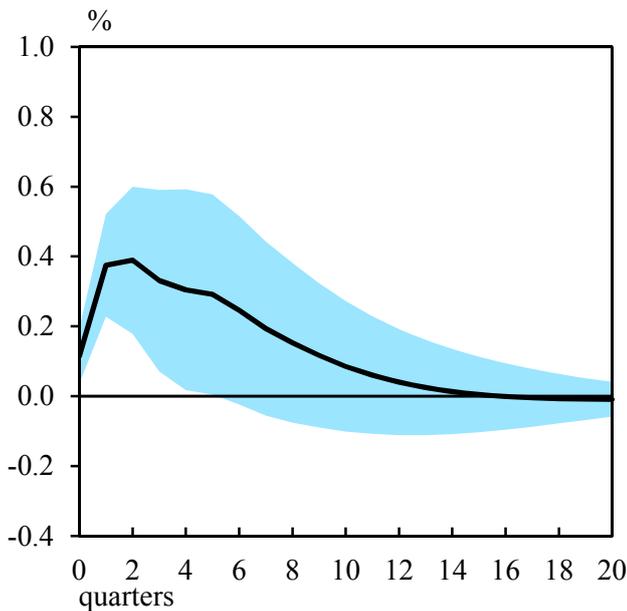
(1) Crude Oil Price



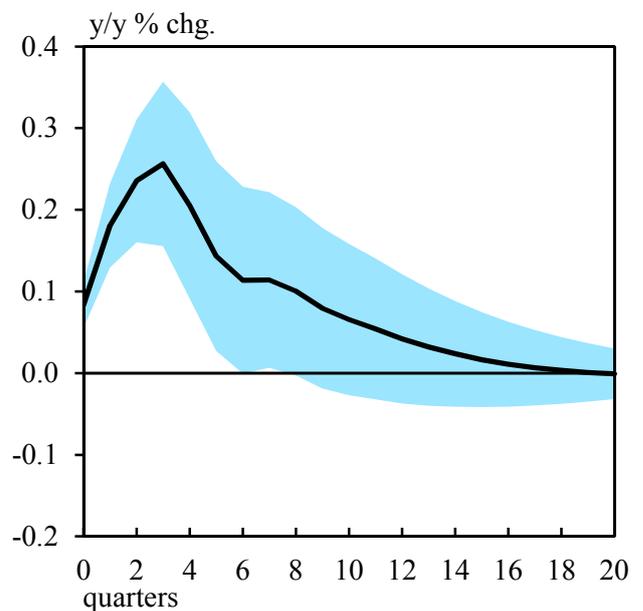
(2) Nominal Effective Exchange Rate of the Yen



(3) Output Gap



(4) CPI (Excludes Volatile Fresh Foods)



Notes: 1. The VAR model is estimated using the following variables. The crude oil price, the nominal effective exchange rate of the yen, the output gap, and the CPI (excludes volatile fresh foods). Shock identification is based on Cholesky decomposition in the above order.

2. The estimation period is 1984/Q1-2016/Q1.

3. In the estimation the output gap is used as level data, and other variables are converted into quarter-on-quarter changes. The crude oil prices are obtained by deflating WTI prices by the U.S. headline CPI.

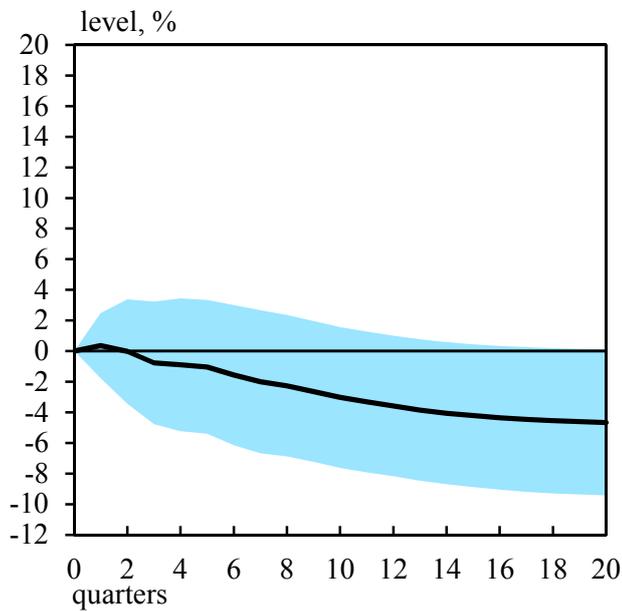
4. Shaded areas indicate 90 percentile bands.

