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Inflation expectations and monetary policy under disagreements

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Abstract

Using a wide range of survey data on Japanese inflation outlook, this study examines two types of disagreements regarding inflation expectations and accordingly, presents monetary policy implications. The analysis reveals three key findings. First, information rigidities are determinants of cross-sectional disagreement among not only households but also experts. Second, survey data indicate dissonance regarding the long-run forecasts of inflation rates between the central bank and economic entities, despite the adoption of a 2% inflation target in January 2013 and the introduction of an unconventional monetary policy (QQE) in April 2013. While short- and mid-term inflation forecasts by households are generally close to the 2% target rate, long-term forecasts fail to converge to the target level. Finally, under the two types of disagreements, the private sector's perception about a monetary policy stance does not significantly differ before and after the introduction of the inflation target and QQE. These findings suggest that the policy regime of the monetary policy dose not *abruptly* change on basis of perception; that is, there is no upheaval in the agents' perception about a monetary policy stance enough to induce a regime change.

JEL Classification: E31; E44; E52; E58

Keywords: disagreement; forecast data; inflation expectations; inflation target; information rigidities; unconventional monetary policy

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1 Introduction: two types of disagreements in inflation expectations

In January 2013, the Bank of Japan introduced an inflation target of 2% followed by *quantitative and qualitative monetary easing* (QQE) in April 2013. These measures aim at establishing more accommodative monetary conditions, even at the zero lower bound of short-term nominal interest rates, by increasing inflation expectations and lowering real interest rates, which in turn should end chronic deflation. The objective is to manage expectations *a la* Eggertsson and Woodford (2003) because according to academic literature, inducing a policy regime change by managing expectations can stop virulent inflation or deflation[1]. The unconventional monetary policy, QQE, aims at easing a monetary policy under the zero lower bound of nominal interest rates by controlling the inflation expectations of the private sector. Thus, the success of QQE ending chronic deflation depends on the feasibility of management of expectations.

However, what if such management of expectations was unsuccessful? To conduct a policy evaluation, we examine whether agents in the private sector agree to the inflation outlook. An investigation of disagreement identifies two aspects: cross-sectional disagreement among forecasters and dissonance in long-run inflation outlook between the central bank and economic entities.

Disagreements regarding inflation expectations among forecasters are widely observed in survey data. Capistrán and Timmermann (2009) document cross-sectional dispersion among forecasters using U.S. data and Dovern et al. (2009) discuss disagreements among forecasters in G7 countries. While the literature reports cross-sectional disagreement among forecasters, it is possible cross-sectional dispersion poses as an obstacle in implementing an unconventional monetary policy through management of expectations.

Another aspect of disagreement is whether long-run inflation forecasts converge to the 2% target set by the Bank of Japan to achieve price stability. The Bank of Japan is committed to achieving this target over a 2-year period starting from April 2013. If this commitment is fully credible and becomes widespread, long-term inflation forecasts by agents will immediately converge to the 2% level. Otherwise, any dissonance among the central bank and agents can hinder attempts to end chronic deflation in Japan.

Using a wide range of survey data on Japanese inflation outlook, this study examines two types of disagreements regarding inflation expectations and accordingly, presents monetary policy implications. First, we focus on information rigidities as the determinants of cross-sectional dispersion among forecasters. To identify the source of cross-sectional disagreement, we investigate whether

[1] See Sargent (1982), Temin and Wigmore (1990), and Eggertsson (2008).

such information rigidities hold for survey data on inflation expectations in Japan. Second, we explore the existence of dissonance in long-run inflation forecasts between the central bank and private sector agents. The goal is to identify whether long-term inflation forecasts converge to the 2% target set by the Bank of Japan as a measure to achieve price stability. Next, we compare the experiences of countries that have adopted an inflation target with those of Japan. Finally, under the two types of disagreements, we examine whether a drastic change in the perception about a monetary policy regime is induced by QQE. Sargent (1982) argues that a regime shift requires an *abrupt* change in the continuing policy. In fact, Kuroda (2013) states that QQE is intended to drastically change the expectations of markets and economic entities. Thus, in the context of our study, the judgment criteria for a regime change is a drastic change in the perception about the new monetary policy introduced by the Bank of Japan.

The three key findings of this analysis are as follows. First, we find information rigidities as the determinants of cross-sectional disagreement among not only households but also experts. Our estimation results imply that both households and experts do not regularly update their forecasts during each forecasting period. As for experts' forecasts, the noisy information model is also supported. In other words, the forecasting behavior of professional forecasters can be expressed by the weighted average of signals for the true states and their previous forecasts using old information sets. This explains cross-sectional disagreements among households as well as experts.

Second, the evidence indicate the presence of dissonance in long-run forecasts for inflation rates between the central bank and economic entities, despite the adoption of the 2% inflation target in January 2013 and the introduction of the unconventional monetary policy (QQE) in April 2013. Further, while short- and mid-term forecasts for inflation rates by households are generally close to the 2% target, long-term forecasts fail to converge to this level. Long-run inflation forecasts do not reach the target, although they gradually align with it. This result is confirmed by survey data from all aspects: households, firms, professionals, and market participants. In other words, not only experts but also households disagree with the 2% level as the long-run inflation rate. By contrast, experiences of countries that have also adopted an inflation target show that these countries, except Japan, succeed in aligning long-run inflation forecasts with the target rate set by each of their central banks.

Finally, we find that under the two types of disagreements, the private sector's perception about a monetary policy stance does not significantly differ before and after the introduction of the inflation target and QQE in 2013. The estimation results show that the monetary policy was already perceived to be accommodative enough to break the Taylor principle. This implies that the policy regime of the new monetary policy does not *abruptly* change on basis of perception. Thus, we conclude that there is no upheaval in the agents' perception about a monetary policy stance enough to induce a regime

change.

The structure of this paper proceeds as follows. Section 2 summarizes the descriptions of forecasts for Japan's inflation rates. Section 3 shows the existence of a cross-sectional disagreement among forecasters and examines information rigidities as the determinants of a disagreement. Section 4 presents the disagreements regarding long-run forecasts for inflation rates between the central bank and private sector agents and examines whether the perceived monetary policy stance drastically changes after the introduction of the 2% inflation target under the two types of disagreements: cross-sectional disagreement among forecasters and dissonance of inflation expectations between the Bank of Japan and consumers. Section 5 summarizes the findings and concludes.

2 Surveys on inflation forecasts and classification

This section summarizes the descriptions of inflation forecasts for Japan and the surveys referenced in this study[2].

2.1 Descriptions of forecasts for Japan's inflation rates

The Consumer Confidence Survey (CCS) The Consumer Confidence Survey (CCS)[3] is a monthly survey to measure households' confidence about their overall livelihood, income growth, employment, willingness to buy durable goods, and price expectations by the Cabinet office. More than 5,000 respondents are asked about their inflation expectations regarding frequent purchase prices for the next year. They are asked to select from eight alternatives: (1) go down greater than or equal to -5% (2) go down less than -5% to greater than or equal to -2% (3) go down less than -2% (4) stay the same about 0% (5) go up less than 2% (6) go up greater than or equal to 2% to less than 5% (7) go up greater than or equal to 5%, and (8) "Don't know." To calculate the monthly mean forecasts among respondents using qualitative answers, this study uses the weighted average of response percentages or mid-points, excluding "Don't know." The numbers are -5%, -3.5%, -1.0%, 0%, 1.0%, 3.5%, and 5%.

The Opinion Survey (OS) The Opinion Survey (OS)[4] is conducted on a quarterly basis by the Bank of Japan to examine the effects of macroeconomic conditions on household views and behavior. About 4,000 respondents are asked to answer questions about their inflation outlook for price levels

[2]Table 1 lists the outlook for inflation forecasts.

[3]CCS is available at http://www.esri.cao.go.jp/en/stat/shouhi/shouhi-e.html.

[4]OS is available at http://www.boj.or.jp/en/research/o_survey/index.htm.

for the next one and five years. The mean forecasts are calculated by excluding 0.5 percent of the highest and lowest figures. Mean and median data are published by the Bank of Japan.

Table 2 presents the descriptive statistics of CCS and OS. The mean forecasts of OS tend to be larger than those of CCS, possibly because of the extreme OS figures. However, the OS median is similar to the CCS average. While price expectations for the next one year fluctuate over time, the mean and median for the next five years' forecasts are stable at 4% and 2%.

Inflation Outlook of Enterprises (Tankan) Inflation Outlook of Enterprises is part of Tankan[5], a quarterly survey by the Bank of Japan to measure enterprises' short- and mid-term inflation expectations and was first conducted in 2014. Enterprises are asked about percent changes in the consumer price index (CPI) for the next one, three, and five years, excluding the impact of a consumption tax hike on the CPI. The respondents are asked to choose from 10 option regarding the forecasts of an annual percent rate change for the CPI, ranging from "around $+6\%$ or higher" to "around -3% or lower," in addition to one percent increments and "Don't have clear views on General Prices." To calculate monthly mean forecasts among respondents using qualitative answers, the weighted average by response percentage or mid-point, excluding "Don't have clear views on General Prices." is adopted. The numbers range from $+6\%$ to -3% by one percent.

Table 3 presents the descriptive statistics for Tankan[6]. The mean forecast of Tankan tends to be larger in the long run and this tendency is common among the three categories. In addition, the smaller their capital, the larger their forecasts tend to be.

Consensus Forecast (CF) Consensus Forecast (CF) [7] is one of the longest surveys regarding inflation expectations in Japan. CF is a monthly survey, published by Consensus Economics, on developed and developing countries for professional forecasters such as economists. Each month, about 20 professionals forecast macroeconomic and financial variables over the current and next calendar year-end (December). CF publishes quarterly forecasts in the first month of each quarter and special surveys on long-term forecasts on a semi-annual basis. As for inflation outlook, forecasters submit year-on-year changes for the CPI (all items).

[5]Tankan is available at http://www.boj.or.jp/en/statistics/tk/index.htm.

[6]Tankan categorizes enterprises into three types on the basis of their capital: large- (1 billion yen and more), mid- (from 100 million yen to less than 1 billion yen), and small-scale enterprises (100 million yen).

[7]For more details, visit http://www.consensuseconomics.com.

ESP Forecast (ESP) ESP Forecast (ESP)[8] is a monthly survey for economists in Japan, conducted by the Japan Center for Economic Research. Each month, about 40 professionals forecast macroeconomic and financial variables mainly on Japan over the current and the next fiscal year end (March). ESP publishes quarterly forecasts every month and special surveys on long-term forecasts for real GDP and inflation rates on semi-annual basis. As for inflation outlook, forecasters are asked to answer questions on year-on-year changes in the CPI (all items, less fresh foods).

Quick Survey System (QSS) The Quick Survey System (QSS)[9] is a monthly survey for market participants conducted by QUICK Corporate. QUICK Corp. asks market participants about their outlook regarding stock and bond markets and inflation developments. The respondents include market participants from securities firms, banks, investment trusts, insurance firms, pension funds, and other private financial institutions. The QSS is an unbalanced panel with about 150 respondents per month. Respondents submit their outlook regarding interest rates for newly issued government bonds with a maturity of 2, 5, 10, and 20 years. Forecasts are available for the next one, three, and six months. As for a survey of inflation rates, a year-on-year rate of change in the CPI (all items, less fresh foods) is collected. For each, average inflation expectations over the next 1, 2, and 10 years are available. Using average inflation expectations for the next 1, 2, and 10 years, this study calculates "forward" inflation expectations for next 1–2 years and 2–10 years. The unique characteristic of the QSS is its panel data for forecasts on both inflation rates and bond yields for each respondent. This allows us to examine whether a perceived monetary policy stance drastically changed before and after the QQE was implemented.

Table 4 presents the descriptive statistics for the CF, ESP, and QSS. The objective is to establish stability in long-run inflation forecasts. Long-run forecasts in each survey generally range from 1.0% to 1.5% when the impact of a consumption tax hike is subtracted[10]. If we focus on the sample for about nine years before October 2012, the long-run forecasts are slightly more than 1.0%. For 2015, they align with the 1.5% level.

2.2 Classification of surveys on inflation forecasts

The inflation forecast surveys can be classified on the basis of the following five criteria.

[8] Details on ESP are available at http://www.jcer.or.jp/eng/index.html.

[9] For details on QSS, visit http://corporate.quick.co.jp.

[10] Figure A.1 in the Appendix shows the maximum contribution of a consumption tax hike to the inflation expectations in the QSS.

(1) Respondents' attributes

(2) Frequency

(3) Forecast horizons

(4) Price (index) forecast

(5) Impact of consumption tax hike

Respondents' attributes The survey focuses on specific populations[11]. CCS and OS are for households, Tankan is for firms, CF and ESP are for professionals (or economists), and QSS for market participants.

Frequency Survey frequency tends to differ. CCS, CF, ESP, and QSS are monthly surveys, while OS and Tankan are conducted on a quarterly basis. CF and ESP also conduct a biannual special survey for long-term inflation forecasts.

Forecast horizons CF and ESP survey inflation forecast over the current and next calendar and fiscal year end, respectively. CCS, OS, Tankan, and QSS ask respondents to provide inflation forecasts over the next one year. In addition, surveys for professional forecasts (CF and ESP) provide point forecasts at the end of each quarter for the next two years. As for long-run forecasts, CF, ESP, and QSS collect inflation expectations over a 10-year period.

Price (index) forecast Surveys for firms, professionals, and market participants ask respondents to submit inflation forecasts for the CPI. However, the surveys do not collect data for the same price index or price level. While CF and Tankan survey changes for all items in the CPI, ESP and QSS exclude fresh foods. Furthermore, CCS and OS ask households to provide responses to changes in the prices of goods and services they frequently purchase, not the CPI. However, because forecast variables differ by survey, a comparison of surveys cannot be easily drawn.

Impact of consumption tax hike Unlike other surveys, Tankan and ESP ask respondents to forecast inflation rates without the impact of a consumption tax hike. This issue is important when analyzing QQE implemented in 2013 and its effects on expectation formation because the consumption tax was raised from 5% to 8% in April 2014 and a subsequent hike from 8% to 10% is scheduled for April 2017. When forecast horizons include changes in consumption tax rates, inflation forecasts are inevitably affected by the hike.

[11] Although they are not surveys, inflation outlook published by the government and central bank are presented in Table 1.

Researchers should account for the following points when comparing each survey. First, it is noteworthy that CF and QSS inflation forecasts include consumption tax hike effects, OS excludes such impacts, and ESP provides forecasts with and without the impact. Second, CF and Tankan provide year-on-year changes in the CPI (all items), whereas ESP and QSS publishes changes for the core CPI, that is, all items excluding fresh foods. Third is the surveyed horizons. CF surveys forecasters of CPI changes over the current and next calendar year end. ESP surveys CPI changes over the current and next fiscal year end. QSS and OS collect CPI changes for the next one, two, and ten years and the next one and five years. These differences make it difficult to conduct a comparative analysis of these surveys.

3 Information rigidities as determinants of cross-sectional disagreements

This section shows the existence of cross-sectional disagreements among forecasters and examines information rigidities as the determinants of disagreements. Suppose that all agents are rational and have full information and the forecast variables are the same among forecasters. In this case, there is no disagreement measured by standard deviation in the cross-section for each forecasting period. However, the data do not imply full-information rational expectations (FIRE), rather they indicate disagreements among agents. Figures 1 and 2 illustrate the following three facts: presence of disagreement, different degrees of disagreement among the forecast horizons, and time-varying disagreements.

First, the forecasts do not converge. If all agents rationally form their expectations on the basis of identical and full-information sets, their forecasts would also be identical. However, the figures show heterogeneous forecasts and the standard deviations are greater than zero. This indicates a dispersion of inflation outlook among agents.

Second, the degree of disagreements differs by forecast horizons. Figure 1 shows that the averages of cross-sectional disagreements for the next one, two, and ten years for the QSS are 0.39%, 0.44%, and 0.63%, respectively, and the test for equality among them rejects the null at the 1% significance level. It is also found that longer forecast horizons increase the degree of disagreements; this is confirmed even among professional forecasters. Figure 2 suggests that the standard deviation of forecasts for the next two years tends to be larger than that of forecasts for the next one year. This tendency is statistically significant at the 5% significance level.

Third, the degree of disagreement is not constant. The cross-sectional standard deviations vary over time. Specifically, standard deviations of forecasts for the next one year, as shown in Figure 1,

are not stable. They increase in 2008 and gradually decline from 2009 to 2012 and surge again in 2013.

These three facts—presence of disagreements, different degrees of disagreements, and time-varying disagreements—contradict the theoretical prediction of FIRE and motivate background exploration. The dominant theories explaining these facts about cross-sectional disagreements are information rigidities: they are *sticky* and *noisy information*.

3.1 Households

3.1.1 Sticky information

Mankiw and Reis (2002) first argue that sticky information—the slow dispersal of information about macroeconomic conditions—can help account for sluggish adjustments in prices and real effects that occur in response to monetary shocks[12]. Their fundamental idea is that all agents do not always update their information sets. Thus, their model assumes that inattentive agents process their information less frequently. Under the assumption that all agents do not necessarily update their information sets, it is inevitable to disperse forecasts made by each agent, which becomes a source of cross-sectional disagreement.

The situation can be written as follows:

$$\mathbb{F}_t[\pi_{t+h}] = (1-\lambda)\sum_{j=0}^{\infty}\lambda^j\mathbb{E}_{t-j}[\pi_{t+h}], \tag{1}$$

where inattentive agents update their information set in each period with probability $(1-\lambda)$ and $\mathbb{E}$, $\mathbb{F}$, and π_t are full-information rational expectations, average forecast across agents at time t, and inflation rates at time t, respectively. Here, parameter λ implies the frequency of households' updating forecasts.

Regarding sticky information, Carroll (2003) provides micro foundations for sticky information theory and derives a simple equation suitable for empirical analysis. Duper et al. (2010) develop a model that integrates sticky prices and information and find that both types of rigidities are present in U.S. data. Using Japanese data, Hori and Kawagoe (2013) test the sticky information hypothesis for consumer inflation forecasts.

