Inflation Expectations of Japanese Households: Micro Evidence from a Consumer Confidence Survey*

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Abstract

Economists unanimously agree that economic agents' expectations are crucially important in determining macroeconomic outcomes. However, mainstream macroeconomists usually simply *assume* that expectations are rational, leaving unexamined the fundamental question whether individual agents' *actual* expectations are rational or not. Against this background, this study examines the properties of Japanese households' inflation expectations using micro-based inflation expectations data from the *Monthly Consumer Confidence Survey Covering All of Japan*. Our analyses show that actual inflation expectations by Japanese households are not rational in the sense that they are upward biased, at least ex post, and individual households appear not to instantaneously incorporate into their expectations information that is freely available from news reports on the views of professional forecasters. Our findings, moreover, suggest that while the sticky information model appears to better explain inflation expectations dynamics (than rational expectations models), we encounter a handful of facts that look inconsistent with the simple model.

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1. Introduction

Economists unanimously agree that the expectations of economic agents are crucially important in determining macroeconomic outcomes. Yet, to a large extent, the assumption by mainstream economists that the expectations of a "representative" agent are rational is simply that, an assumption, and fundamental questions such as whether expectations are really rational or not, whether it is harmless to ignore the fact that not everyone has the same expectations, and many related issues have not been empirically examined.

While there is large body of literature testing the rationality of macroeconomic expectations,[1] until recently there had been essentially no work testing alternative models of expectations using actual empirical data on expectations. Only in the past decade or so have there been efforts to provide testable alternatives which incorporate a more realistic account of expectations into mainstream economic theory. One of the first attempts in this direction was the study by Mankiw and Reis (2002), who introduced the costs of information processing into their model of "sticky information." The model suggests that if there are any costs involved in collecting and processing information, agents may choose to update their expectations less frequently, creating staggered changes in expectations.

Sticky information models provide a handful of empirically testable implications, including the fact that there should be disagreement among economic agents about inflation expectations (Mankiw, Reis, and Wolfers 2004). In the United States, there is a long tradition of collecting data on inflation expectations,[2] and based on such data, a considerable number of empirical studies have been conducted to test the hypotheses derived from these models (for an overview of such studies, see Curtin 2005). Inspired by models of disease spread from the

[1] See Thomas (1999) and Ashiya (2009) for surveys.

[2] The University of Michigan's Survey Research Center has been collecting data on households' inflation expectations for almost 50 years, while the Conference Board has conducted monthly household surveys since the late 1970s.

epidemiology literature, Carroll (2003), for example, provides micro foundations for the sticky information theory and derives a simple equation suitable for empirical analysis.

Turning to Japan, there has been almost no serious research on households' inflation expectations, primarily due to the lack of data on inflation expectations. A rare exception is the study by Hori and Shimizutani (2004) examining survey data from the *Kokumin Seikatsu Monitors* (Monitor Survey on National Life in Japan). Only following the experience of deflation in the late 1990s and early 2000s did the Japanese government and a government-affiliated institution, in April 2004, launch two independent surveys on inflation expectations. The first is the *Monthly Consumer Confidence Survey Covering All of Japan* (MCCS), which collects information on households' expectations about inflation; the second is the *Monthly Survey of Japanese Economic Forecasts* (ESPF) covering economic forecasts produced by professional economists in Japan.

This paper takes advantage of micro level data from the two monthly surveys to estimate inflation expectation dynamics. To the best of our knowledge, this is the first study on Japan of this kind.[3] Based on the sticky information literature in the United States, and especially the study by Carroll (2003), we propose a test of alternative models of inflation expectations. While Carroll's study used aggregated macro data to produce interesting findings, here we use the same setting to analyze the rich information contained in the micro data from the survey on inflation expectations by individual households. Although we are of course interested in the macroeconomic implications of inflation expectation dynamics, our main purpose here is to examine the micro foundations of inflation expectations modeling. And for this reason, it is more natural to use micro data rather than macro data in our empirical analysis.

Our analysis shows that actual inflation expectations of households in Japan are far

[3] Strictly speaking, this study is the first to use both surveys simultaneously. A number of studies examining the expectations of ESPF professional forecasters have already been conducted as part of the ESRI International Collaboration Project (see, e.g., Kawagoe 2007, Komine et al. 2009, and Ashiya 2009).

from rational in the sense that they are biased upward, at least ex post, and that households do not instantaneously utilize information that is available almost for free from news reports on professional forecasts. We also find that although sticky information models appear to better explain the observed dynamics of inflation expectations (than rational expectations models), they can only explain a relatively small part of the disagreements in households' expectations, suggesting that there must be other factors present that are not accounted for by the existing simple models.