5. Figures for the CPI are adjusted to exclude the estimated effects of changes in the consumption tax rate.

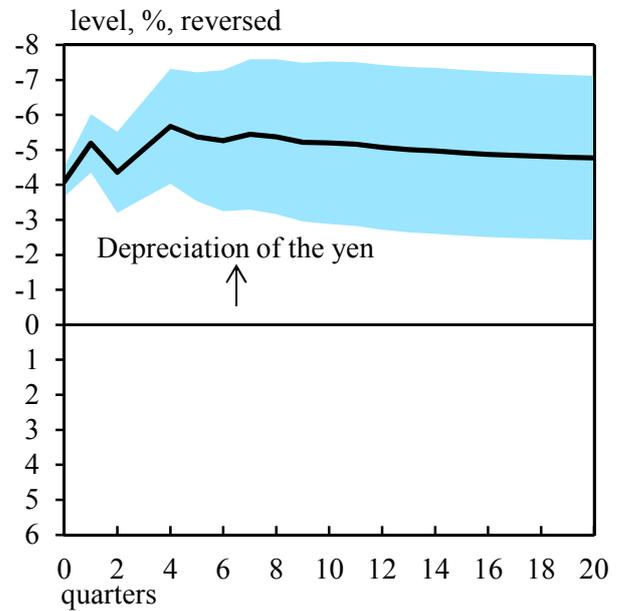
Sources: Ministry of Internal Affairs and Communications; Cabinet Office; BIS; Bloomberg, etc.

Chart 5. Impulse Responses to the Yen's Depreciation Shock ($1\sigma=4.1\%$)