To test whether the sticky information hypothesis holds for households' forecasts, Carroll (2003) presents a framework and proposes to test the predictability of households' inflation expectations using professional outlooks for inflation rates. It is likely that households will refer to professional forecasts if they are publicly available. Carroll (2003) first tests the forecasting power of consumers

[12] See Walsh (2010).

and professionals' forecasts using survey on a quarterly basis as follows:

$$\pi_{t+4,t} = \alpha_0 + \alpha_1 \pi_{t-1,t-5} + \alpha_2 \mathbb{E}_t \left[\pi^{\mathrm{H}}_{t+4,t}\right] + \alpha_3 \mathbb{E}_t \left[\pi^{\mathrm{CF}}_{t+4,t}\right], \tag{2}$$

where $\pi_{t+4,t}$, $\mathbb{E}_t \left[\pi^{\mathrm{H}}_{t+4,t}\right]$, and $\mathbb{E}_t \left[\pi^{\mathrm{CF}}_{t+4,t}\right]$[13] are defined as inflation rates over the next one year and the mean forecasts of inflation rates from household surveys (CCS or OS), and CF at time t, respectively. Table 5 shows the estimation results of Equation 2 and finds that professionals have stronger predictability than households. While α_2 in Equation (2-I) indicates the ability of households' forecast (CCS) of inflation rates, the power of forecasting disappears once professional forecasts are added to Equation (2-III). That is the case for OS as well. Equations (2-II) and (2-IV) show that OS has no prediction power and professional forecasts from CF have the strong predictability. This evidence is supported in Equation (2-V). Evidence of the stronger predictability for professionals than households is consistent with Carroll (2003), which is the rationale as a first step for the sticky information hypothesis.

Carroll (2003) states that if professional outlook has stronger predictability for future inflation dynamics, households update their forecasts according to theirs. Carroll (2003) also proposes an estimation equation to examine how households process information:

$$\mathbb{E}_t \left[\pi^{\mathrm{H}}_{t+4,t}\right] = \alpha_0 + \alpha_1 \mathbb{E}_t \left[\pi^{\mathrm{CF}}_{t+4,t}\right] + \alpha_2 \mathbb{E}_{t-1} \left[\pi^{\mathrm{H}}_{t+3,t-1}\right] + \alpha_3 \pi_{t-1,t-5}. \tag{3}$$

If professional forecasts can be a useful reference for households, updated household forecasts at time t should be affected by professionals' average survey, $\mathbb{E}_t \left[\pi^{\mathrm{CF}}_{t+4,t}\right]$. Tables 6 and 7 indicate the effects of professionals' forecasts on households' information processing and updated frequencies of households. Equations (3-I) and (3-VI) in Tables 6 and 7 show that α_1 and α_2 are significant. This suggests that professional forecasts are referred when updating household forecasts. The evidence is consistent with the result in Carroll (2003); households' survey data is well represented by Equation (3). Importantly, the point estimates of α_1 range from 0.28 to 0.32 in Equations (3-II') and (3-VII') with a constant term, where the restriction of $\alpha_1 + \alpha_2 = 1$ is imposed. The point estimates of $\alpha_1 (\approx 0.3)$ are remarkably close to the value of 0.25 assumed by Mankiw and Reis (2002). As discussed in Equation (1), the coefficient α_1 corresponds to the parameter of updating frequency λ in the sticky information model. Estimation results from the two surveys (CCS and OS) indicate that only about one-fourth of households update their forecasts of inflation rates in each quarter.

We estimate Equations (3-I') and (3-VI') without a constant term, where the restriction of $\alpha_1 + \alpha_2 = 1$ is also imposed, but fail to reject the null that $\alpha_1 = 0$. However, Equations (3-II') and (3-VII') with a constant term reject the null that $\alpha_1 = 0$ and obtain reasonable point estimates of α_1. The

[13] CCS is a monthly survey, but we use the last month' data of each quarter.

evidence suggests that household surveys in Japan may have upward biases, as discussed in Ueno and Namba (2014).

3.2 Professionals and market participants

3.2.1 Sticky information

While studies have found that cross-sectional disagreements exist among households, there is empirical evidence of such disagreements among experts as well. As discussed, Figure 2 suggests cross-sectional disagreement among professional forecasters, particularly in the case of market participants. Figure 3 shows the probability of updating a forecast by calculating the ratio of revised forecasts by market participants to subsequent forecast timings. Figure 3 confirms that the updating probability is not 100%; rather, market participants revise their information sets infrequently.

This directly results in disagreements about inflation forecasts among professionals and market participants. When experts do not revise their forecasts according to changes in economic fundamentals, it is likely that their forecasts will fail to converge. In fact, each professional forecaster of inflation rates has different outlooks, as shown in Figures 1 and 2; they cross-sectionally disagree with the inflation outlook even over the one-year horizon.

Here, we conduct a formal test to explain disagreements using sticky information. When experts do not revise their information sets in each period, inattentive forecasts induce cross-sectional disagreements even among professional forecasters. To test whether the sticky information hypothesis holds for professional forecasters, we use a simple framework proposed by Coibion and Gorodnichenko (2015)[14] The methodology proposed by Coibion and Gorodnichenko (2015) relates ex-post forecast errors to ex-ante forecast revisions on average. Equation (1) can be rewritten as

$$\pi_{t+h,t} - \mathbb{F}_t[\pi_{t+h,t}] = \frac{\lambda}{1-\lambda}(\mathbb{F}_t[\pi_{t+h,t}] - \mathbb{F}_{t-1}[\pi_{t+h,t}]) + \eta_{t+h,t}. \tag{4}$$

Here, $\eta_{t+h,t} \equiv \pi_{t+h,t} - \mathbb{E}_t[\pi_{t+h,t}]$ is the forecast error of agents, which cannot be predicted using information available in period t under FIRE. Thus, η_{t+h_t} should be considered white noise. As a result, we can test the degree of sticky information by estimating Equation (4).

While Equation (4) is simple enough to test the null, it needs (at least two) sequential forecasts over adjacent horizons at time t, because the forecasts of $\pi_{t+h,t}$ at time t and $t-1$ are needed[15].

[14]Coibion and Gorodnichenko (2015) propose a methodology to test the FIRE hypothesis that can identify whether a null is rejected because of information rigidities. They document that pervasive evidence is consistent with the presence of information rigidities using U.S. and international forecast data.

[15]Following Coibion and Gorodnichenko (2015), $\pi_{t+h,t}$ refers to the average inflation arte over the current (t) and next h quarters.

However, forecast data are not always rich. In fact, surveys that have sequential inflation forecasts over multiple horizons are from professional forecasters (i.e. CF and ESP)[16].

3.2.2 Noisy information

While the sticky information model assumes inattentive agents, the noisy information model considers agents who update their information sets in every period, but do not directly observe the true states of the forecasted variables. If the signals of the true states of variables differ by forecaster, they cause the dispersion of forecasts in every forecasting period. Thus, if the noisy information model is supported, the model can be a main determinant of cross-sectional disagreement.

The model proposed by Coibion and Gorodnichenko (2015) is expressed as the relationship between ex-post forecast errors and ex-ante forecast revisions on average. Suppose that inflation rates at time t follow an AR(1) process:

$$\pi_t = \rho\pi_{t-1} + \varepsilon_t, \qquad 0 \leq \rho \leq 1,$$

where ε is i.i.d. and orthogonal to π_t. Agents update their information sets, but do not perfectly observe the true states of inflation dynamics. Instead, a signal ($s_{i,t}$) about the true states is obtained by agent i:

$$s_{i,t} = \pi_t + \epsilon_{i,t},$$

where $\epsilon_{i,t}$ is an error term. In this setting, an agent i who generates $\mathbb{F}_{i,t}[\pi_{t+h,t}]$ via the Kalman filter forms inflation expectations as below:

$$\mathbb{F}_t[\pi_{t+h,t}] = \beta s_{i,t} + (1-\beta)\mathbb{F}_{t-1}[\pi_{t+h,t}],$$

Coibion and Gorodnichenko (2015) link mean forecast errors with forecast revisions:

$$\pi_{t+h,t} - \mathbb{F}_t[\pi_{t+h,t}] = \frac{1-\beta}{\beta}(\mathbb{F}_t[\pi_{t+h,t}] - \mathbb{F}_{t-1}[\pi_{t+h,t}]) + \nu_{t+h,t}, \tag{5}$$

where $\nu_{t+h,t} = \sum_{j=1}^{h} \rho^{h-j}\nu_{t+j}$ should be the rational expectations error. Here as well, to test the null hypothesis, we check for the average revisions to predict ex-post mean forecast errors.

To test the null hypothesis for information rigidities, we estimate the following equation:

$$\pi_{t+h,t} - \mathbb{F}_t[\pi_{t+h,t}] = \gamma(\mathbb{F}_t[\pi_{t+h,t}] - \mathbb{F}_{t-1}[\pi_{t+h,t}]) + e_{t+h,t}. \tag{6}$$

[16] Another approach is to test the sticky information hypothesis suggested by Coibion and Gorodnichenko (2012). The key objective to test the null is to identify whether the response of forecast errors to various macroeconomic shocks are predictable and need successive forecasts at time t.

Estimating Equation (6) arising from Equations (4) and (5) is a commonly used approach to test the FIRE. However, Coibion and Gorodnichenko (2015) mention that Equation (6) not only is a testing equation for FIRE but also uses theoretical mapping from economic theory to empirical tests. Once the coefficients in the estimating equations are obtained, the parameters λ and β can be calculated and interpreted; λ and β imply the frequency of agents' updating forecasts and the weights on private signals. The difference between the classical tests of rationality and Equation (6) is the possibility of interpretations based on economic theory.

We estimate Equation (6) using quarterly data of inflation forecasts on Japan for the next one year from CF. Table 8 supports two facts about information rigidities. First, information rigidities are confirmed in inflation rate forecasts in Japan. The results show that the degree of stickiness is 17% and the weight of individual signals is 83% in the full sample, although the deeper parameter of stickiness λ is not significant. However, the values of the parameters are reasonable. It is indicated that most professional forecasters update their information sets every three to four months on average and assign heavy weight to their forecasting signals. This is consistent with the literature. Andrae and Le Bihan (2013) report that when using survey data for various macroeconomic variables in European quarterly data, the frequency of revising a forecast approximates to 80%. Focusing on the sample from 1994 to 2007, both the null that γ and β are all equal to zero is rejected. The point estimate of $\lambda \approx 0.4$ implies that forecasters update their forecasts every five month on average. The frequency of revising their forecasts before 2008 becomes smaller than that in all sample. The point estimate of $\beta \approx 0.6$ indicates that forecasters assign moderate weight on signals s in submitting survey.

Second is the time-dependence of information rigidities. Once the sample is shifted to data for the period after the 2008 Great Recession, their updating frequencies and weights are changed. The parameter γ fails to reject the null that $\gamma = 0$. This implies that professionals systematically update their forecasts during this period. The parameter β is greater than 0.925 and fails to reject the null $\beta = 1$. This indicates that professionals prioritize their signals far more than old information sets after the Great Recession. While the sample period is not long, it is consistent with the literature documenting state dependence in information rigidities (Coibion and Gorodnichenko, 2015).

In sum, the information rigidities hold: evidence from survey data on Japanese inflation rates suggests information rigidities as determinants of cross-sectional disagreement. The above-mentioned results imply that both households and experts do not always update their forecasts in each forecasting period, rather, they revise them infrequently. As for expert forecasts, the noisy information model is also supported. The forecasting behavior of professional forecasters can be expressed by the weighted average of signals for the true states and their previous forecasts are based on old information sets.

These findings explain cross-sectional disagreements among households and experts, as shown in Figures 1–3.

4 Dissonance in long-run inflation forecasts and monetary policy

Another disagreement that warrants investigation is dissonance in long-run inflation forecasts between the central bank and economic agents in the private sector. This section, first, presents recent developments in inflation expectations and clarifies the existence of disagreements regarding long-term forecasts of inflation rates between them. The objective is to test whether forecasts of inflation rates change as a result of the newly introduced inflation target and converge to the 2% level set by the Bank of Japan. Second, we examine the experiences of countries adopting inflation targeting. It is graphically shown that long-run inflation expectations in the countries, except Japan, are well anchored. Finally, the effects of such dissonance on a monetary policy are investigated. The main question is how the Bank of Japan's monetary policy stance under dissonance is perceived and whether the perception abruptly changes before and after the introduction of inflation targets and QQE.

4.1 Recent developments in inflation expectations

Tables 2–4 and Figures 4–7 depict short-, mid-, and long-term inflation forecasts in Japan. The tables and figures show the chronological developments of inflation expectations.

When focusing on the recent developments of inflation expectations, we obtain three findings. First, the short-run inflation expectations measured by the next one year's inflation forecasts and mid-term inflation expectations for the next 2–5 years increase by 0.5% to 1.0% when the impact of a consumption tax hike is excluded. As for short-term forecasts, Tables 2 and 4 and Figures 4 and 5 show that households increase their forecasts by about 1% when the impact of a consumption tax hike is included, while professional forecasts increase by 0.5% to 1.0% compared to pre-QQE. Although precisely identifying QQE effects on short-run inflation expectations are difficult because of fluctuations in oil prices and a consumption tax hike, inflation forecasts for the next one year roughly increase by 0.5% to 1.0% when comparing the period before and after QQE. Regarding mid-term inflation expectations captured for the next 2–5 years, ESP forecasts increase by approximately 0.9%. The mid-term forecast by professionals increase and reach 1.4% in 2015 from 0.5% in Subsample (B), which is just before the Abenomics period.

Second, long-run inflation expectations do not drastically change, that is, they go from -0.3% to 0.6%. Professional and market participants' inflation expectations increase by 0.3% to 0.6% when the impact of a consumption tax hike is excluded, while households lower their long-run forecasts

measured by OS. As for professionals and market participants, long-run forecasts continue to increase from 2013 to 2014 and reach 1.5% when the impact of a consumption tax is subtracted. On the other hand, household forecasts decrease from 4.18% in Subsample (B) to 3.83%, as shown in Table 2.

Third, inflation expectations by enterprises, professionals, and market participants fail to reach the 2% level set by the Bank of Japan for price stability. Inflation forecasts excluding the impact of a consumption tax hike by firms, professionals, and market participants are all below 2%, regardless of forecast-horizons. As for short-term forecasts, Tankan and ESP forecasts for 2014 are 1.5% and 1.0%. Long-run forecasts for Tankan, CF, ESP, and QSS range from 1.4% to 1.7%[17]. In fact, inflation forecasts edge up gradually between 2013 and 2014, but hover below the target rate[18].

In sum, inflation expectations seem to response to QQE, but the response differs by forecast horizons. Short- and mid-term inflation forecasts increase by 0.5% to 1.0%, but in the case of forecasts by firms, professionals, and market participants, they fail to achieve the 2% inflation target when the impact of a consumption tax hike is excluded. As for the long-term outlook, the forecasts do not drastically change and hover below 2.0%.

What happens to inflation forecasts in Japan and why do forecasts fail to converge to the 2% target? A possible reason that long-run inflation forecasts fail to converge to the target level set by the central bank is that forecasters disagree with the 2% target; in fact, survey data show the inertia of forecasts and disagreement among forecasters. Figures 8–9 of CF is a histogram of professionals' inflation forecasts for various durations, which exclude the impact of a consumption tax hike[19]. Figures 8 and 9 show stability in the mode values and increased disagreements.

First, we find that the mode is inactive. The mode values of inflation forecasts for the next ten years, as shown in Figure 9, are stable at 1% during all periods. The mode of inflation forecasts for the next two years, as shown in Figures 8, ranges from 0% to 0.5% for the entire period[20]. Other panel surveys for professionals support the stickiness of long-run inflation forecasts to the pre-QQE level. The mode values of professional inflation forecasts for the next two years increase by about 1% before and after the introduction of inflation targets, as shown in Figure 10. Panels (A) and (B) (Panels (C)

[17]Note that CF and QSS include the impact of a consumption tax hike.

[18]Some exceptions are household forecasts. Short-term forecasts from CCS are greater than 2.0% for 2013–2014, but note that they include the impact of a consumption tax hike. Short- and mid-term forecasts from OS including the impact of a consumption tax hike are also greater than 2.0%, although the average forecasts of OS are generally more than 2.0%.

[19]The data are divided into four subsamples: Subsample (I) July 2004–December 2006, Subsample (II) January 2007–December 2009, Subsample (III) January 2010–December 2012, and Subsample (III) January 2013–2015.

[20]The mode of inflation forecasts for the next one year, as shown in Figures A.2, are also stable at 0% for an entire period when the effects of a consumption tax hike are subtracted.

and (D)) are the forecasts for the next two years from CF and ESP in the three years before (after) the introduction of the inflation target. Note that CF includes the impact of a consumption tax hike, and thus, the forecasts in Panel (C) are "over valued." Both the mode values of CF and ESP increase by about 1% from 0% if the forecasts in Panel (C) are "under valued." Forecasts for the next two years indeed increase, but do not achieve the target level and are less than 1%. The inertia confirms that Japan is in the midst of increasing inflation outlook using QQE.

Second, we find that the disagreement of inflation outlook widens. Figures 8 and 10 show that the height of the mode values lowers and the tails of the histogram expand from 2013 to 2015. This implies that the disagreement measured by the dispersion of forecasts increases after 2013, when the 2% inflation target is introduced[21]. Disagreements among forecasters are also confirmed in Figures 1 and 2. Figures 1 shows that cross-sectional standard deviations from QSS increase in 2013 and Figure 2 implies that disagreements regarding inflation forecasts for the next two years are larger than those before 2012.

A simple index can further clarify the extent of deviation in agents' forecasts from the inflation goals set by the Bank of Japan:

$$\text{Dispersion index}_t \equiv \sqrt{\frac{1}{n}\sum_{j=1}^{n}\left(\mathbb{E}_{j,t}\left[\pi_{t+120,t+24}\right]-\pi_t^*\right)^2},$$

where π_t^* is the Bank of Japan's price stability goals; it was 1% till December 2012 and 2% from January 2013. $\mathbb{E}_{j,t}\left[\pi_{t+120,t+24}\right]$ is individual j's inflation forecasts as per QSS for the next 2–10 years at time t. This measure calculates the difference between cross-sectional long-run forecasts of inflation rates and the Bank of Japan's inflation rate targets and can capture whether agents agree with the inflation target set by the central bank. Figure 11 shows the development and confirms the spike in differences between long-run forecasts for inflation rates and the Bank's inflation target. The dispersion hovers around 0.5 till 2012, but doubles to 1.0 after the 2% inflation target is introduced in January 2013. Evidence from survey data suggests that disagreements among forecasters expand after QQE is introduced.

The new data also support the above evidences on the dissonance of long-run forecasts for inflation rates between the central bank and economic agents. We conduct a monthly online survey for households to collect inflation expectations over the short and long run from 2014. Every month, about

[21] Nishiguchi et al. (2014) report that the disagreement of households' inflation forecasts becomes smaller after the QQE rather than before. As shown, however, disagreements among professionals and market participants in CF, ESP, and QSS after 2013 is wider than before. Consider that the predictive power of professionals' forecasts are larger than that of households' forecasts, as shown in Section 3, we believe that it is more important that the dispersion of professional and market participant forecasts are larger than that before.