The remainder of the paper is organized as follows. Section 2 briefly describes the settings of the sticky information model proposed by Carroll (2003) and derives our empirical specification to test the model using our micro data. Next, Section 3 provides an outline of the two sets of survey data on inflation expectations in Japan, the MCCS and the ESPF, and discusses interesting features of the derived series for inflation expectations in Japan. We then confirm the fact that professional forecasts are "more rational" than household expectations, and that therefore households can use the consensus professional forecast as an anchorage to form reasonable inflation expectations. Section 4 then presents the results of several regressions to test whether the sticky information model, as well as the rational expectations model, can well represent expectation dynamics among Japanese households. Section 5 concludes the paper.

2. Empirical Model Derivation

We base our inflation expectation analysis below on the type of sticky information model proposed by Carroll (2003). The Carroll model assumes that in any given period each individual faces a probability λ of reading the latest news article on inflation. Individuals who do not read an article simply continue to believe the last forecast they read about. Thus, individuals change their inflation expectations with a probability of λ. Let $\pi_{t,t+12}$ be the inflation rate

between month *t* and month *t+12*, i.e., $\pi_{t,t+12} = \log(p_{t+12}) - \log(p_t)$, where p_t is the aggregate consumer price index in month *t*.[4] If we denote the Newspaper forecast printed in month *s* for inflation between month t_1 and month t_2 $(\geq t_1)$ as $N_s[\pi_{t_1,t_2}]$, the inflation expectation of an individual household (*i*) as of date *t* is given by $E_{i,t}[\pi_{t,t+12}] = N_t[\pi_{t,t+12}]$ with probability λ and $E_{i,t}[\pi_{t,t+12}] = E_{i,t-1}[\pi_{t,t+12}]$ with probability $1-\lambda$.[5]

Defining $M_t[\bullet]$ as the operator that yields the population-mean value at time *t*, we can express the mean inflation expectation as a function of the Newspaper forecasts:

$$\begin{aligned} M_t[\pi_{t,t+12}] &= \lambda N_t[\pi_{t,t+12}] + (1-\lambda) M_{t-1}[\pi_{t,t+12}] \\ &= \lambda N_t[\pi_{t,t+12}] + (1-\lambda)\{\lambda N_{t-1}[\pi_{t,t+12}] + (1-\lambda)(\lambda N_{t-2}[\pi_{t,t+12}] + \cdots\}. \end{aligned} \quad (1)$$

This expression for the mean inflation expectation is identical to the equation in Mankiw and Reis (2002), except that they assume updating agents that compute their own rational forecasts rather than forming their expectations based on Newspaper forecasts. Carroll presents his model with information processing costs as the micro foundations for the Mankiw and Reis equation. With a few additional assumptions on consumers' beliefs about the information process, he further derives the following equation:

$$M_t[\pi_{t,t+12}] = \lambda N_t[\pi_{t,t+12}] + (1-\lambda) M_{t-1}[\pi_{t-1,t+11}]. \quad (2)$$

That is, mean inflation expectations for the next year should be a weighted average of the current 'rational' (or Newspaper) forecast and last period's mean inflation expectations. Carroll used this directly testable time series equation[6] to estimate the evolution of inflation expectations and to find a plausible middle ground between rational expectations and adaptive expectations.

While time series analyses based on aggregated data have produced interesting

[4] Here, we set up the model on a monthly basis, while Carroll's model is on a quarterly basis.
[5] For the sake of simplicity, we assume that all newspapers report the same forecast for inflation.
[6] Equation (1) is not suitable for empirical work, as it is not possible to obtain from newspapers a complete forecast of the inflation rates for all future months.

findings, here we use the same setting to derive a different specification that we use to examine inflation expectations by individual households (*i*). Although we are of course interested in the macroeconomic implications of inflation expectation dynamics, our main interest is in the micro foundations of the model, so that it is more appropriate to use micro data in our empirical analysis. Moreover, given the nature of the data available for Japan – a panel that covers only a relatively short period but contains a large cross-section of agents – a micro data based analysis is the only efficient way to examine the validity of the model.

By focusing on the changes in inflation expectations, we can derive the following equations for inflation expectations by individual households:

$$E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t,t+12}] = N_t[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t,t+12}]$$

when the household's expectation is revised in the month, and

$$E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t,t+12}] = E_{i,t-1}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t,t+12}] = 0$$

when the household's expectation is unchanged in the month.