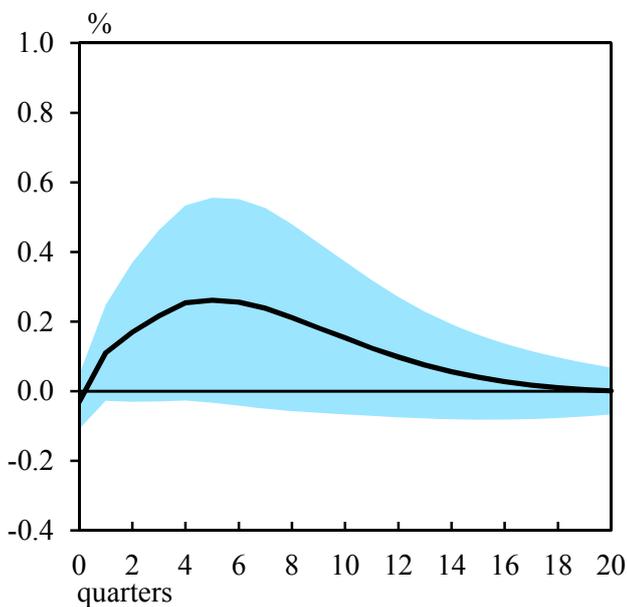
(1) Crude Oil Price



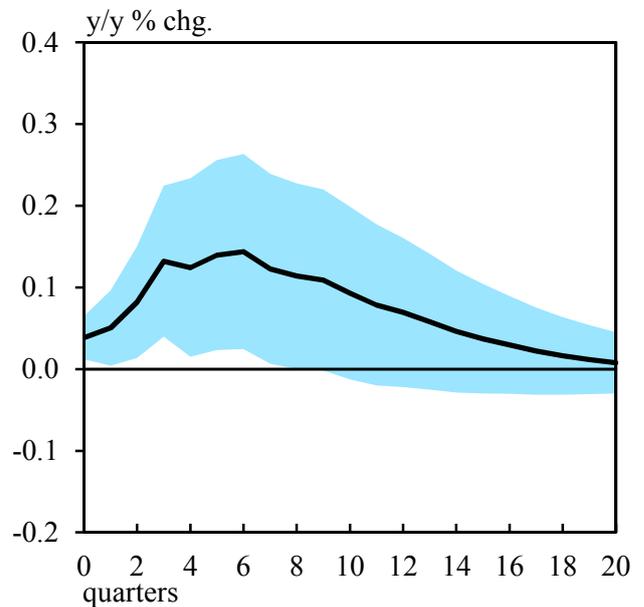
(2) Nominal Effective Exchange Rate of the Yen



(3) Output Gap



(4) CPI (Excludes Volatile Fresh Foods)



Notes: 1. The estimated model and estimation period are the same as those in Chart 4.

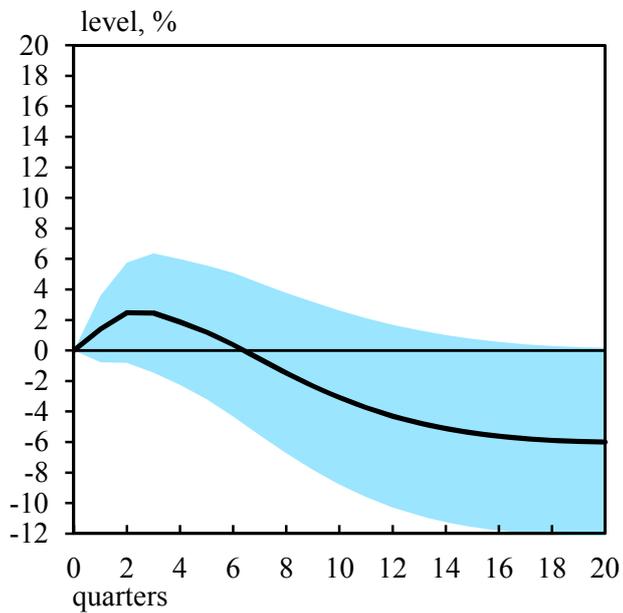
2. Shaded areas indicate 90 percentile bands.

3. Figures for the CPI are adjusted to exclude the estimated effects of changes in the consumption tax rate.

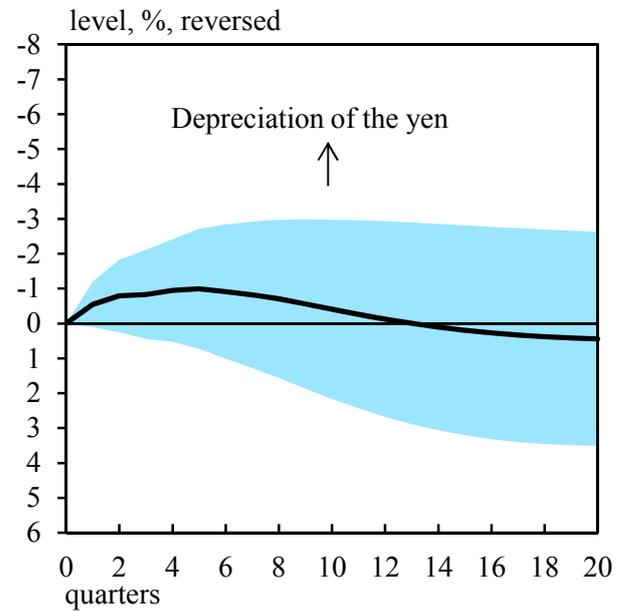
Sources: Ministry of Internal Affairs and Communications; Cabinet Office; BIS; Bloomberg, etc.