1,000 consumers[22] respond to the outlook for price expectation. Respondents are asked to answer questions about price expectations, for example, "what would the CPI price levels be for the next one, three, and ten years if the current level of the CPI were 10,000? Provide price level figures for each horizon, excluding the impact of the consumption tax hike." Forecasts on inflation rates are calculated on the basis of the responses. For example, if the response to the price outlook for the next 3 years was 10,500, the inflation rates would be computed as

$$\left(\frac{10,500}{10,000}\right)^{\frac{1}{3}} - 1 \approx 1.64\%.$$

We also compute "forward" forecasts. Inflation forecasts for the next 1 and 3 years and 3 and 10 years are calculated from the price outlook for the next 1 and 3 years and 3 and 10 years. Table 9 shows the descriptive statistics of the newly surveyed data[23]. Table 9 supports the evidence for the dissonance in the long-run forecasts of inflation rates between the central bank and consumers. While short- and mid-term forecasts of inflation rates measured using the median are generally close to the 2% target rate, long-term forecasts decline by about 1%. The median values for the next one and three years' forecasts from the truncated sample are almost 2%. However, inflation expectations decline as the forecast horizons become longer; the median values for the next ten years and 3–10 years decrease to 1%. As for forecasts for the next 3–10 years, the households' forecasts are at most at the 1.5% level if we evaluate them using mean values. Tables A.1–A.5 in the Appendix presents the descriptions of the statistics in further detail. Regarding long-run inflation forecasts, Table A.5 suggests that even households disagree with the target rates. In fact, forecasts for the next 3–10 years fail to converge to the 2% level for all attributes; the mean and median values are around 1.5% and below 1.0%. This indicates that households believe that while the price levels increase in the short run, the momentum drops and inflation rates hover from 1.0% to 1.5% in the long run. Therefore, not only experts but also households disagree with the 2% level as a long-run inflation rate.

4.2 Experiences of countries adopting inflation targets

To consider the fact that long-run inflation forecasts do not converge to the 2% target rate in Japan, we investigate the experiences of countries adopting inflation targets. Studies such as Bernanke et al. (1999), Little and Romano (2008), Gürkaynak et al. (2010), and Beechey et al. (2011) examine the relationship between inflation target and expectations. Bernanke et al. (1999) discuss the effects of inflation targets on declining inflation expectations using inflation forecasts for the next 12 and 18 months and Little and Romano (2008) mainly investigate this situation in the United States but do

[22] We use online monitors registered with INTAGE Inc.

[23] Data are provided for October 2014–June 2015.

not evaluate the relationship post the inflation target adoption. Gürkaynak et al. (2010) focus on the effects of adopting an inflation target on decreasing long-run inflation forecasts, but use a measure of market-based expectations rather than survey-based ones. Beechey et al. (2011) compare the evolution of long-run inflation expectations in the United States and the Eurozone using market-based evidence and survey data for inflation rates. We examine how long-run inflation forecasts are affected by the adoption of an inflation target and are anchored by or converge to the target rate set by the central bank to achieve price stability.

Figures 12 and 13 show the chronological development of long-run inflation expectations in countries adopting inflation targets[24]. First, overseas long-run inflation forecasts are slightly higher than the targeted inflation rate. For example, New Zealand, which is the first country to adopt an inflation target, successfully anchors long-term inflation forecasts, as shown in Panel (B) of Figure 12. Since it introduced its inflation target in 1990, New Zealand has succeeded in lowering inflation. Canada, which is the second country to adopt an inflation target, also allows for its inflation expectations to converge to the target rate. Panel (C) of Figure 12 shows that the inflation forecasts for the next 5–10 years lie on the mid points of the range for the inflation target set by the Bank of Canada. The United Kingdom and Switzerland succeeds in anchoring inflation forecasts in the long run between the upper and mid points of the inflation target range, as shown in Panel (D) of Figure 12 and Panel (H) of Figure 13. Countries in the Eurozone, as shown in Figure 13, are able to keep their long-run forecasts anchored. As for Germany, France, and Italy, long-run forecasts are slightly lower than the 2% level. This is consistent with price stability definition set by the European Central Bank, which announces that price stability in terms of the year-on-year inflation rates is below but close to 2%.

As for Japan, Panel (A) of Figure 12 shows that while the forecasts are stable at about 1% from 2006 to 2012, long-run forecasts only partially convergence to the 2% level. Long-term forecasts for Japan's inflation rates in fact edge up; however, they fall short of the 2% target level, despite the long-run forecasts in the countries adopting inflation targets, except Japan, being well anchored to the target rates set by each of their central banks.

4.3 Perception of a monetary policy stance under dissonance

In this section, we turn our interest to monetary policy implications. We attempt to answer the following research question: under the disagreement of long-run inflation forecasts between the central bank and private sector, does the newly introduced monetary policy framework induce a regime change

[24]The history and development of inflation targets in each country are summarized in Bernanke et al. (1999) and Little and Romano (2008).

leading to an abrupt shift in agents' expectations about the inflation outlook and can it stop chronic deflation? As discussed, evidence from survey data suggests the existence of disagreements regarding the 2% inflation target among forecasters. Under these circumstances, does QQE impact agents' perceptions of a monetary policy stance drastically enough to induce a change?[25] Following Fujiwara et al. (2015) and Kim and Pruitt (2015), we evaluate the monetary policy stance perceived by economic agents under the disagreement using long-run survey data for inflation rates from QSS.

We assume that the monetary policy follows the Taylor-type policy rule below:

$$i_t = r^* + \pi^* + \alpha(\pi_t - \pi^*), \tag{7}$$

where i_t, r^*, π^*, and π_t denote the short-term nominal interest rates at time t, equilibrium real rate, long-run inflation target, and inflation rates at time t, respectively. Equation (7) can lead to an expectation-based form:

$$\mathbb{E}_{j,t}[i] = r^* + \alpha\mathbb{E}_{j,t}[\pi_t] + (1-\alpha)\pi^*. \tag{8}$$

In this setting, we can estimate a policy reaction function perceived by agents. Parameter α should exceed unity to satisfy the Taylor principle, but can be below unity if the monetary policy commits to maintaining low interest rates. Thus, the perception of a monetary policy stance is examined by the value of parameter α.

However, what happens if the agents do not fully agree to the inflation target level? In Equation (8), the level of the inflation target π^* is constant. As Figure 7 shows, however, long-term inflation expectations are not always constant; rather, they are time-varying. Furthermore, there is a disagreement among agents, as shown above. Considering that the long-run inflation expectations do not uniformly converge, Equation (8) can be improved.

Kim and Pruitt (2015) propose an approach to estimate a policy reaction function under the problem that long-term inflation expectations are not constant. They assume that long-run forecasts are proxies for the market's estimate of the central bank's inflation target and estimate the Federal Reserve's policy reaction function. Following this assumption, we also assume that long-term inflation forecasts in the QSS represent the Bank of Japan's inflation target. This assumption allows π^* to be time-varying and deviate from 2%. To identify market participants' perception about the Bank of

[25] Using QSS, Fujiwara et al. (2015) examine whether such policy regime changes are perceived by economic agents and depict a declining trend for monetary policy reactions to inflation rates since the mid-2000s, implying intensified forward guidance before QQE was introduced in 2013.

Japan's monetary policy stance under time-varying π_t^*, we estimate the following equation:

$$
\begin{aligned}
\text{(I)} &: \mathbb{E}_{j,t}[i^{2\text{yr}}] = c + \alpha \mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \\
\text{(II)} &: \mathbb{E}_{j,t}[i^{2\text{yr}}] = c_j + \alpha \mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \\
\text{(III)} &: \mathbb{E}_{j,t}[i^{2\text{yr}}] = c + \big(\alpha_1 \mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi}) \\
&\qquad + \big(\alpha_2 \mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) \\
\text{(IV)} &: \mathbb{E}_{j,t}[i^{2\text{yr}}] = c_j + \big(\alpha_1 \mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi}) \\
&\qquad + \big(\alpha_2 \mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi})
\end{aligned}
$$

where $\mathbb{E}_{j,t}[i^{2\text{yr}}]$ and $\mathbb{E}_{j,t}[\pi_{t+120,t+24}]$ are defined as agent j's forecasts for 2-year bond interest rates for the next three months and agent j's forecasts of inflation rates for the next 2–10 years from QSS[26]. The objective is to adopt π_t^*, not π^*, as the inflation rate target. The indicator function $I(\cdot)$ is in unity if market participants generally agree with the inflation target announced by the Bank of Japan. More precisely, the indicator function takes the value of one if the inflation rate forecasts for the next 2–10 years are equal to or greater than 1.5% after January 2013[27] (and 0.5% before December 2013) and zero otherwise. The sample is divided into three subsamples: Subsample (A) July 2004–December 2007, Subsample (B) January 2008–December 2012, and Subsample (C) January 2013–2015. This estimation strategy allows us to examine whether a monetary policy stance under the dissonance of long-run forecasts for inflation rates between the central bank and economic agents changes abruptly and agents disagree about a monetary policy stance.

The estimation results in Table 10 show three findings: time-varying perception, disagreements about the monetary policy stance, and a downward trend for the constant term. First, α in Equations (I) and (II) declines from Subsample (A) to Subsample (C). From 2004 to 2007, α is greater than 1. This suggests that the monetary policy stance satisfies the Taylor principle. This is not surprising because the Bank of Japan discontinued the QQE in March 2006; thereafter, short-term interest rates were used as a monetary policy instrument until the 2008 Great Recession. Furthermore, the coefficient α falls below 1 in Subsamples (B) and (C) and hovers from 0.3 to 0.7. Note that coefficient α already declines below 1 and is between 0.5 to 0.7 in Subsamples (B) and ranges from 0.3 to 0.7 in Subsample (C). This suggests that market participants already consider the monetary policy stance to be accommodative enough to break the Taylor principle, both before and after the introduction of QQE. This indicates that policy regime does not *abruptly* change, that is, the private sector's perception about the monetary policy stance measured by the parameters α does not significantly differ between before and after the introduction of an inflation target and QQE.

[26] Figures A.3 and A.4 present forecasts for interest and inflation rates from QSS.

[27] The Bank of Japan introduced the price stability target at 2% in January 2013.

Second, we find disagreements among forecasters regarding the monetary policy stance. The differences between α_1 and α_2 approximate 0.6 in all Subsamples. Furthermore, it is noteworthy that the higher the long-term inflation rates forecasted by the agents, the tighter their perception of a monetary policy stance. For example, in Subsample (C), agents whose forecasted long-term inflation rates are higher have a "mild" perception about the monetary policy stance measured by $\alpha_1 (\approx 0.6)$, while those with a pessimistic outlook about the 2% price stability level believe that the Bank of Japan's monetary policy stance, measured by $\alpha_2 (\approx 0.0)$, is completely accommodative.

The decline in α from Subsample (B) to Subsample (C) is attributed to a decrease in the number of agents who believe that price stability can be satisfied in two years. Remember that more agent forecasts deviate from the inflation target set by the Bank of Japan in January 2013, as shown in Figure 11, which can be attributed to differing perceptions of long-term price stability. Before the inflation target was raised to 2%, agents who believes that the long-run inflation rate is not more than 0.5% are in the minority and their perception about the monetary policy stance observed by α_2 is already stimulative enough to break the Taylor principle. In fact, the coefficient α_2 is almost zero. However, once the target is introduced, pessimistic agents who forecasts that the long-term inflation rate is not more than 1.5% switched to a majority, but their perception about the monetary policy stance measured by α_2 remains accommodative. Thus, the pessimistic view about the long-run inflation rate relative to the 2% inflation target increases and maintains α_2 at almost zero, which mainly results in a lower α in Subsample (C). This may lead to a slight lift in the α value in Subsample (B). Given that both the mean and median values for the long-run forecasts of inflation rates from QSS without the impact of a consumption tax hike remain at about 1.0% even after the introduction of the 2% inflation target in January 2013, it is suggested that the key driver of the decline in α from Subsample (B) to Subsample (C) changes in terms of balance: agents who forecasted the long-term inflation rate to be lower than the inflation target switched from a minority to the majority.

Third, we find that the constant terms decline over the sample periods. While in Subsample (A) these terms are approximately 0.2, they decease to around -0.8 in Subsample (C). This drop is consistent with the downward trend in interest rates. The yields for the two-year bond reach 1.2% in June 2007 and sharply dropped below 0% in December 2014. The decline in c may be due to other macroeconomic factors. As discussed in Fujiwara et al. (2015), this decline may be partly due to a decrease in real interest rates and the impact of sequential QEs in 2008.

For a robustness check, we adopt a two-year bond interest rates for the next six months as a dependent variable. Table 11 confirms results that are similar to those in Table 10: a time-varying perception, disagreements among agents about the Bank of Japan's monetary policy stance, and a downward trend for the constant term. Furthermore, we estimate the equations using forecasts that do

not subtract the impact of a consumption tax hike and Tables A.6 and A.7 present the results. They also support the main findings suggested in Table 10.

In conclusion, our estimation results imply that the policy regime did not change *abruptly*, that is, the private sector's perception about the monetary policy stance does not greatly differ before and after the introduction of the inflation target and QQE under the two types of disagreements. As discussed in Fujiwara et al. (2015), it has been widely established in the academic literature that stopping chronic inflation or deflation means to produce a policy regime change by managing expectations. Our results, however, suggest that changes in the perception of a monetary policy stance are not drastic enough to satisfy "Sargent's (1982) criteria for regime change," as termed by Eggertsson (2008)[28]. We believe that the main reason perception fails to drastically change is that monetary policy is already accommodative before the introduction of QQE. The fact that an abrupt change in the perception regarding a monetary policy stance does not occur under the disagreements suggests difficulties in conducting an effective policy under the long-term liquidity trap, as discussed in Fujiwara et al. (2015).

5 Conclusion

This study examines two types of disagreements regarding inflation expectations using a wide range of survey data on Japanese inflation outlook and presents monetary policy implications. First, we focus on information rigidities as the determinants of cross-sectional dispersion among forecasters. To identify the source of cross-sectional disagreement, we investigate whether information rigidities as determinants of disagreements hold for survey data on inflation expectations in Japan. Second, we explore whether there is dissonance in the long-run inflation forecasts between the central bank and agents in the private sector. The final goal is to identify whether long-term inflation forecasts converge to the 2% target set by the Bank of Japan to achieve price stability. We also compare experiences of countries that have adopted inflation target with those in Japan. Finally, under the two types of disagreements, we examine whether a monetary policy regime change is induced by QQE. Sargent (1982) argues that a regime shift requires an *abrupt* change in the continuing policy. In fact, Kuroda (2013) states that QQE is intended to drastically change the expectations of markets and economic entities. Thus, in the context of this study, the judgment criteria for a change in regime is a drastic change in the perception about the new monetary policy introduced by the Bank of Japan.

[28] Kim and Pruitt (2015) show that the perceptions of a monetary policy stance in the United States have drastically changed. Kim and Pruitt (2015) report that policy rule parameters of inflation rates in the Taylor rule sharply fall after December 2008, when sequential quantitative easing was initiated by the Federal Reserve. The parameter for inflation changes fell from 1.55 to below 0.

Our three main findings are as follows[29]. First, we find that information rigidities are determinants of cross-sectional disagreement among not only households but also experts. Our estimation results imply that both households and experts do not always update their forecasts in every forecasting period; rather, revisions occur infrequently. As for experts' forecasts, the noisy information model is also supported. It is possible that the forecasting behavior of professional forecasters can be expressed by the weighted average of signals for the true states and their previous forecasts are based on the old information sets. This explains cross-sectional disagreements among households and experts.

Second, our findings indicate dissonance in long-run forecasts for inflation rates between the central bank and economic entities, despite the adoption of the 2% inflation target in January 2013 and the introduction of the unconventional monetary policy (QQE) in April 2013. While short- and mid-term forecasts of inflation rates by households are close to the 2% target rate, long-term forecasts fail to converge to it; long-run inflation forecasts indeed edge up gradually, but do not reach the target level. This result for long-term inflation forecasts is confirmed in surveys for all respondent types: households, firms, professionals, and market participants. This means that not only experts but also households disagree with the 2% inflation rate as the long-run inflation rate. Experiences of countries adopting the inflation target shows that countries, except Japan, have succeeded in anchoring long-run inflation forecasts.

Finally, we find that under the two types of disagreements, the private sector's perception about the monetary policy stance does not drastically differ before and after the introduction of an inflation target and QQE. The estimation results also show that the monetary policy was already perceived to be accommodative enough to break the Taylor principle. Furthermore, we find that disagreements exist among the market participants regarding the perception about the monetary policy stance, which may stem from cross-sectional disagreements and dissonance between the central bank and economic agents. This implies that the policy regime of the newly introduced monetary policy did not *abruptly* change on the basis of the perception under the two types of disagreement. Thus, we conclude that there is no upheaval in the agents' perception about a monetary policy stance enough to induce a regime change.

[29] We use information rigidities to explain disagreements among forecasters; however, other explanations are possible. Disagreements can be attributed to those regarding the inflation trend (Cogley and Sbordone, 2008) and learning from inflation experiences (Malmendier and Nagel, 2015). Further research is needed on these aspects.

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Table 1: List of inflation outlook on Japan

Households	Consumer Confidence Survey (Cabinet Office)
	Opinion Survey (Bank of Japan)
Firms	Tankan (Bank of Japan)
Professionals	Consensus Forecast (Consensus Economics)
	ESP forecast (Japan Center for Economic Research)
Market participants	Quick Survey System (Quick corporation)

Government	Economic Projection (Cabinet Office)
Central Bank	Outlook for Economic Activity and Prices (Bank of Japan)

Table 2: Descriptive statistics of Inflation forecasts: The Consumer Confidence Survey (CCS) and The Opinion Survey (OS)

Item	Price expectations		
All sample	CCS	OS	
2004/07 to 2014/12	1-year	1-year	5 -year
Mean	1.714%	4.000%	3.995%
Median	—	2.074%	2.310%
Subsample (A)	CCS	OS	
2004/07 to 2012/10	1-year	1-year	5-year
Mean	1.464%	3.791%	4.006%
Median	—	1.856%	2.353%
Subsample (B)	CCS	OS	
2011/11 to 2012/10	1-year	1-year	5-year
Mean	1.817%	3.775%	4.175%
Median	—	2.250%	2.375%
Subsample (C)	CCS	OS	
2012/11 to 2013/12	1-year	1-year	5-year
Mean	2.462%	4.380%	4.020%
Median	—	2.600%	2.200%
Subsample (D)	CCS	OS	
2014/01 to 2014/12	1-year	1-year	5-year
Mean	2.990%	4.700%	3.825%
Median	—	3.000%	2.000%

Note: CCS is from households of two or more persons.