After a few steps of simple mathematical manipulation, we can rewrite the equations as

$$E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t-1,t+11}] = (N_{t-1}[\pi_{t-1,t+11}] - E_{i,t-1}[\pi_{t-1,t+11}]) + (N_t[\pi_{t,t+12}] - N_{t-1}[\pi_{t-1,t+11}]) \quad (3),$$

and

$$E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t-1,t+11}] = (N_{t-1}[\pi_{t-1,t+11}] - E_{i,t-1}[\pi_{t-1,t+11}]) + (E_{i,t-1}[\pi_{t-1,t+11}] - N_{t-1}[\pi_{t-1,t+11}]) + (E_{i,t-1}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t-1,t+11}]). \quad (4).$$

And as Carroll's assumptions on households' belief about the inflation process imply $E_{i,t-1}[\pi_{t,t+12}] = E_{i,t-1}[\pi_{t-1,t+11}]$, we obtain

$$E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t-1,t+11}] = (N_{t-1}[\pi_{t-1,t+11}] - E_{i,t-1}[\pi_{t-1,t+11}]) + (N_t[\pi_{t,t+12}] - N_{t-1}[\pi_{t-1,t+11}]) \quad (5),$$

and

$$E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t-1,t+11}] = (N_{t-1}[\pi_{t-1,t+11}] - E_{i,t-1}[\pi_{t-1,t+11}]) + (E_{i,t-1}[\pi_{t-1,t+11}] - N_{t-1}[\pi_{t-1,t+11}]) \quad (6).$$

That is, when a household revises its inflation expectation from month *t-1* to month *t*, the size of the adjustment should be the gap between its inflation expectation and the Newspaper forecast

in the previous month (*t-1*) plus the size of the change in the Newspaper forecast from *t-1* to *t*. When the household chooses not to revise its expectation, the size of adjustment equals zero by definition.

Since all variables in (5) and (6) are directly observable, we can run the regression below to assess the validity of the sticky information model of inflation expectations:

$$E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t-1,t+11}] = \beta_1 (N_{t-1}[\pi_{t-1,t+11}] - E_{i,t-1}[\pi_{t-1,t+11}]) + \beta_2 (F_t[\pi_{t,t+12}] - N_{t-1}[\pi_{t-1,t+11}]) + \varepsilon_{i,t} \quad (7),$$

where $F_t[\pi_{t,t+12}] = N_t[\pi_{t,t+12}]$ if $E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t-1,t+11}] \neq 0$, and $F_t[\pi_{t,t+12}] = E_{i,t-1}[\pi_{t-1,t+11}]$ if $E_{i,t}[\pi_{t,t+12}] - E_{i,t-1}[\pi_{t-1,t+11}] = 0$. Comparing this to (5) and (6) provides the testable restriction that $\beta_1 = \beta_2 = 1$, which implies that the sticky information model describes inflation expectation dynamics well. Another testable restriction, namely that $\beta_1 = 0$, is also of interest, since it is a necessary condition for rational expectations. It is obvious that $\beta_1 \neq 0$ violates rationality, because it means that the expectation revision is correlated with information that could have been known at the time of the preceding forecast.[7] The necessary and sufficient conditions for inflation expectations of individual households to be rational are $(\beta_1, \beta_2) = (0, 1)$, and that the Newspaper forecast ($N_t[\pi_{t,t+12}]$) is rational.

3. Data Sources

Estimating equation (7) requires us to identify data sources for inflation expectations and for Newspaper forecasts of inflation over the next year. Here we explain our data sources.

3.1 Monthly Consumer Confidence Survey (MCCS)

In order to obtain the micro based annual inflation expectation data ($E_{i,t}[\pi_{t,t+12}]$), we take advantage of the household level data from the *Monthly Consumer Confidence Survey Covering*

[7] Batchelor and Dua (1991) argue that, if a forecaster is rational, his/her forecast revision must be uncorrelated with variables known at the time of the preceding forecast, and propose to use the martingale test to examine whether expectations are rational.

All of Japan (MCCS) from April 2004 to February 2009 collected by Shin Joho Center, Inc., on behalf of the Cabinet Office. (See Appendix A for more details on the MCCS.) One component of the survey asks households to think about the inflation rate over the next year. The exact wording of the question on price expectations is as follows, with allowed the responses shown in brackets:

(Price Expectation Question) During the next 12 months, do you think that prices of goods and services that you frequently purchase will go down, up, or remain the same? [(1) down by more than 5 percent, (2) down by 2-5 percent, (3) down by less than 2 percent, (4) remain the same, (5) up by less than 2 percent, (6) up by 2 to 5 percent, (7) up by more than 5 percent, or (8) don't know.]