Chart 6. Impulse Responses to the Output Gap Shock ($1\sigma=0.5\%$)

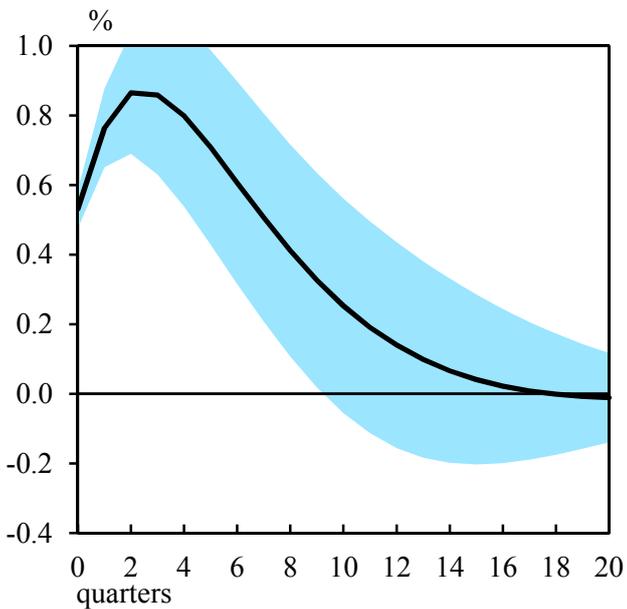
(1) Crude Oil Price



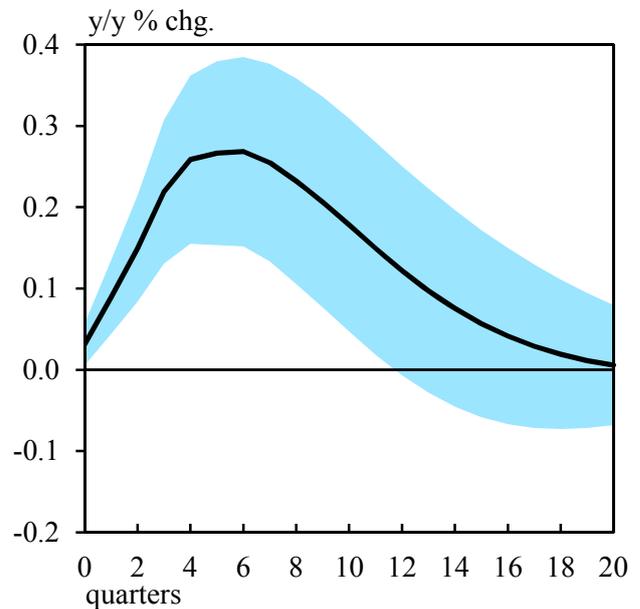
(2) Nominal Effective Exchange Rate of the Yen



(3) Output Gap



(4) CPI (Excludes Volatile Fresh Foods)



Notes: 1. The estimated model and estimation period are the same as those in Chart 4.

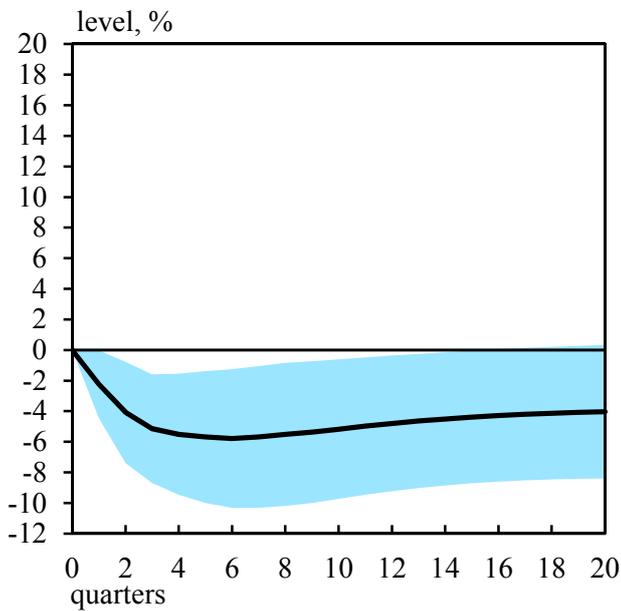
2. Shaded areas indicate 90 percentile bands.