Table 3: Descriptive statistics of firms' inflation forecasts: Tankan

Item	CPI (All items; tax-excl.)		
Respondents	All Enterprises		
2014Q1 to 2015Q2	1-year	3-year	5-year
Mean	1.450%	1.600%	1.667%
Respondents	Large Enterprises		
2014Q1 to 2015Q2	1-year	3-year	5-year
Mean	1.067%	1.217%	1.200%
Respondents	Medium Enterprises		
2014Q1 to 2015Q2	1-year	3-year	5-year
Mean	1.300%	1.483%	1.550%
Respondents	Small Enterprises		
2014Q1 to 2015Q2	1-year	3-year	5-year
Mean	1.633%	1.783%	1.867%

Note: Tankan categorizes enterprises into three types on the basis of their capital: large- (1 billion yen and more), mid- (from 100 million yen to less than 1 billion yen), and small-scale enterprises (100 million yen).

Table 4: Descriptive statistics of Inflation forecasts: Consensus Forecast (CF), Quick Survey System (QSS), and ESP Forecast (ESP)

Item	CPI (All items)			CPI (All items, less fresh food)					CPI (All items, less fresh food)		
All sample	CF (tax-incl.)			QSS (tax-incl.)					ESP (tax-excl.)		
2004/07 to 2014/12	1-year	1.5-year	5 to 10-year	1-year	2-year	10-year	1 to 2-year	2 to 10-year	1-year	2 to 5-year	6 to 10-year
Mean	0.170%	0.422%	1.249%	0.248%	0.480%	1.052%	0.713%	1.196%	0.118%	0.800%	1.314%
Subsample (A)	CF (tax-incl.)			QSS (tax-incl.)					ESP (tax-excl.)		
2004/07 to 2012/10	1-year	1.5-year	5 to 10-year	1-year	2-year	10-year	1 to 2-year	2 to 10-year	1-year	2 to 5-year	6 to 10-year
Mean	0.007%	0.234%	1.230%	−0.011%	0.257%	0.983%	0.524%	1.166%	−0.030%	0.486%	—
Subsample (B)	CF (tax-incl.)			QSS (tax-incl.)					ESP (tax-excl.)		
2011/11 to 2012/10	1-year	1.5-year	5 to 10-year	1-year	2-year	10-year	1 to 2-year	2 to 10-year	1-year	2 to 5-year	6 to 10-year
Mean	−0.138%	0.100%	1.000%	−0.009%	0.221%	0.845%	0.452%	1.001%	−0.068%	0.500%	0.900%
Subsample (C)	CF (tax-incl.)			QSS (tax-incl.)					ESP (tax-excl.)		
2012/11 to 2013/12	1-year	1.5-year	5 to 10-year	1-year	2-year	10-year	1 to 2-year	2 to 10-year	1-year	2 to 5-year	6 to 10-year
Mean	1.000%	2.120%	1.200%	0.520%	0.876%	1.165%	1.234%	1.238%	0.420%	1.133%	1.267%
Subsample (D)	CF (tax-incl.)			QSS (tax-incl.)					ESP (tax-excl.)		
2014/01 to 2014/12	1-year	1.5-year	5 to 10-year	1-year	2-year	10-year	1 to 2-year	2 to 10-year	1-year	2 to 5-year	6 to 10-year
Mean	2.200%	1.775%	1.650%	2.082%	1.879%	1.496%	1.677%	1.400%	1.006%	1.400%	1.500%

Note: Long-term forecasts of ESP on inflation rates for next 2-5 years and 6-10 years starts in June 2009 and June 2012, respectively. The impact of a consumption tax hike is included in forecasts from CF and QSS, but ESP collects forecasts without the impact.

Table 5: Forecasting the power of households' inflation forecasts (CCS and OS) and professionals (CF)

$$\pi_{t+4,t} = \alpha_0 + \alpha_1 \pi_{t-1,t-5} + \alpha_2 \mathbb{E}_t \left[\pi^{\mathrm{CCS}}_{t+4,t}\right] + \alpha_4 \mathbb{E}_t \left[\pi^{\mathrm{CF}}_{t+4,t}\right] + \varepsilon_t$$

$$\pi_{t+4,t} = \alpha_0 + \alpha_1 \pi_{t-1,t-5} + \alpha_3 \mathbb{E}_t \left[\pi^{\mathrm{OS}}_{t+4,t}\right] + \alpha_4 \mathbb{E}_t \left[\pi^{\mathrm{CF}}_{t+4,t}\right] + \varepsilon_t$$

Equation	α_0	α_1	α_2	α_3	α_4	$\bar{R}^2$
(2-I)	-0.957^{*}	-0.554^{*}	0.729^{**}			0.129
	(0.481)	(0.296)	(0.331)			
(2-II)	0.033	-0.169		0.062		-0.040
	(0.412)	(0.303)		(0.495)		
(2-III)	0.281	-0.426^{***}	-0.264		1.328^{***}	0.620
	(0.331)	(0.136)	(0.240)		(0.140)	
(2-IV)	0.354	-0.424^{***}		-0.130	1.269^{***}	0.636
	(0.309)	(0.115)		(0.095)	(0.087)	
(2-V)	-0.136^{*}	-0.320^{***}			1.125^{***}	0.620
	(0.077)	(0.101)			(0.079)	

Note: $\mathbb{E}_t \left[\pi^{\mathrm{CCS}}_{t+4,t}\right]$, $\mathbb{E}_t \left[\pi^{\mathrm{OS}}_{t+4,t}\right]$, $\mathbb{E}_t \left[\pi^{\mathrm{CF}}_{t+4,t}\right]$, and $\pi_{t-1,t-5}$ are defined as mean of cross-sectional forecasts for the next four quarters (one year) CCS, OS, and CF, and year-on-year (realized) inflation rates in the previous quarter, respectively. As for CCS, we use the data forecasted in the last month of each quarter (March, June, September, and December). The data cover from June 2004:Q2 to 2014:Q4. Standard errors are calculated by Huber-White estimator. Here, ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 6: Forecasting households' inflation forecasts (CCS) by professionals (CF)

$$\mathbb{E}_t\left[\pi^{\mathrm{CCS}}_{t+4,t}\right] = \alpha_0 + \alpha_1 \mathbb{E}_t\left[\pi^{\mathrm{CF}}_{t+4,t}\right] + \alpha_2 \mathbb{E}_{t-1}\left[\pi^{\mathrm{CCS}}_{t+3,t-1}\right] + \alpha_3 \pi_{t-1,t-5} + \varepsilon_t$$

Equation	α_0	α_1	α_2	α_3	$\bar{R}^2$	Test
						p-value
(3-I)		0.242^{***}	0.925^{***}		0.756	$\alpha_1 + \alpha_2 = 1$
		(0.191)	(0.056)			0.032
(3-I')		0.065	0.935		0.730	$\alpha_1 = 0.25$
		(0.049)	—			0.001
(3-II)	0.450^{***}	0.329^{***}	0.691^{***}		0.799	$\alpha_0 = 0$
	(0.146)	(0.066)	(0.083)			0.762
(3-II')	0.471^{***}	0.319^{***}	0.681^{***}		0.804	$\alpha_1 = 0.25$
	(0.103)	(0.065)	—			0.295
(3-III)		0.274^{***}	0.947^{***}	-0.120	0.768	$\alpha_1 + \alpha_2 + \alpha_3 = 1$
		(0.070)	(0.044)	(0.074)		0.168
(3-IV)	0.466^{**}	0.329^{***}	0.680^{***}	0.011	0.794	$\alpha_3 = 0$
	(0.190)	(0.067)	(0.117)	(0.072)		0.876
(3-V)			1.015^{***}	-0.074	0.717	$\alpha_2 + \alpha_3 = 0$
			(0.041)	(0.082)		0.430

Note: $\mathbb{E}_t\left[\pi^{\mathrm{CCS}}_{t+4,t}\right]$, $\mathbb{E}_t\left[\pi^{\mathrm{CF}}_{t+4,t}\right]$, and $\pi_{t-1,t-5}$ are defined as mean of cross-sectional forecasts for the next four quarters (one year) of CCS and CF each quarter and year-on-year (realized) inflation rates in the previous quarter, respectively. The data cover from June 2004:Q2 to 2014:Q4. Standard errors are calculated by Huber-White estimator. Here, ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 7: Forecasting households' inflation forecasts (OS) by professionals (CF)

$$\mathbb{E}_t\left[\pi^{\mathrm{OS}}_{t+4,t}\right] = \alpha_0 + \alpha_1 \mathbb{E}_t\left[\pi^{\mathrm{CF}}_{t+4,t}\right] + \alpha_2 \mathbb{E}_{t-1}\left[\pi^{\mathrm{OS}}_{t+3,t-1}\right] + \alpha_3 \pi_{t-1,t-5} + \varepsilon_t$$

Equation	α_0	α_1	α_2	α_3	$\bar{R}^2$	Test
						p-value
(3-VI)		0.410^{**}	0.935^{***}		0.659	$\alpha_1 + \alpha_2 = 1$
		(0.070)	(0.045)			0.001
(3-VI')		0.040	0.960		0.637	$\alpha_1 = 0.25$
		(0.055)	—			0.000
(3-VII)	0.912^{**}	0.445^{**}	0.740^{***}		0.700	$\alpha_0 = 0$
	(0.363)	(0.177)	(0.108)			0.016
(3-VII')	1.041^{***}	0.276^{**}	0.724^{**}		0.700	$\alpha_1 = 0.25$
	(0.356)	(0.112)	—			0.820
(3-VIII)		0.518^{**}	0.953^{***}	-0.254	0.674	$\alpha_1 + \alpha_2 + \alpha_3 = 1$
		(0.226)	(0.050)	(0.151)		0.208
(3-IX)	0.791^{**}	0.490^{**}	0.774^{***}	-0.118	0.697	$\alpha_3 = 0$
	(0.369)	(0.200)	(0.111)	(0.126)		0.353
(3-X)			0.995^{***}	-0.130	0.629	$\alpha_2 + \alpha_3 = 0$
			(0.047)	(0.141)		0.335

Note: $\mathbb{E}_t\left[\pi^{\mathrm{OS}}_{t+4,t}\right]$, $\mathbb{E}_t\left[\pi^{\mathrm{CF}}_{t+4,t}\right]$, and $\pi_{t-1,t-5}$ are defined as mean of 4-quarter (1-year) ahead forecasts of OS and CF each quarter and year-on-year (realized) inflation rates in the previous quarter, respectively. The data cover from June 2004:Q2 to 2015:Q2. Standard errors are calculated by Huber-White estimator. Here, ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 8: Tests of information rigidities: Consensus Forecast

$$\pi_{t+3,t} - \mathbb{F}_t[\pi_{t+3,t}] = \gamma(\mathbb{F}_t[\pi_{t+3,t}] - \mathbb{F}_{t-1}[\pi_{t+3,t}]) + \eta_{t+3,t}$$

Sample	c		$\lambda = \frac{\gamma}{1+\gamma}$		$\beta = \frac{1}{1+\gamma}$		$\bar{R}^2$	Standard Error of Regression	Observations
All sample			0.173	(0.185)	0.827***	(0.185)	0.020	0.382	82
	−0.002	(0.044)	0.173	(0.189)	0.827***	(0.189)	0.008	0.384	82
1994 to 2007			0.419***	(0.092)	0.581***	(0.092)	0.092	0.324	55
	0.023	(0.044)	0.434***	(0.088)	0.566***	(0.088)	0.079	0.327	55
2008 to 2014			0.075	(0.288)	0.925***	(0.288)	0.005	0.470	27
	−0.000	(0.091)	0.075	(0.293)	0.925***	(0.293)	−0.035	0.479	27

Note: Standard errors of the deeper parameters, λ and β, are calculated by the Delta Method using Huber-White estimator. Here, ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 9: Descriptive statistics of Households' inflation forecasts: Intage

	All sample			Truncated sample		
	Mean	Median	Observations	Mean	Median	Observations
1-year ahead	6.788%	2.000%	3,628	4.669%	2.000%	3,404
3-year ahead	3.453%	1.643%	3,231	3.615%	1.961%	3,144
10-year ahead	1.954%	0.958%	2,854	2.260%	0.958%	2,806
1 to 3-year ahead	3.198%	1.460%	3,208	2.798%	1.474%	3,136
3 to 10-year ahead	1.441%	0.820%	2,838	1.562%	0.901%	2,797

Note: "Truncated sample" is calculated by using the data truncated at -5% and $+30\%$. The data cover from October 2014 to June 2015.

Table 10: Regressions of 3-month ahead interest rate expectations on differences between the short-term inflation expectations and an inflation target which each forecaster perceives.

(I) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c + \alpha\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] + \varepsilon_{j,t}$

(II) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c_j + \alpha\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] + \varepsilon_{j,t}$

(III) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c + \big(\alpha_1\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi})$
$+\big(\alpha_2\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) + \varepsilon_{j,t}$

(IV) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c_j + \big(\alpha_1\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi})$
$+\big(\alpha_2\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) + \varepsilon_{j,t}$

Subsample (A) 2004/07 to 2007/12	c		α				Standard Error of Regression	Observations
Equation (I)	0.199^{***}	(0.020)	1.082^{***}	(0.018)			0.372	6,316
Equation (II)	0.149^{***}	(0.028)	1.019^{***}	(0.028)			0.307	6,316
$\bar{\pi} = 0.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 0.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 0.5$		Standard Error of Regression	Observations
Equation (III)	0.205^{***}	(0.017)	1.095^{***}	(0.015)	0.420^{***}	(0.115)	0.364	6,316
Equation (IV)	0.164^{***}	(0.016)	1.042^{***}	(0.020)	0.469^{***}	(0.129)	0.301	6,316

Subsample (B) 2008/01 to 2012/12	c		α				Standard Error of Regression	Observations
Equation (I)	-0.133^{***}	(0.034)	0.659^{***}	(0.033)			0.525	8,645
Equation (II)	-0.259^{***}	(0.046)	0.533^{***}	(0.046)			0.404	8,645
$\bar{\pi} = 0.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 0.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 0.5$		Standard Error of Regression	Observations
Equation (III)	-0.180^{***}	(0.032)	0.666^{***}	(0.032)	-0.084^{**}	(0.037)	0.485	8,645
Equation (IV)	-0.274^{***}	(0.043)	0.557^{***}	(0.045)	0.002	(0.047)	0.383	8,645

Subsample (C) 2013/01 to 2015/01	c		α				Standard Error of Regression	Observations
Equation (I)	-0.779^{***}	(0.041)	0.440^{***}	(0.038)			0.688	3,406
Equation (II)	-0.872^{***}	(0.040)	0.324^{***}	(0.050)			0.488	3,406
$\bar{\pi} = 1.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 1.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 1.5$		Standard Error of Regression	Observations
Equation (III)	-0.836^{***}	(0.040)	0.717^{***}	(0.039)	0.048	(0.029)	0.563	3,406
Equation (IV)	-0.896^{***}	(0.025)	0.592^{***}	(0.049)	0.020	(0.026)	0.398	3,406

Note: The impact of a consumption tax hike is subtracted from each forecast in Subsamples (B) and (C). $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}]$, $\mathbb{E}_t[\pi_{t+120,t+24}]$ and $\mathbb{E}_{j,t}[\pi_{t+120,t+24}]$ are defined as agent j's 3-month ahead forecasts on 2-year bond interest rates, the mean forecasts and agent j's forecasts for 2-10 years inflation rates from QSS, respectively. The indicator function $I(\cdot)$ is unity if the inflation rate forecasts for the next 2-10 years are equal to or greater than 1.5% after January 2013 (and 0.5% before December 2013) and zero otherwise. *White period* standard errors for heteroscedasticity and serial correlation are reported in parenthesis. Here, ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table 11: Regressions of 6-month ahead interest rate expectations on differences between the short-term inflation expectations and an inflation target which each forecaster perceives.