3. Figures for the CPI are adjusted to exclude the estimated effects of changes in the consumption tax rate.

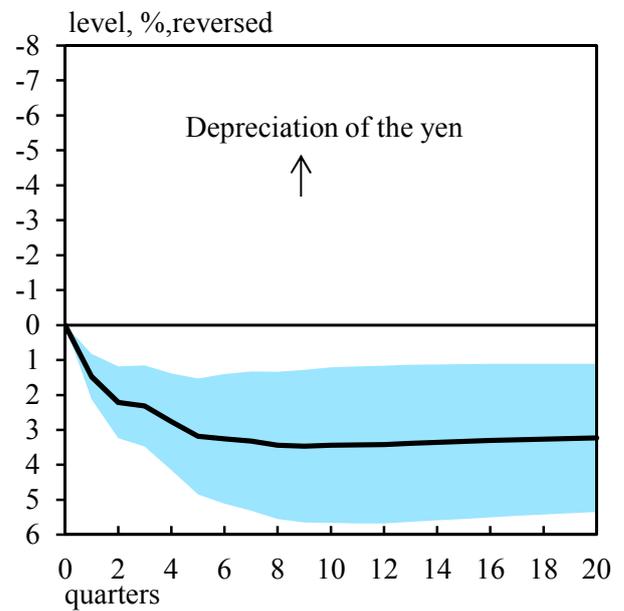
Sources: Ministry of Internal Affairs and Communications; Cabinet Office; BIS; Bloomberg, etc.

Chart 7. Impulse Responses to the Inflation-Specific Shock ($1\sigma=0.2\%$)

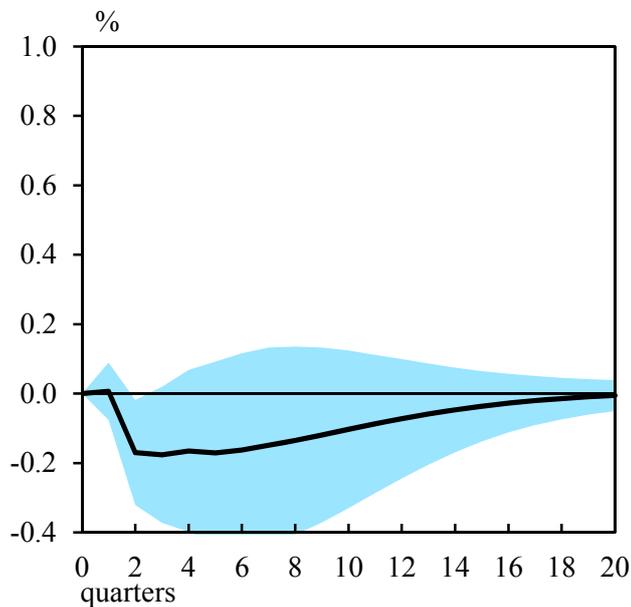
(1) Crude Oil Price



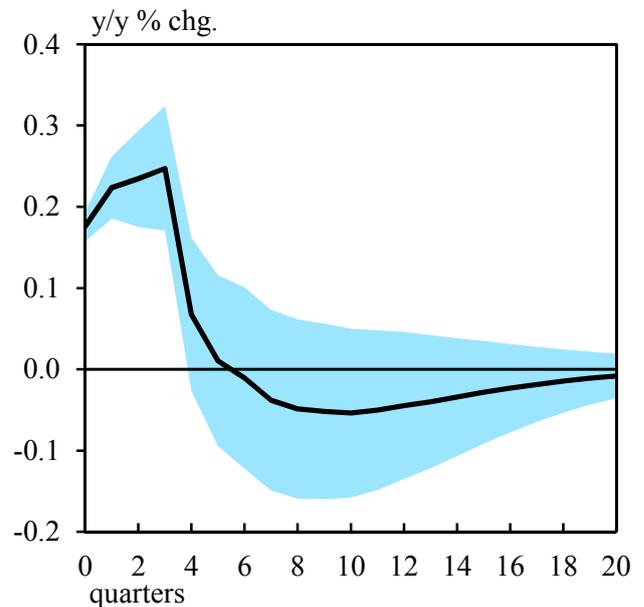
(2) Nominal Effective Exchange Rate of the Yen



(3) Output Gap



(4) CPI (Excludes Volatile Fresh Foods)



Notes: 1. The estimated model and estimation period are the same as those in Chart 4.