(I) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c + \alpha\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] + \varepsilon_{j,t}$

(II) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c_j + \alpha\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] + \varepsilon_{j,t}$

(III) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c + \big(\alpha_1\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi})$
$+\big(\alpha_2\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) + \varepsilon_{j,t}$

(IV) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c_j + \big(\alpha_1\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi})$
$+\big(\alpha_2\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) + \varepsilon_{j,t}$

Subsample (A) 2004/07 to 2007/12	c		α				Standard Error of Regression	Observations
Equation (I)	0.261^{***}	(0.021)	1.079^{***}	(0.019)			0.393	6,286
Equation (II)	0.221^{***}	(0.023)	1.028^{***}	(0.029)			0.354	6,286
$\bar{\pi} = 0.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 0.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 0.5$		Standard Error of Regression	Observations
Equation (III)	0.267^{***}	(0.018)	1.091^{***}	(0.017)	0.470^{***}	(0.127)	0.367	6,286
Equation (IV)	0.235^{***}	(0.017)	1.050^{***}	(0.021)	0.504^{***}	(0.137)	0.319	6,286

Subsample (B) 2008/01 to 2012/12	c		α				Standard Error of Regression	Observations
Equation (I)	-0.110^{***}	(0.033)	0.662^{***}	(0.033)			0.522	8,642
Equation (II)	-0.234^{***}	(0.046)	0.537^{***}	(0.046)			0.403	8,642
$\bar{\pi} = 0.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 0.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 0.5$		Standard Error of Regression	Observations
Equation (III)	-0.156^{***}	(0.032)	0.669^{***}	(0.032)	-0.065^{**}	(0.037)	0.483	8,642
Equation (IV)	-0.281^{***}	(0.042)	0.558^{***}	(0.045)	-0.001	(0.051)	0.384	8,642

Subsample (C) 2013/01 to 2015/01	c		α				Standard Error of Regression	Observations
Equation (I)	-0.772^{***}	(0.041)	0.440^{***}	(0.038)			0.688	3,405
Equation (II)	-0.866^{***}	(0.040)	0.324^{***}	(0.050)			0.488	3,405
$\bar{\pi} = 1.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 1.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 1.5$		Standard Error of Regression	Observations
Equation (III)	-0.829^{***}	(0.040)	0.716^{***}	(0.039)	0.049^{*}	(0.029)	0.563	3,405
Equation (IV)	-0.889^{***}	(0.025)	0.592^{***}	(0.049)	0.021	(0.026)	0.397	3,405

Note: The impact of a consumption tax hike is subtracted from each forecast in Subsamples (B) and (C). $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}]$, $\mathbb{E}_t[\pi_{t+120,t+24}]$ and $\mathbb{E}_{j,t}[\pi_{t+120,t+24}]$ are defined as agent j's 6-month ahead forecasts on 2-year bond interest rates, the mean forecasts and agent j's forecasts for 2-10 years inflation rates from QSS, respectively. The indicator function $I(\cdot)$ is unity if the inflation rate forecasts for the next 2-10 years are equal to or greater than 1.5% after January 2013 (and 0.5% before December 2013) and zero otherwise. *White period* standard errors for heteroscedasticity and serial correlation are reported in parenthesis. Here, ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

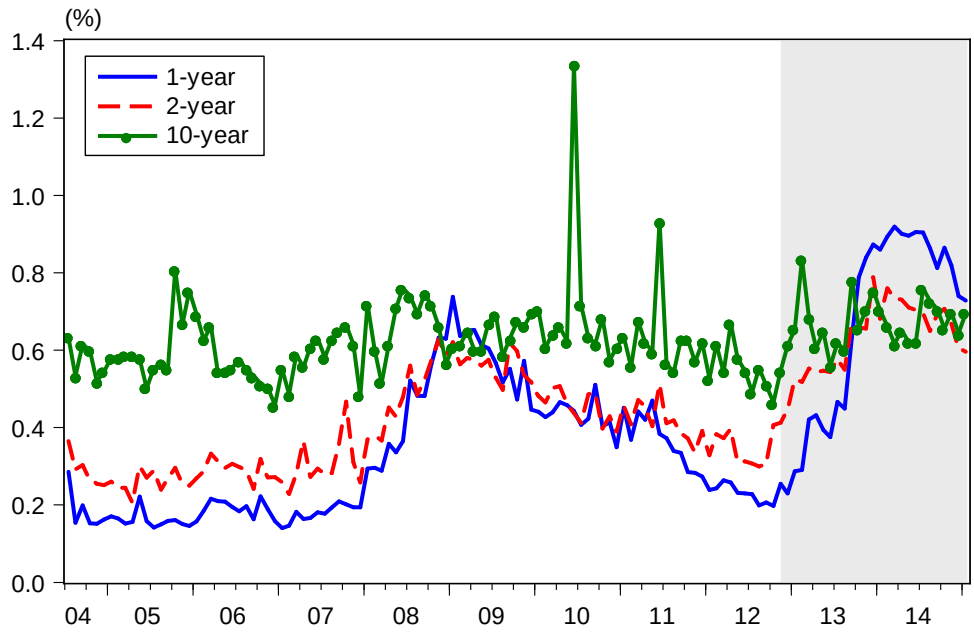
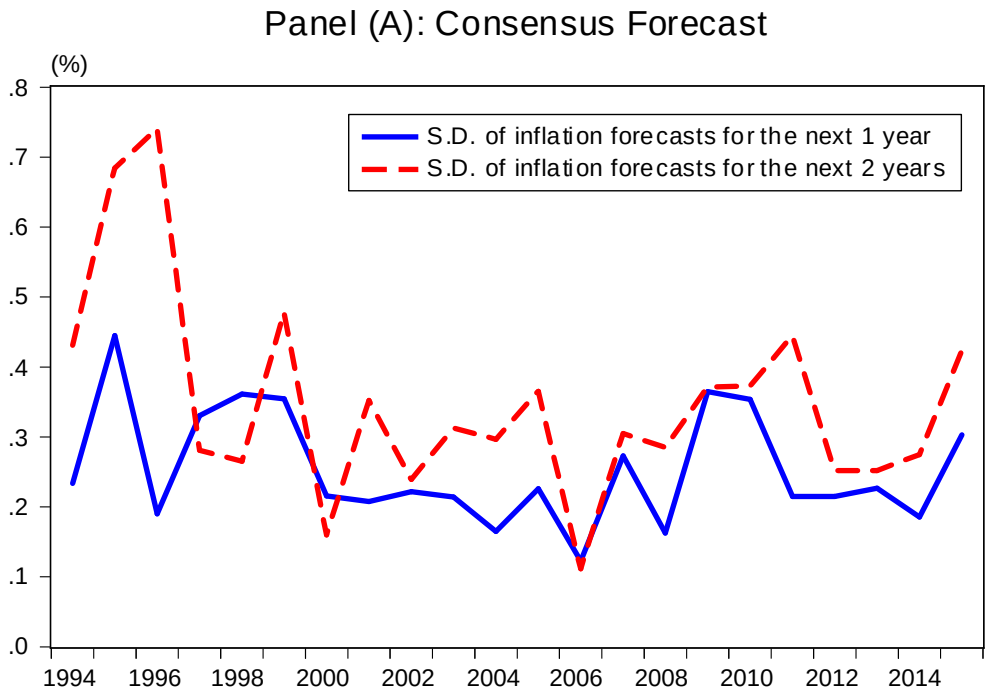


Figure 1: Cross-sectional standard deviation of QSS inflation forecasts for the next 1, 2, and 10 years. The data cover from July 2004 to January 2015. Shaded area is drawn from November 2012 when Abenomics started.



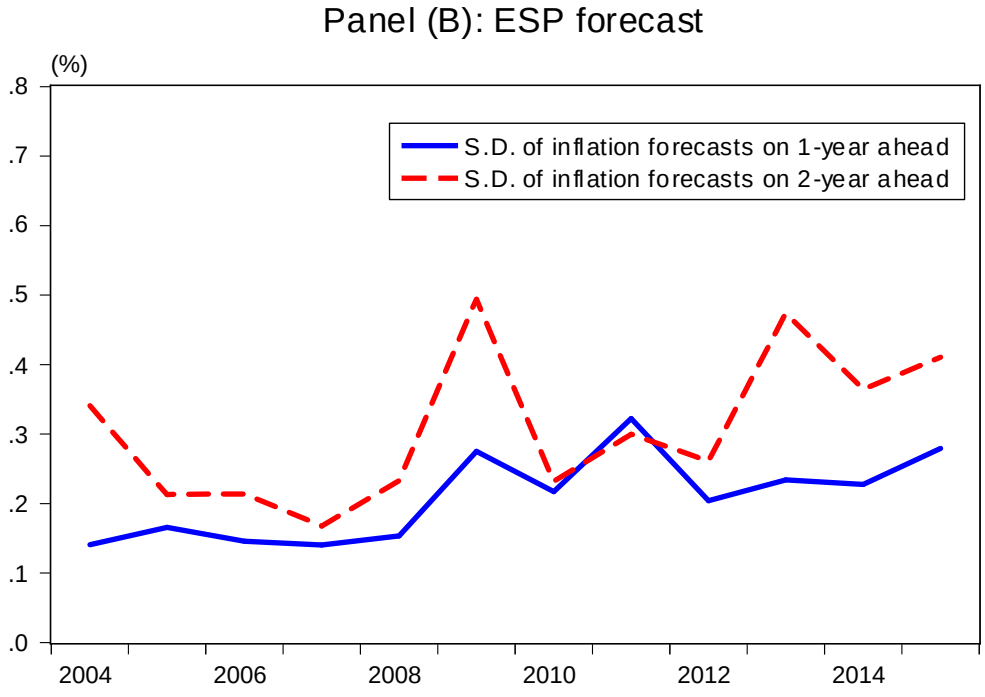


Figure 2: Cross-sectional standard deviation of inflation forecasts for the next 1 and 2 years from CF and ESP. The data from CF and ESP are from forecasts every January and every April, respectively.

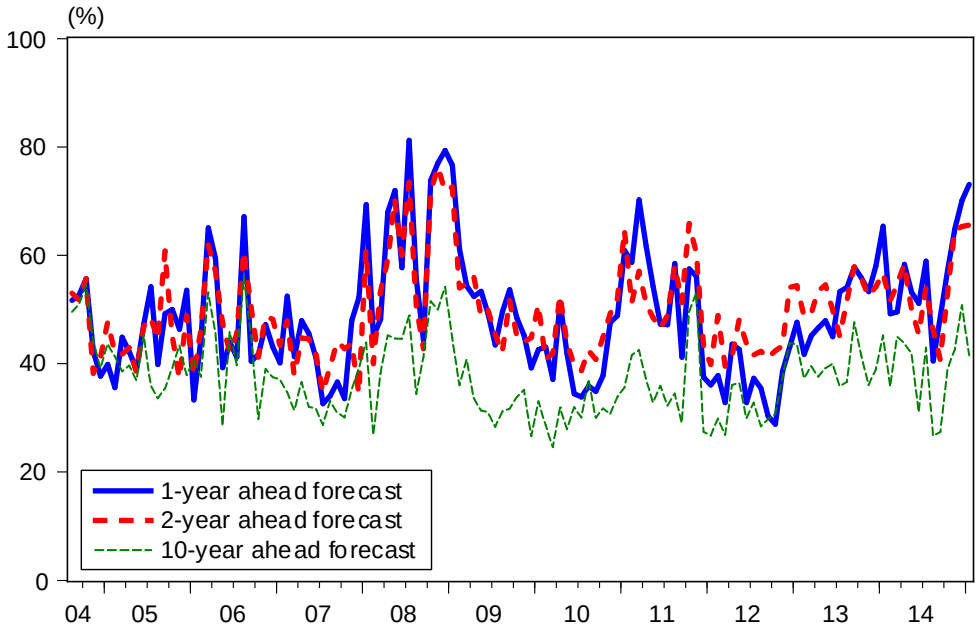


Figure 3: Probability of revising a forecast of QSS between two subsequent months for the next 1, 2, and 10 years. The data cover from August 2004 to January 2015.

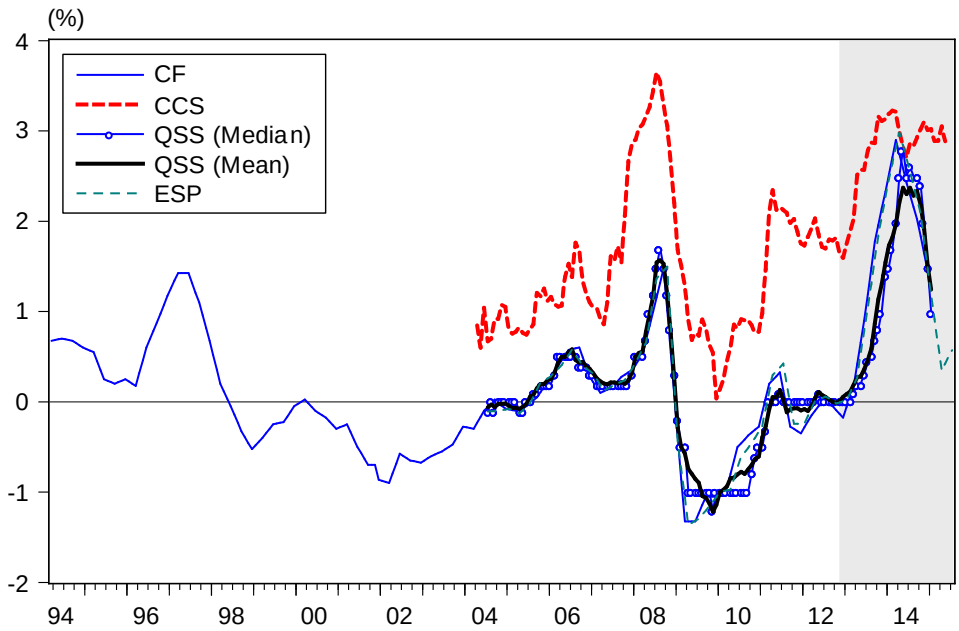


Figure 4: Inflation forecasts for the next 1 year and include the impact of a consumption tax hike. Shaded area is drawn from November 2012 when Abenomics started.

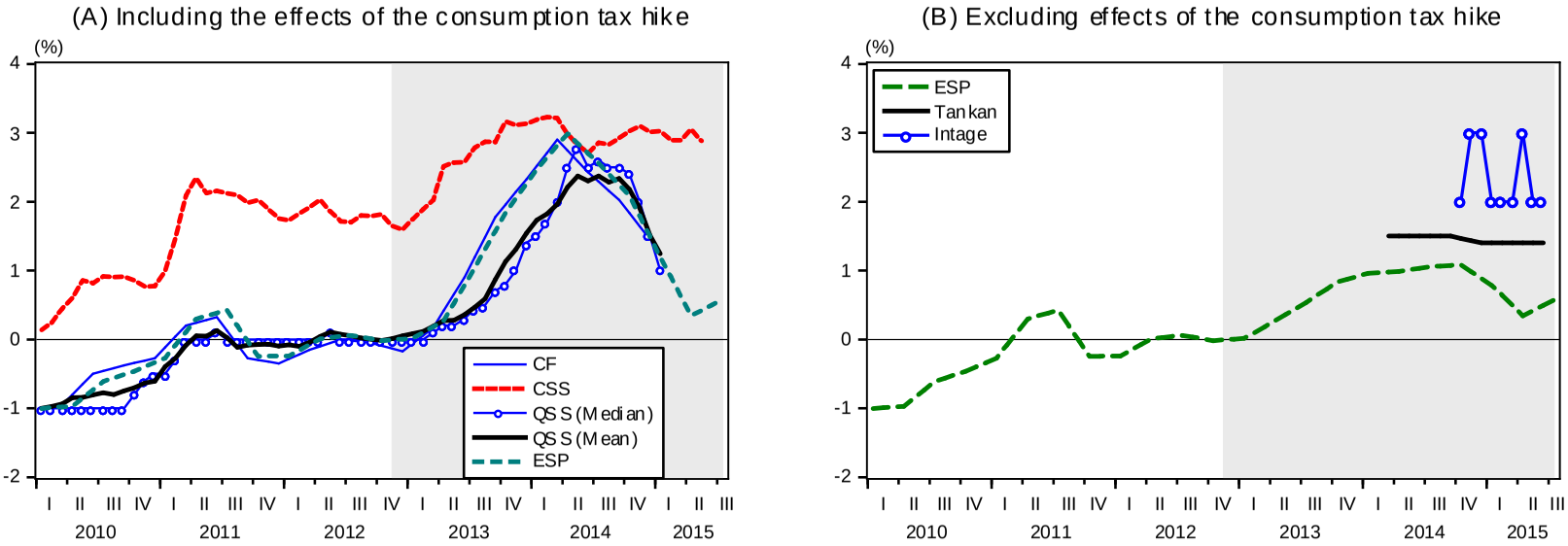


Figure 5: Forecasts on 1-year inflation rates. Panel (A) includes the impact of a consumption tax hike and Panel (B) excludes it. Shaded area is drawn from November 2012 when Abenomics started.

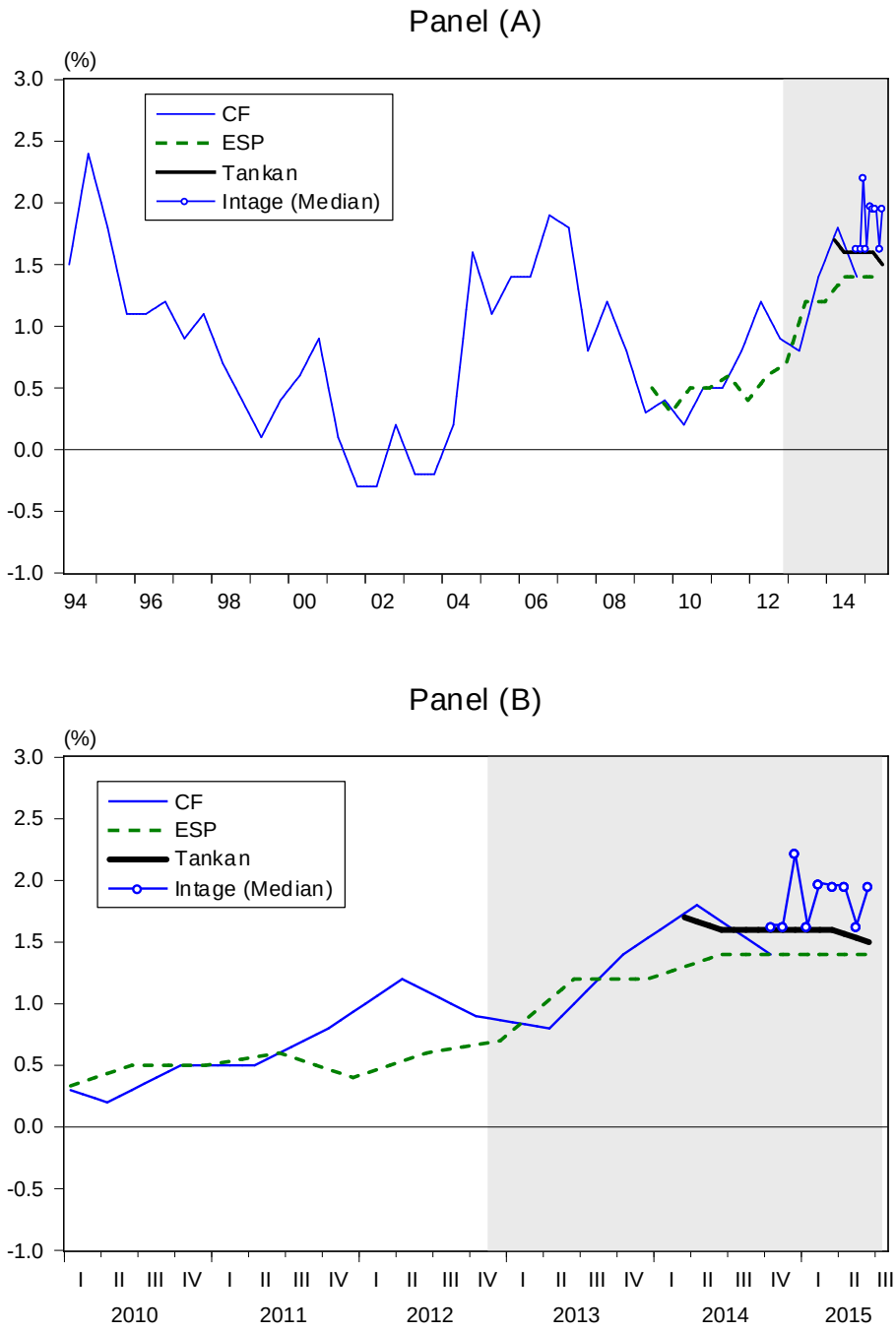


Figure 6: Forecasts on 3-year inflation rates. Forecasts of Consensus Economics include the impact of a consumption tax hike. Panel (A) covers from March 1994 to June 2015. Panel (B) covers from January 2010 to June 2015. Shaded area is drawn from November 2012 when Abenomics started.

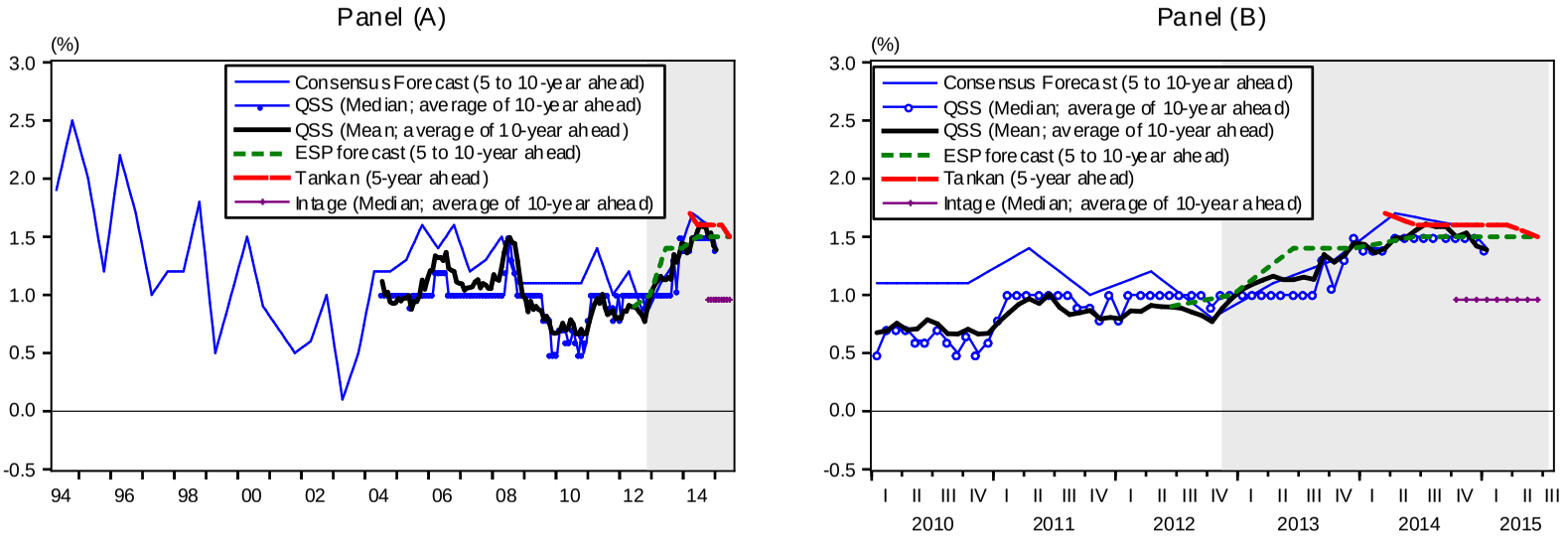


Figure 7: Long-run inflation forecasts. Forecasts of CF and QSS include the impact of a consumption tax hike. Panel (A) covers from March 1994 to June 2015. Panel (B) covers from January 2010 to June 2015. Shaded area is drawn from November 2012 when Abenomics started.

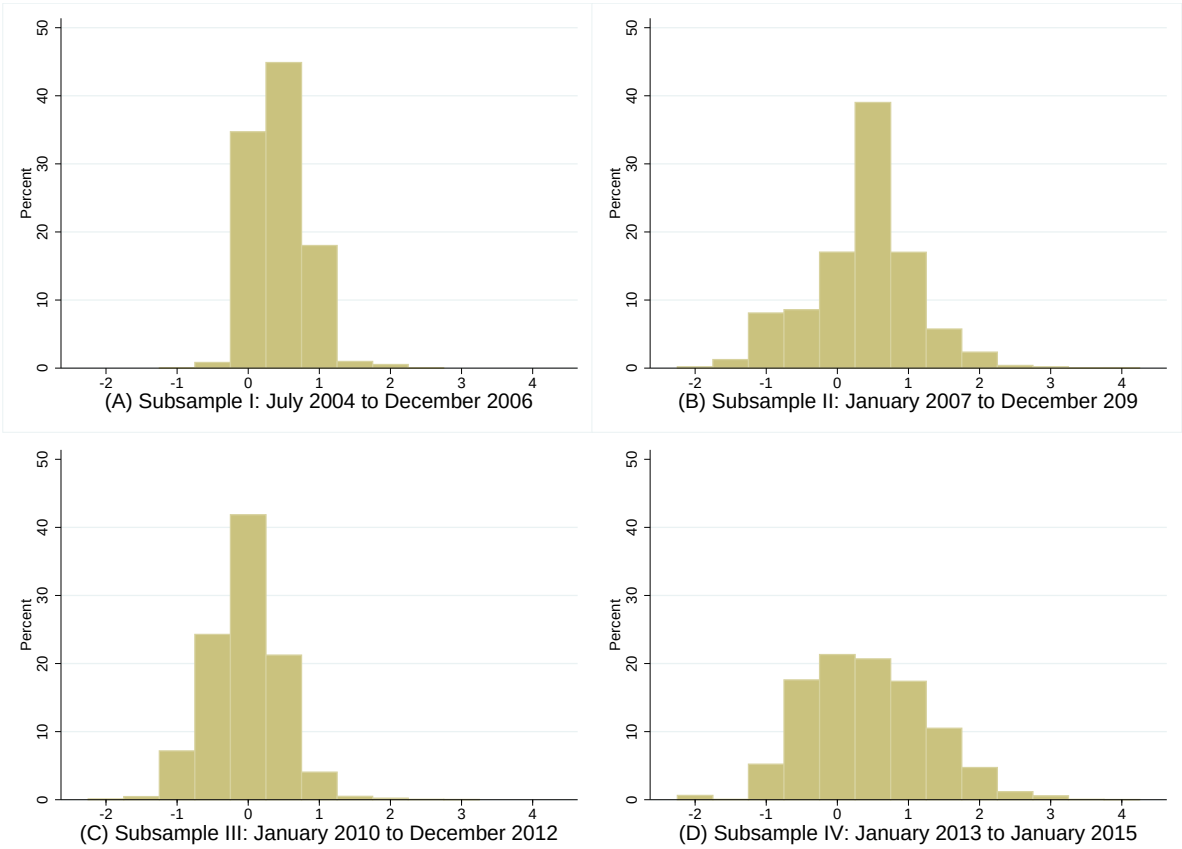


Figure 8: Histogram of inflation forecasts of market participants for the next 2 years. Note that the impact of a consumption tax hike is excluded. Data: QSS.

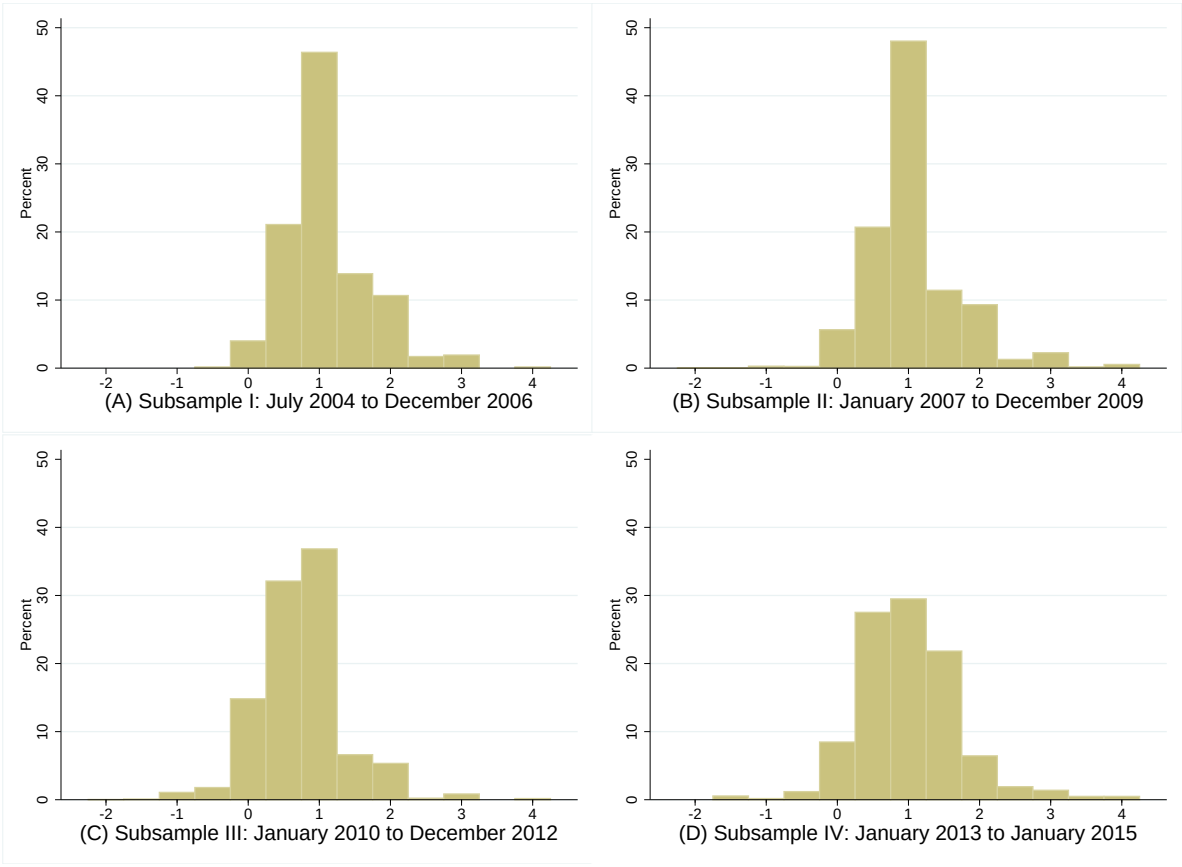


Figure 9: Histogram of inflation forecasts of market participants for the next 10 years. Note that the impact of a consumption tax hike is excluded. Data: QSS.

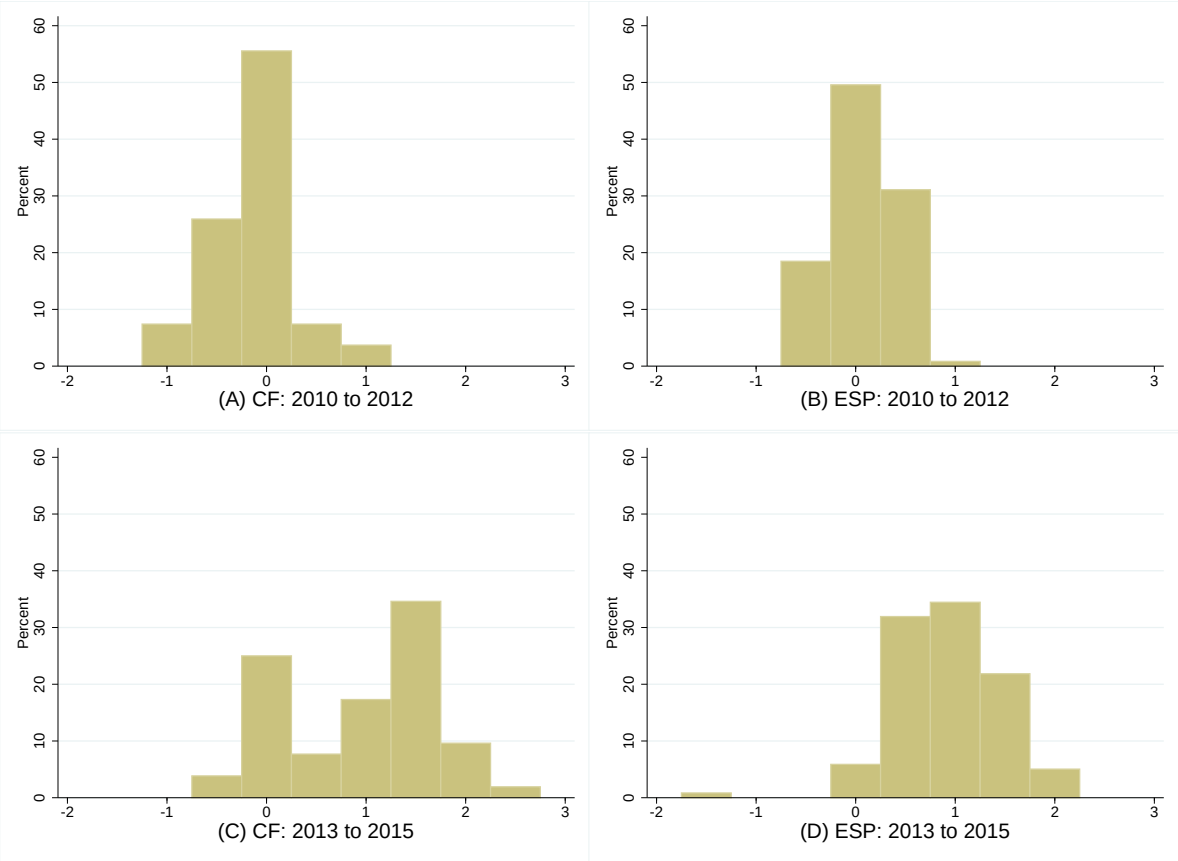


Figure 10: Histogram of inflation forecasts of professionals for the next 2 years. The data in Panels (A) and (C) are from CF and the impact of a consumption tax hike is included. Every forecast from CF is made in January. The data in Panels (B) and (D) are from ESP and the impact of a consumption tax hike is excluded. Every forecast from ESP is made in April. The 2% are subtracted from each forecast in 2013 (Panel (D)) to exclude the impact of a consumption tax hike from 5% to 8% because forecasts without the impact are not available.

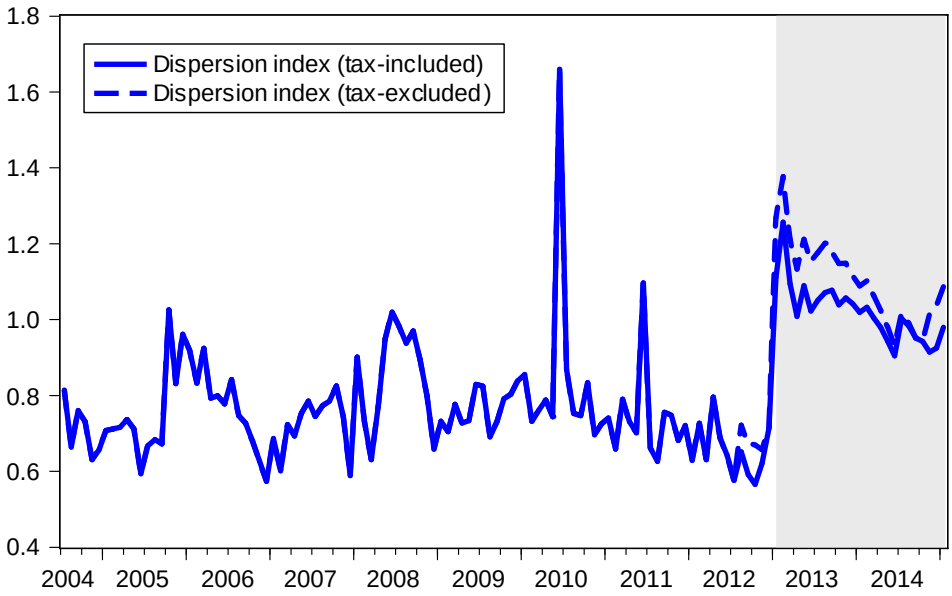


Figure 11: Dispersion index, measured by cross-sectional deviation from the price stability level set by the Bank of Japan. The target rates are 1% until December 2012 and 2% from January 2013. The data come from QSS's inflation forecasts for the next 2-10 years. The data covers from July 2004 to January 2015. Shaded area is drawn from January 2013 when a 2% inflation target was adopted by the Bank of Japan. The index depicted by the dashed line is calculated by the forecasts subtracting the impact of a consumption tax hike.

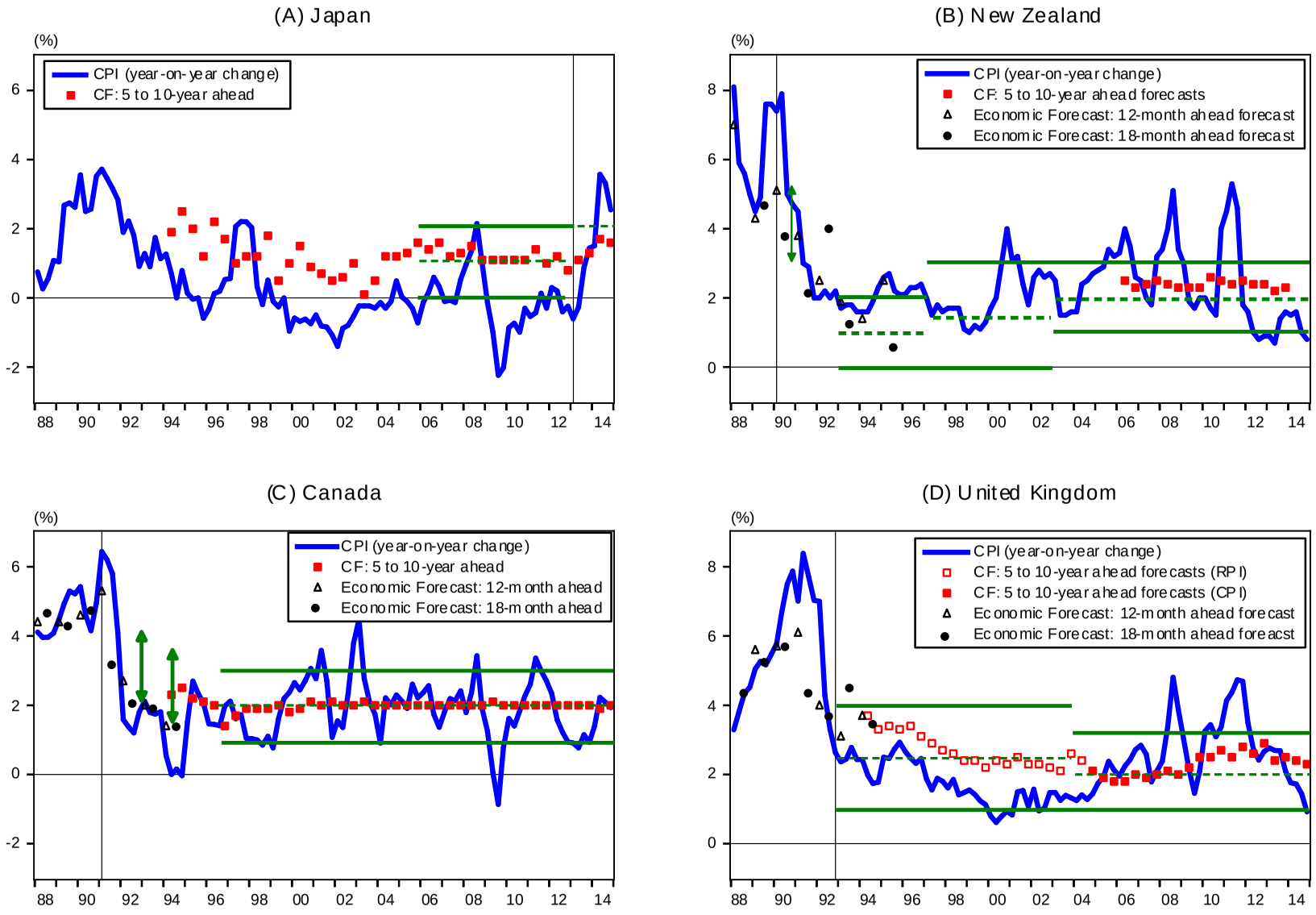


Figure 12: Longer-term inflation forecasts and inflation rates. The solid and dashed lines are defined as upper and lower limits of inflation targets and the point targets or the middle points, respectively. The vertical lines show the time when inflation targets are introduced. Panels (B) to (D) present 12- and 18-month ahead forecasts of Economic Forecast as well as 5 to 10-year ahead forecasts of CF.