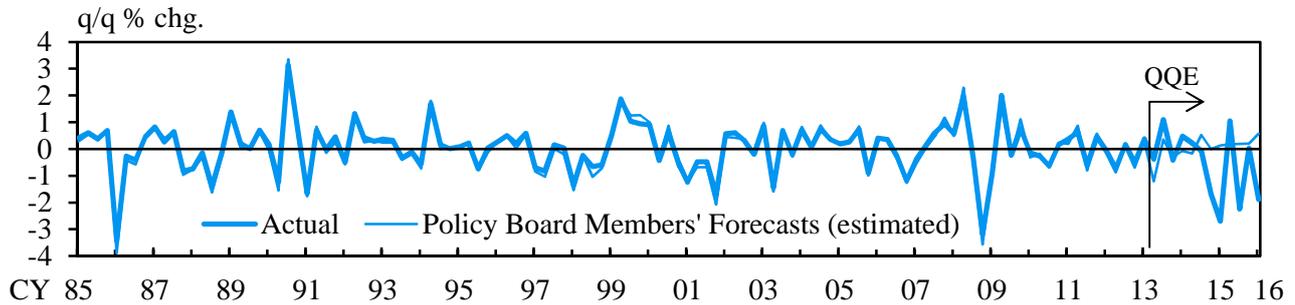
2. Shaded areas indicate 90 percentile bands.

3. Figures for the CPI are adjusted to exclude the estimated effects of changes in the consumption tax rate.

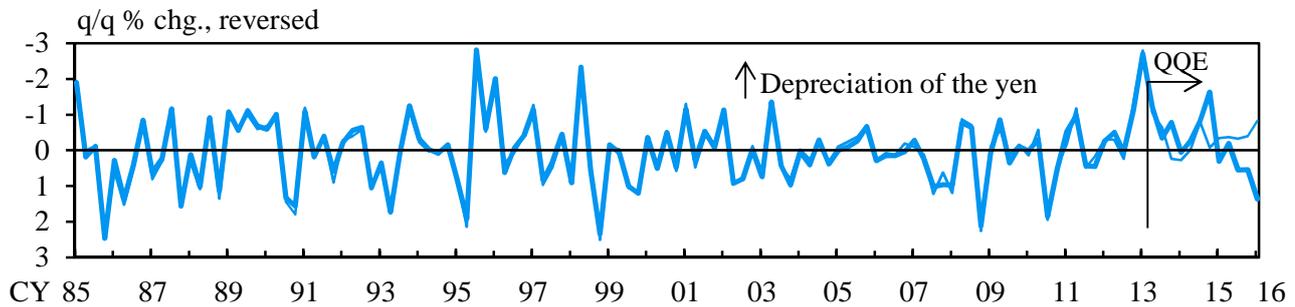
Sources: Ministry of Internal Affairs and Communications; Cabinet Office; BIS; Bloomberg, etc.

Chart 8. Identified Shocks

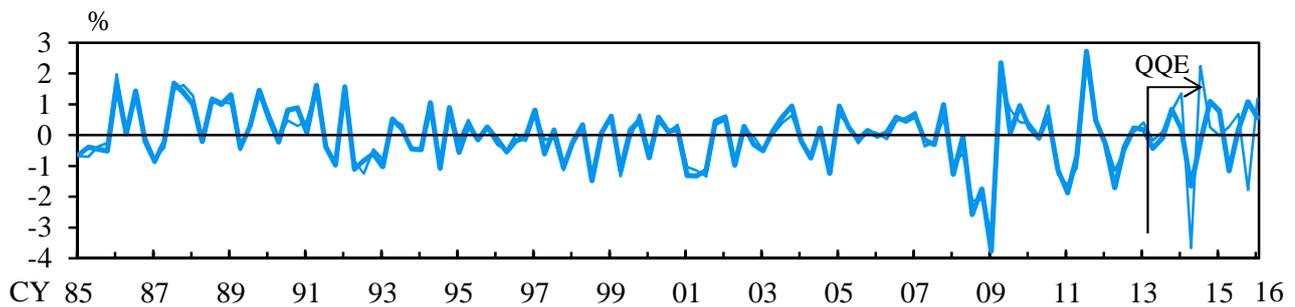
(1) Crude Oil Price



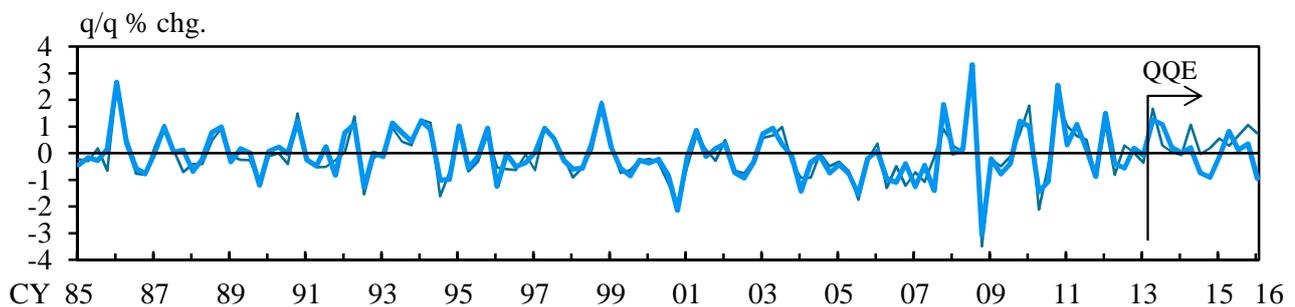
(2) Nominal Effective Exchange Rate of the Yen



(3) Output Gap



(4) CPI (Excludes Volatile Fresh Foods)



Notes: 1. The estimated model and estimation period are the same as those in Chart 4.

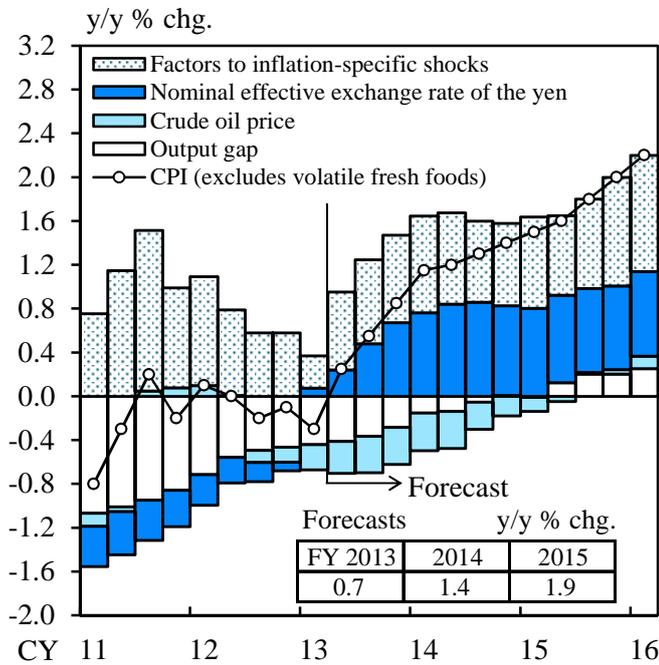
2. Figures for the CPI are adjusted to exclude the estimated effects of changes in the consumption tax rate.