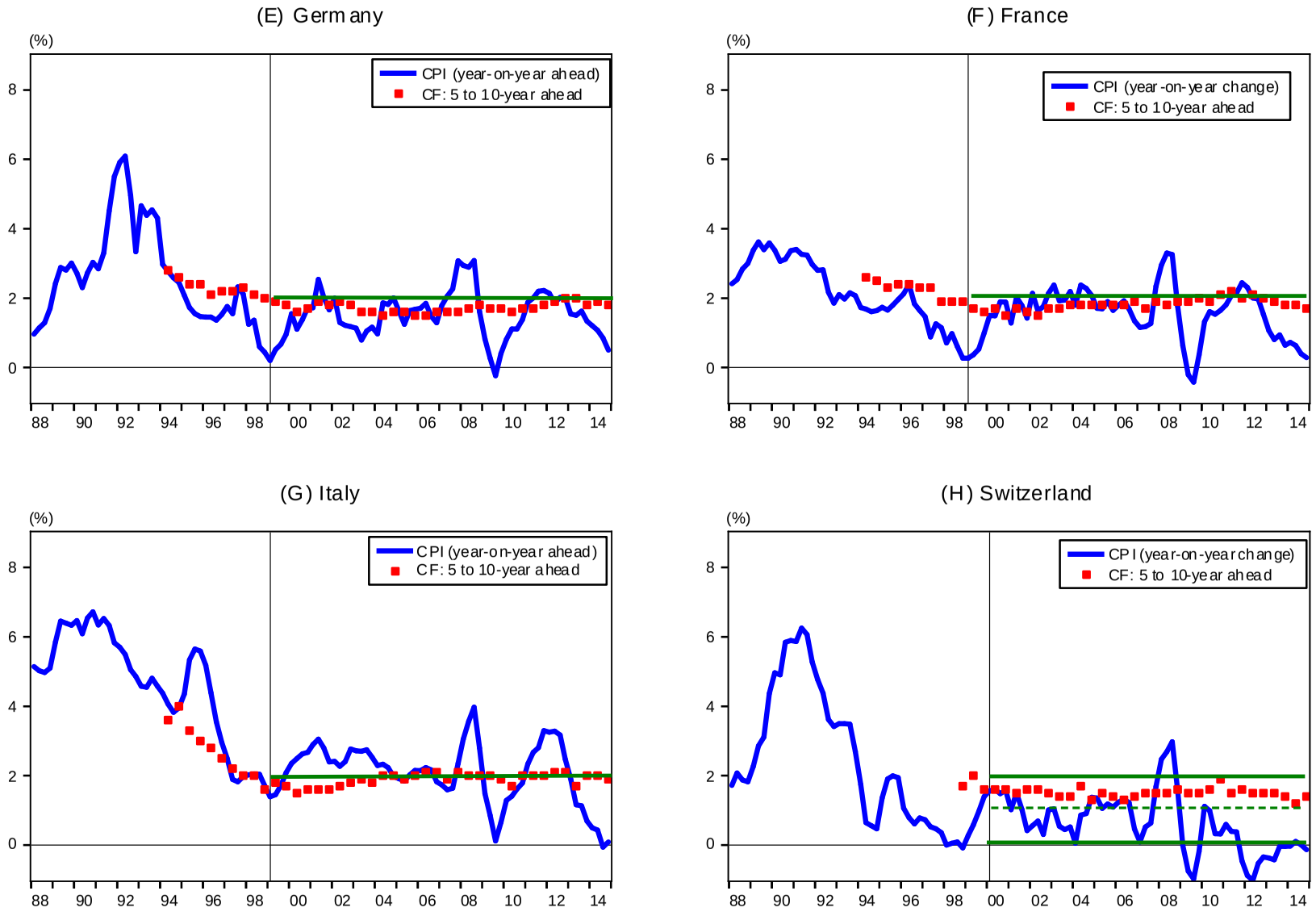


Figure 13: Longer-term inflation forecasts and inflation rates. The solid and dashed, green lines are upper and lower limits of inflation targets and the point targets or the middle points, respectively. The vertical lines show the time when inflation targets are introduced.

Table A.1: Descriptive statistics of Households' inflation forecasts for the 1 year: Intage

1-year average	All sample			Truncated sample		
	Mean	Median	Observations	Mean	Median	Observations
All	6.788%	2.000%	3,628	4.669%	2.000%	3,404
20 to 29 years old	7.695%	2.000%	487	4.777%	2.000%	443
30 to 39 years old	5.502%	2.000%	686	4.475%	2.000%	637
40 to 49 years old	7.368%	2.000%	743	4.560%	2.000%	701
50 to 59 years old	6.818%	3.000%	800	4.715%	3.000%	759
60 to 69 years old	6.774%	2.000%	912	4.804%	2.000%	864
Under 44 years old	6.695%	2.000%	1,562	4.563%	2.000%	1,448
Over 45 years old	6.859%	2.000%	2,066	4.747%	2.300%	1,956
Male	5.992%	2.000%	2,104	4.508%	2.000%	1,985
Female	7.888%	3.000%	1,524	4.893%	2.500%	1,419
Area 1: Hokkaido & Tohoku	7.026%	2.500%	425	4.729%	2.000%	399
Area 2: Kanto	5.980%	2.000%	1,248	4.678%	2.000%	1,182
Area 3: Chubu	5.214%	2.000%	606	4.783%	2.000%	567
Area 4: Kinki	9.987%	2.000%	625	5.015%	2.000%	583
Area 5: Chugoku & Shikoku	8.807%	2.000%	348	4.150%	2.000%	323
Area 6: Kyushu & Okinawa	4.557%	2.000%	376	4.287%	2.000%	350
High education	7.136%	2.000%	1,880	4.614%	2.000%	1,775
Low education	6.740%	2.000%	609	4.594%	2.000%	565
Nikkei readers	7.379%	2.000%	264	3.781%	2.000%	251
No newspaper	7.190%	2.000%	2,402	4.704%	2.000%	2,255
Smokers	6.001%	2.000%	491	5.091%	2.500%	457
Non-smokers	7.268%	2.000%	2,013	4.498%	2.000%	1,898
High income	5.810%	2.000%	1,126	4.206%	2.000%	1,067
Low income	7.305%	2.000%	2,470	4.888%	2.000%	2,306

Note: Respondents are asked to answer a 1-year ahead price level. Based on the answer, 1-year average inflation rates are computed. "Truncated sample" is calculated by using the data truncated at -5% and $+30\%$. The data cover from October 2014 to June 2015.

Table A.2: Descriptive statistics of Households' inflation forecasts for the next 3 years: Intage

3-year average	All sample			Truncated sample		
	Mean	Median	Observations	Mean	Median	Observations
All	3.453%	1.643%	3,231	3.615%	1.961%	3,144
20 to 29 years old	4.306%	1.640%	427	3.916%	1.640%	414
30 to 39 years old	3.148%	1.640%	616	3.577%	1.640%	599
40 to 49 years old	3.558%	1.640%	678	3.526%	1.640%	658
50 to 59 years old	3.706%	2.599%	721	3.637%	2.599%	706
60 to 69 years old	2.907%	1.961%	789	3.537%	2.281%	767
Under 44 years old	3.631%	1.640%	1,401	3.687%	1.640%	1,362
Over 45 years old	3.317%	1.961%	1,830	3.559%	2.281%	1,782
Male	3.158%	1.640%	1,911	3.429%	1.961%	1,859
Female	3.880%	1.961%	1,320	3.883%	2.281%	1,285
Area 1: Hokkaido & Tohoku	3.411%	2.089%	380	3.613%	2.281%	372
Area 2: Kanto	3.510%	1.640%	1,109	3.541%	1.640%	1,077
Area 3: Chubu	3.585%	2.897%	538	4.172%	3.228%	524
Area 4: Kinki	3.496%	1.961%	553	3.778%	2.599%	539
Area 5: Chugoku & Shikoku	3.170%	1.640%	311	2.870%	1.640%	299
Area 6: Kyushu & Okinawa	3.291%	1.640%	340	3.382%	1.640%	333
High education	3.462%	1.961%	1,683	3.541%	1.961%	1,649
Low education	3.137%	1.640%	544	3.527%	1.640%	520
Nikkei readers	2.448%	1.640%	234	3.030%	1.640%	229
No newspaper	3.437%	1.961%	2,149	3.579%	1.961%	2,091
Smokers	3.166%	1.961%	449	3.796%	1.961%	435
Non-smokers	3.413%	1.640%	1,789	3.450%	1.643%	1,745
High income	2.868%	1.640%	1,028	3.080%	1.640%	1,002
Low income	3.705%	1.961%	2,172	3.871%	2.281%	2,113

Note: Respondents are asked to answer a 3-year ahead price level. Based on the answer, 3-year average inflation rates are computed. "Truncated sample" is calculated by using the data truncated at -5% and $+30\%$. The data cover from October 2014 to June 2015.

Table A.3: Descriptive statistics of Households' inflation forecasts for the next 10 years: Intage

10-year average	All sample			Truncated sample		
	Mean	Median	Observations	Mean	Median	Observations
All	1.954%	0.958%	2,854	2.260%	0.958%	2,806
20 to 29 years old	2.157%	0.958%	397	2.448%	1.204%	390
30 to 39 years old	1.839%	0.958%	566	2.203%	0.958%	555
40 to 49 years old	1.946%	0.958%	592	2.222%	0.958%	582
50 to 59 years old	1.976%	0.958%	634	2.242%	1.407%	625
60 to 69 years old	1.915%	0.958%	665	2.249%	0.958%	654
Under 44 years old	1.973%	0.958%	1,279	2.278%	0.958%	1,256
Over 45 years old	1.938%	0.958%	1,575	2.246%	0.958%	1,550
Male	1.843%	0.958%	1,712	2.168%	0.958%	1,681
Female	2.119%	0.958%	1,142	2.399%	0.958%	1,125
Area 1: Hokkaido & Tohoku	1.999%	0.958%	335	2.295%	0.958%	330
Area 2: Kanto	1.913%	0.958%	976	2.225%	0.958%	958
Area 3: Chubu	2.088%	1.407%	462	2.456%	1.754%	454
Area 4: Kinki	1.969%	1.363%	496	2.315%	1.407%	487
Area 5: Chugoku & Shikoku	1.719%	0.958%	278	1.908%	0.958%	275
Area 6: Kyushu & Okinawa	2.020%	0.958%	307	2.273%	0.958%	302
High education	2.073%	0.958%	1,479	2.294%	0.958%	1,460
Low education	1.692%	0.958%	478	2.215%	0.958%	464
Nikkei readers	1.889%	0.958%	207	2.100%	0.958%	204
No newspaper	2.002%	0.958%	1,890	2.296%	0.958%	1,858
Smokers	1.891%	0.958%	401	2.265%	0.958%	391
Non-smokers	2.000%	0.958%	1,567	2.273%	0.958%	1,544
High income	1.648%	0.958%	924	1.928%	0.958%	909
Low income	2.110%	0.958%	1,902	2.423%	0.958%	1,870

Note: Respondents are asked to answer a 10-year ahead price level. Based on the answer, 10-year average inflation rates are computed. "Truncated sample" is calculated by using the data truncated at -5% and $+30\%$. The data cover from October 2014 to June 2015.

Table A.4: Descriptive statistics of Households' inflation forecasts for the next 1-3 years: Intage

1 to 3-year average	All sample			Truncated sample		
	Mean	Median	Observations	Mean	Median	Observations
All	3.198%	1.460%	3,208	2.798%	1.474%	3,136
20 to 29 years old	3.858%	1.474%	423	3.170%	1.504%	411
30 to 39 years old	2.922%	1.460%	611	2.708%	1.460%	600
40 to 49 years old	3.389%	1.474%	672	2.768%	1.567%	649
50 to 59 years old	3.396%	1.961%	717	2.805%	1.961%	706
60 to 69 years old	2.711%	1.460%	785	2.689%	1.460%	770
Under 44 years old	3.227%	1.460%	1,389	2.850%	1.460%	1,358
Over 45 years old	3.175%	1.489%	1,819	2.758%	1.543%	1,778
Male	3.003%	1.474%	1,900	2.694%	1.489%	1,853
Female	3.480%	1.460%	1,308	2.948%	1.460%	1,283
Area 1: Hokkaido & Tohoku	2.702%	1.460%	375	2.780%	1.474%	367
Area 2: Kanto	3.063%	1.460%	1,101	2.867%	1.460%	1,070
Area 3: Chubu	3.781%	1.961%	536	3.023%	1.961%	527
Area 4: Kinki	2.763%	1.460%	550	2.803%	1.460%	541
Area 5: Chugoku & Shikoku	3.154%	1.460%	308	2.356%	1.460%	300
Area 6: Kyushu & Okinawa	4.006%	1.460%	338	2.630%	1.460%	331
High education	3.028%	1.474%	1,672	2.745%	1.489%	1,641
Low education	3.523%	1.460%	539	2.800%	1.460%	525
Nikkei readers	1.883%	1.460%	234	2.513%	1.460%	228
No newspaper	3.192%	1.460%	2,133	2.785%	1.482%	2,088
Smokers	2.687%	1.460%	443	2.976%	1.460%	432
Non-smokers	3.233%	1.474%	1,779	2.688%	1.474%	1,743
High income	2.568%	1.460%	1,024	2.458%	1.460%	999
Low income	3.406%	1.489%	2,153	2.958%	1.489%	2,107

Note: Respondents are asked to answer 1- and 3-year ahead price levels. Based on the answer, average "forward" inflation rates for the next 1-3 years are computed. "Truncated sample" is calculated by using the data truncated at -5% and $+30\%$. The data cover from October 2014 to June 2015.

Table A.5: Descriptive statistics of Households' inflation forecasts for the next 3-10 years: Intage

3 to 10-year average	All sample			Truncated sample		
	Mean	Median	Observations	Mean	Median	Observations
All	1.441%	0.820%	2,838	1.562%	0.901%	2,797
20 to 29 years old	1.371%	0.944%	393	1.647%	0.962%	387
30 to 39 years old	1.476%	0.689%	566	1.547%	0.764%	557
40 to 49 years old	1.295%	0.667%	590	1.504%	0.667%	579
50 to 59 years old	1.320%	0.944%	629	1.550%	0.944%	621
60 to 69 years old	1.697%	0.944%	660	1.587%	0.944%	653
Under 44 years old	1.414%	0.764%	1,273	1.544%	0.804%	1,253
Over 45 years old	1.462%	0.944%	1,565	1.576%	0.944%	1,544
Male	1.413%	0.926%	1,703	1.514%	0.944%	1,676
Female	1.481%	0.686%	1,135	1.633%	0.768%	1,121
Area 1: Hokkaido & Tohoku	1.546%	0.699%	330	1.462%	0.732%	324
Area 2: Kanto	1.355%	0.912%	972	1.553%	0.944%	955
Area 3: Chubu	1.532%	0.944%	462	1.697%	0.944%	458
Area 4: Kinki	1.483%	0.944%	493	1.566%	0.944%	487
Area 5: Chugoku & Shikoku	1.169%	0.667%	275	1.277%	0.667%	271
Area 6: Kyushu & Okinawa	1.637%	0.693%	306	1.744%	0.748%	302
High education	1.570%	0.827%	1,471	1.611%	0.901%	1,452
Low education	1.147%	0.717%	476	1.538%	0.862%	467
Nikkei readers	1.739%	0.804%	206	1.782%	0.804%	205
No newspaper	1.471%	0.827%	1,881	1.603%	0.901%	1,853
Smokers	1.386%	0.679%	400	1.621%	0.752%	394
Non-smokers	1.494%	0.912%	1,558	1.588%	0.944%	1,537
High income	1.241%	0.679%	919	1.343%	0.699%	906
Low income	1.544%	0.944%	1,891	1.661%	0.944%	1,864

Note: Respondents are asked to answer a 3- and 10-year ahead price levels. Based on the answer, average "forward" inflation rates for the next 3-10 years are computed. "Truncated sample" is calculated by using the data truncated at -5% and $+30\%$. The data cover from October 2014 to June 2015.

Table A.6: Regressions of 3-month ahead interest rate expectations on differences between the short-term inflation expectations and an inflation target which each forecaster perceives.

(I) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c + \alpha\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] + \varepsilon_{j,t}$

(II) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c_j + \alpha\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] + \varepsilon_{j,t}$

(III) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c + \big(\alpha_1\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi})$
$+\big(\alpha_2\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) + \varepsilon_{j,t}$

(IV) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c_j + \big(\alpha_1\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi})$
$+\big(\alpha_2\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) + \varepsilon_{j,t}$

Subsample (B) 2008/01 to 2012/12	c		α				Standard Error of Regression	Observations
Equation (I)	-0.180^{***}	(0.033)	0.650^{***}	(0.033)			0.529	8,645
Equation (II)	-0.298^{***}	(0.045)	0.528^{***}	(0.046)			0.404	8,645
$\bar{\pi} = 0.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 0.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 0.5$		Standard Error of Regression	Observations
Equation (III)	-0.211^{***}	(0.032)	0.663^{***}	(0.032)	-0.103^{***}	(0.038)	0.492	8,645
Equation (IV)	-0.306^{***}	(0.042)	0.554^{***}	(0.045)	-0.012	(0.050)	0.384	8,645

Subsample (C) 2013/01 to 2015/01	c		α				Standard Error of Regression	Observations
Equation (I)	-1.285^{***}	(0.036)	0.438^{***}	(0.036)			0.674	3,406
Equation (II)	-1.275^{***}	(0.046)	0.314^{***}	(0.046)			0.477	3,406
$\bar{\pi} = 1.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 1.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 1.5$		Standard Error of Regression	Observations
Equation (III)	-1.220^{***}	(0.040)	0.646^{***}	(0.068)	0.284^{***}	(0.028)	0.658	3,406
Equation (IV)	-1.199^{***}	(0.012)	0.554^{***}	(0.074)	0.133^{***}	(0.022)	0.452	3,406

Note: The impact of a consumption tax hike is not subtracted from each forecast in Subsamples (B) and (C). $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}]$, $\mathbb{E}_t[\pi_{t+120,t+24}]$ and $\mathbb{E}_{j,t}[\pi_{t+120,t+24}]$ are defined as agent j's 3-month ahead forecasts on 2-year bond interest rates, the mean forecasts and agent j's forecasts for 2-10 years inflation rates from QSS, respectively. The indicator function $I(\cdot)$ is unity if the inflation rate forecasts for the next 2-10 years are equal to or greater than 1.5% after January 2013 (and 0.5% before December 2013) and zero otherwise. *White period* standard errors for heteroscedasticity and serial correlation are reported in parenthesis. Here, ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

Table A.7: Regressions of 6-month ahead interest rate expectations on differences between the short-term inflation expectations and an inflation target which each forecaster perceives.

(I) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c + \alpha\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] + \varepsilon_{j,t}$

(II) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c_j + \alpha\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha)\mathbb{E}_{j,t}[\pi_{t+120,t+24}] + \varepsilon_{j,t}$

(III) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c + \big(\alpha_1\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi})$
$+\big(\alpha_2\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) + \varepsilon_{j,t}$

(IV) : $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}] = c_j + \big(\alpha_1\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_1)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq \bar{\pi})$
$+\big(\alpha_2\mathbb{E}_{j,t}[\pi_{t+24,t}] + (1-\alpha_2)\mathbb{E}_{j,t}[\pi_{t+120,t+24}]\big) \times I(\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < \bar{\pi}) + \varepsilon_{j,t}$

Subsample (B) 2008/01 to 2012/12	c		α				Standard Error of Regression	Observations
Equation (I)	-0.157^{***}	(0.033)	0.653^{***}	(0.033)			0.527	8,642
Equation (II)	-0.274^{***}	(0.044)	0.533^{***}	(0.046)			0.403	8,642
$\bar{\pi} = 0.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 0.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 0.5$		Standard Error of Regression	Observations
Equation (III)	-0.188^{***}	(0.032)	0.666^{***}	(0.032)	-0.088^{**}	(0.038)	0.491	8,642
Equation (IV)	-0.306^{***}	(0.042)	0.554^{***}	(0.045)	-0.012	(0.050)	0.384	8,642

Subsample (C) 2013/01 to 2015/01	c		α				Standard Error of Regression	Observations
Equation (I)	-1.278^{***}	(0.036)	0.438^{***}	(0.036)			0.674	3,405
Equation (II)	-1.268^{***}	(0.046)	0.314^{***}	(0.046)			0.477	3,405
$\bar{\pi} = 1.5$	c		α_1 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] \geq 1.5$		α_2 $\mathbb{E}_{j,t}[\pi_{t+120,t+24}] < 1.5$		Standard Error of Regression	Observations
Equation (III)	-1.214^{***}	(0.040)	0.646^{***}	(0.068)	0.284	(0.028)	0.657	3,405
Equation (IV)	-1.192^{***}	(0.012)	0.555^{***}	(0.074)	0.132^{***}	(0.022)	0.451	3,405

Note: The impact of a consumption tax hike is not subtracted from each forecast in Subsamples (B) and (C). $\mathbb{E}_{j,t}[i^{2\mathrm{yr}}]$, $\mathbb{E}_t[\pi_{t+120,t+24}]$ and $\mathbb{E}_{j,t}[\pi_{t+120,t+24}]$ are defined as agent j's 6-month ahead forecasts on 2-year bond interest rates, the mean forecasts and agent j's forecasts for 2-10 years inflation rates from QSS, respectively. The indicator function $I(\cdot)$ is unity if the inflation rate forecasts for the next 2-10 years are equal to or greater than 1.5% after January 2013 (and 0.5% before December 2013) and zero otherwise. *White period* standard errors for heteroscedasticity and serial correlation are reported in parenthesis. Here, ***, **, and * indicate 1%, 5%, and 10% significance, respectively.

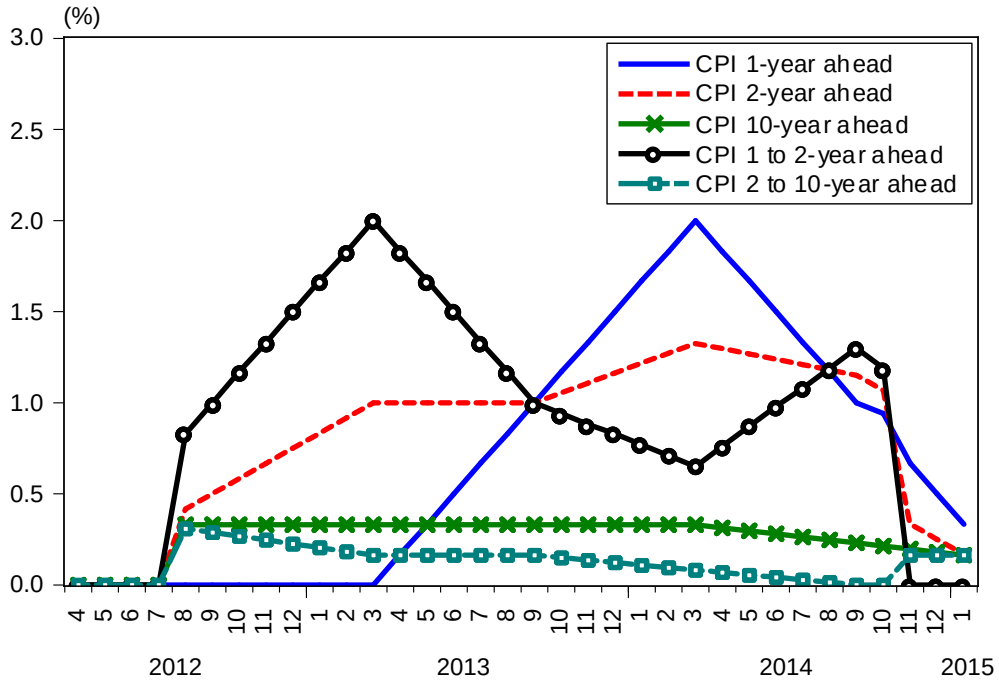


Figure A.1: Maximum contribution of a consumption tax hike on inflation expectations of QSS. In August 2012, the upper-house parliament passed a tax bill to raise the consumption-tax rate from 5% to 8% in April 2014 and then to 10% in October 2015. After that, in November 2014, the subsequent tax hike to 10% is subject to be postpone to April 2017. The horizontal axis indicates the month when the survey conducted.

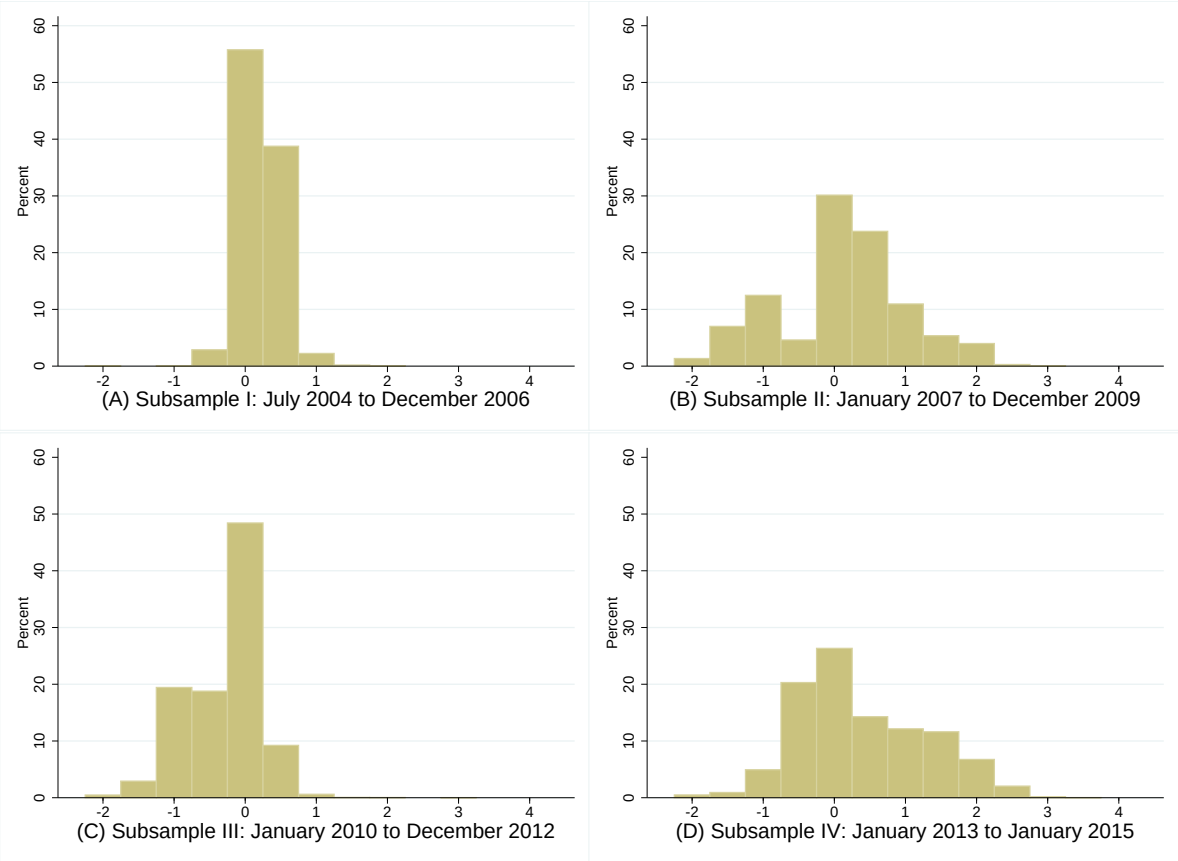


Figure A.2: Histogram of inflation forecasts of market participants for the next 1 year. Note that the impact of a consumption tax hike is excluded. Data: QSS.

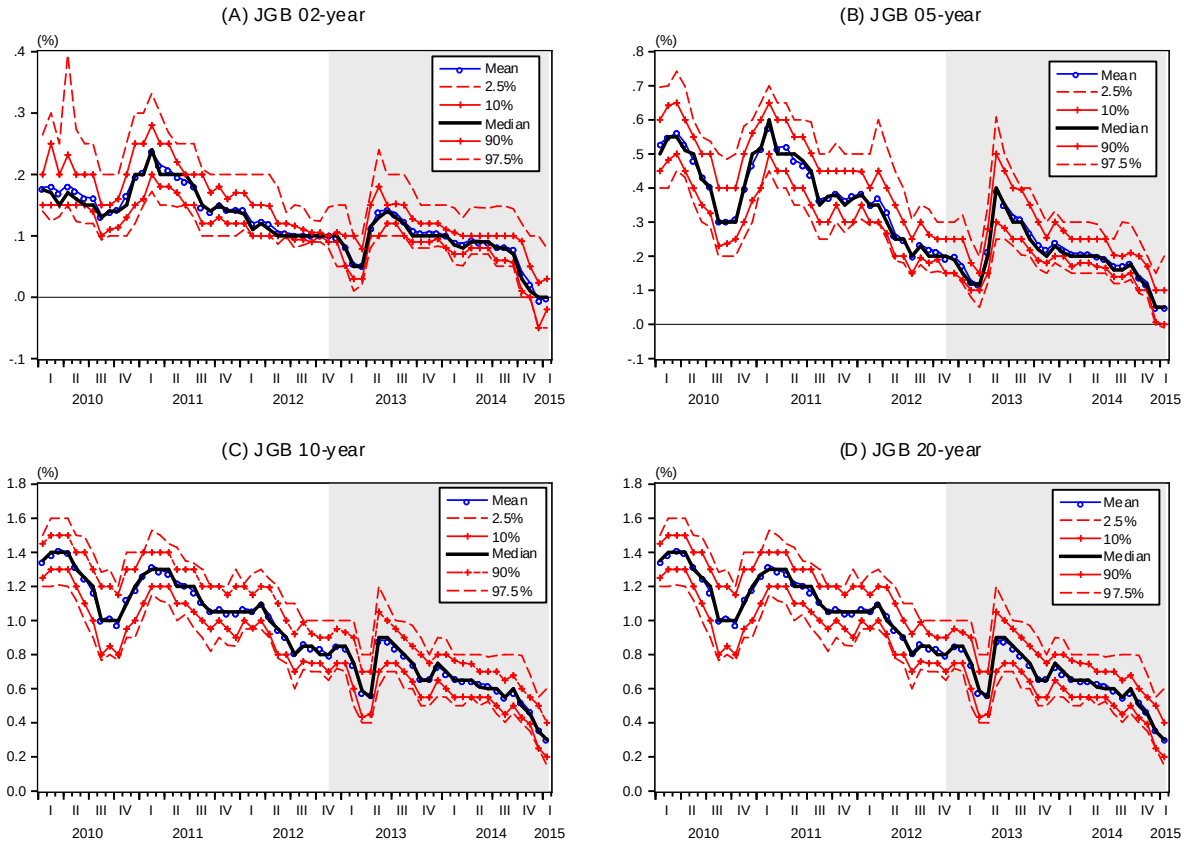


Figure A.3: 3-month ahead expectations for 2-, 5-, 10-, and 20-year bond yields. Regarding respondents' expectations in each month, their mean, 2.5th, 10th, 50th (median), 90th, and 97.5th percentile points are calculated. The data comes from QSS and covers from January 2010 to January 2015. Shaded area is drawn from November 2012 when Abenomics started.

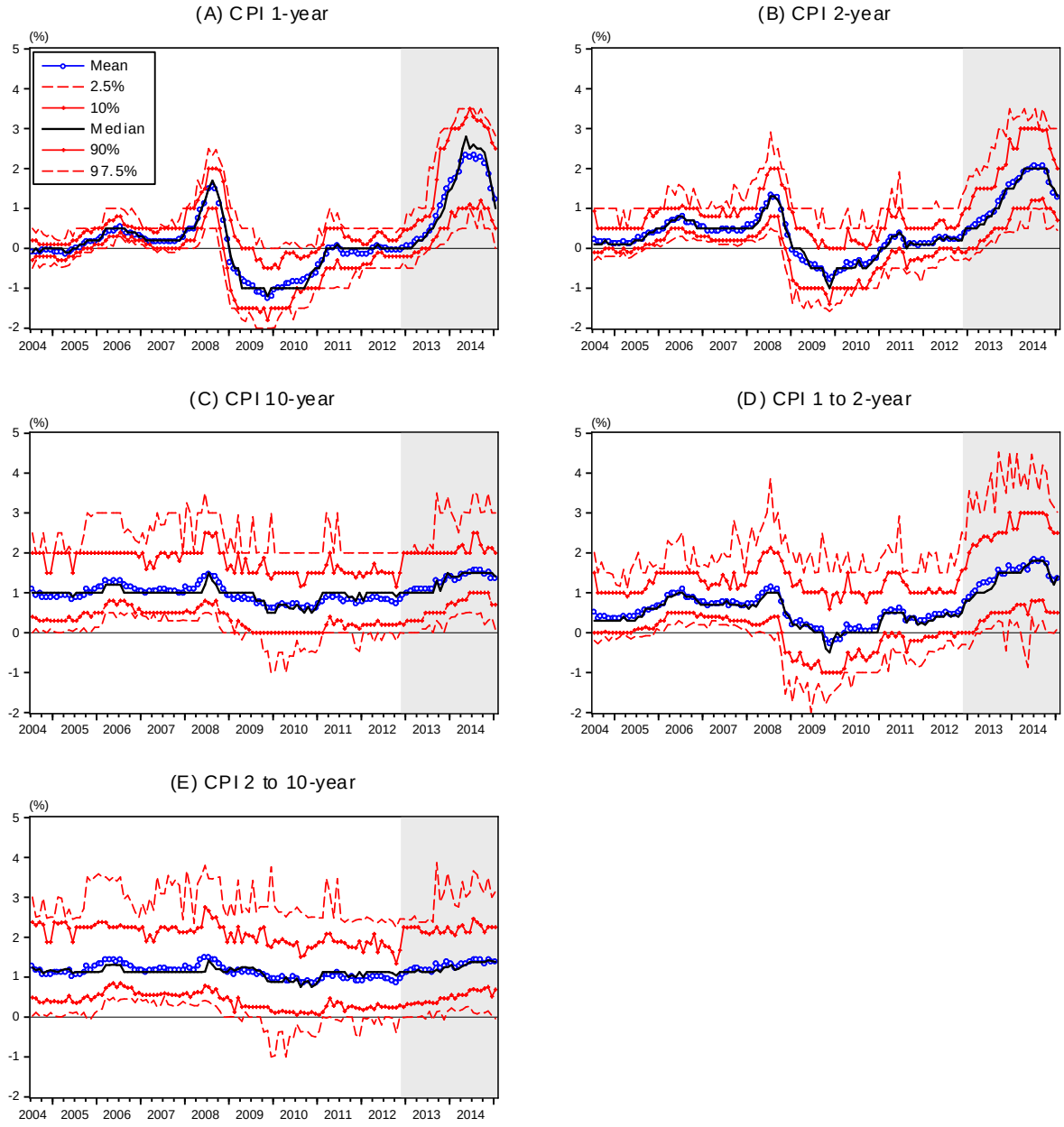


Figure A.4: Inflation expectations for the next (A) 1-, (B) 2-, (C) 10-year, (D) 1-2 years, and (E) 2-10 years. Regarding respondents' expectations in each month, their mean, 2.5th, 10th, 50th (median), 90th and 97.5th percentile points are calculated. The data cover from July 2004 to January 2015. Shaded area is drawn from November 2012 when Abenomics started.