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

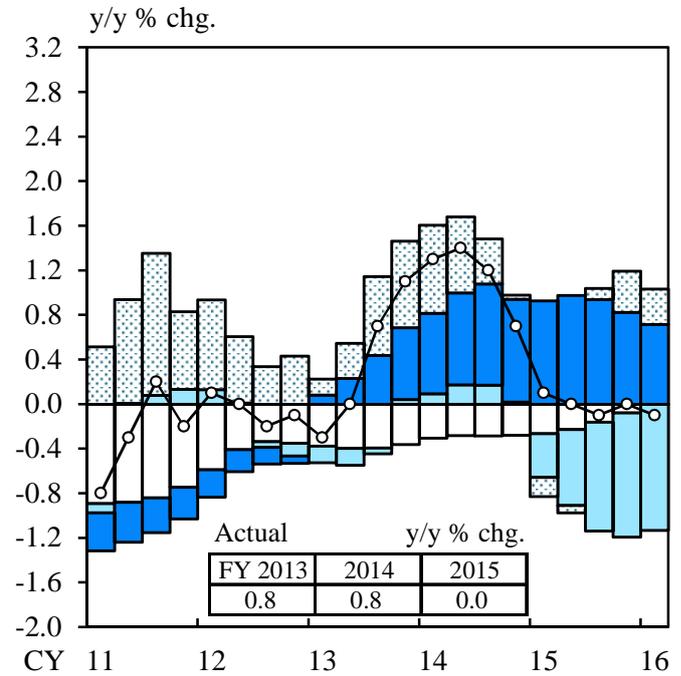
Chart 9. Decomposition of the Unexpected Slowdown of CPI Inflation

(1) Historical Decomposition of CPI (Excludes Volatile Fresh Foods) Based on the VAR Model

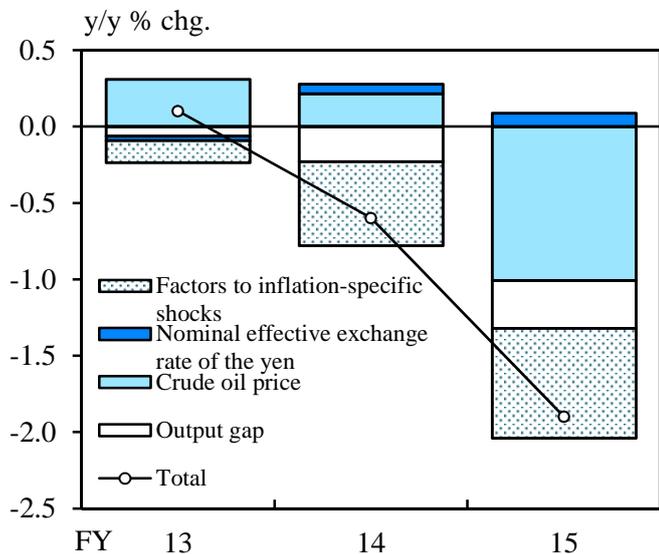
(a) Policy Board Members' Forecasts in April 2013



(b) Actual



(2) Difference between Policy Board Members' Forecasts (Median) and Actual



	y/y % chg.		
	FY 2013	2014	2015
Nominal effective exchange rate of the yen	0.0	0.1	0.1
Crude oil price	0.3	0.2	-1.0
Output gap	-0.1	-0.2	-0.3
Factors to inflation-specific shocks	-0.1	-0.6	-0.7
Total	0.1	-0.6	-1.9

Notes: 1. The estimated model and estimation period are the same as those in Chart 4.

2. The factors to inflation-specific shocks include a constant.

3. The policy board members' forecasts are estimated as follows.

(a) The crude oil price is assumed to remain at 100 U.S. dollars from 2013/Q2 onward in the Dubai oil price.

(b) Exchange rate is assumed to remain at 97.5 yen from 2013/Q2 onward in the yen/U.S. dollar exchange rate.

(c) The output gap is calculated as the difference between the real GDP growth rate and the potential growth rate, and the members' forecasts of the real GDP growth rate in the April 2013 Outlook Report are converted into quarterly figures.

(d) Figures for the CPI (excludes volatile fresh foods) are quarterly figures which are converted from the members' forecasts in the April 2013 outlook report.

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