Unfortunately, the survey does not ask households to answer the question in actual percentage figures. Therefore, when we are forced to use numerical values of inflation expectations in our analysis, we will use the median value of the multiple choice percentage intervals, excluding answers (1) and (7), for which we arbitrarily assigned -7.5 percent and +7.5 percent, respectively. To allow for the possible distortion caused by our imprecise measures, we also tried our regression analyses using the original discrete choice variables, as reported in the tables below for reference,[8] and found that the results of the regressions are almost the same as those based on the median value.

To compare the multiple choice percentage intervals with actual numerical inflation rates, the reverse operation, that is, transforming the actual numerical inflation data into interval based data is also necessary. This means that it becomes necessary to set an interval for the response that prices would "remain the same." We try out three intervals for the "remain the same" response, namely, (-0.1, 0.1), (-0.3, 0.3), and (-0.5, 0.5) in our analysis.

[8] In the discrete multiple-choice based analysis, we transformed all actual number variables, such as current inflation rates, into multiple choice variables.

3.2 Monthly Survey of Japanese Economic Forecasts (ESPF)

Our strategy to identify the Newspaper forecast for annual inflation exactly follows that employed by Carroll (2003) and uses the mean annual inflation forecast from the *Monthly Survey of Japanese Economic Forecasts* (known as ESP Forecast, or ESPF). The ESPF, conducted by the Economic Planning Association, has collected forecasts from leading private economic forecasters in Japan since April 2004.[9] The survey questionnaire is distributed to forecasters around the 25th of each month, and the survey result is published around the 10th of the following month. The survey asks participants for quarter-by-quarter forecasts for the current and next fiscal year for a variety of economic variables, including CPI inflation (excluding fresh food). We calculate the annual inflation rate ($N_t[\pi_{t,t+12}]$) as the weighted average of quarterly expectations. For more details on the ESPF, see Appendix B.

3.3 Preliminary Overview of the Data

We can examine the characteristics of the survey responses by comparing them with the realized inflation rate, i.e., the CPI inflation rate (excluding fresh food) over the next 12 months, as shown in Table 1, where we classified the realized inflation rate into the multiple choice percentage intervals (from (1) to (7) in the MCCS). Regardless of our choice of the "remain the same" interval, the upper triangle regions always show higher probabilities than the lower regions, implying that inflation expectations were upwardly biased.

Transformation of the responses into numerical values as explained in Section 3.1 allows us to compare mean expected inflation rates from various sources. Figure 1 graphs the calculated mean annual inflation expectations based on the two surveys (where the horizontal axis refers to expectations at the endpoint of the relevant forecast horizon rather than at the time

[9] The ESPF was officially launched in May 2004. Our data include a trial survey implemented in April 2004.

the forecast was made), as well as the development of actual (realized) inflation. We include two more inflation expectation series for reference: the mean annual inflation expectations from the *Kokumin Seikatsu Monitors* (between the 2nd quarter of 2001 and the 1st quarter of 2004), and the mean annual inflation expectations from the *Opinion Survey on the General Public's Views and Behavior* (OSGP) (between March 2004 and March 2009) by the Bank of Japan.[10]

These simple figures allow several observations. First, Japanese consumers were in the grip of deflationary expectations until 2004 (see Hori and Shimizutani 2005) but have since shaken them off. Second, average inflation expectations by households have a tendency to be biased upward (by roughly 1 percentage point or more) over the entire observation period.[11] And third, all the forecasts seem to move in parallel with current price developments rather than their target, i.e., future price developments.

The latter two features are striking, because a number of studies using inflation expectations data for the United States report that the mean (or median) of inflation expectations yields relatively accurate inflation forecasts, and that household surveys and professional surveys are equally accurate (see, e.g., Mankiw et al. 2004). The short time span of our dataset – five years compared with 50 years for the U.S. data – prevents us from verifying whether the bias results from idiosyncrasies of Japanese forecasters. Another possible source of the upward bias is low inflation bias. Kamada (2008) showed that corrected forecasts from the *OSGP* using Kahn's (1997) method remain below zero until 2005. However, this correction cannot be applied to the *MCCS* where only qualitative responses are available. Therefore, we will keep these idiosyncratic findings in mind when analyzing the survey data in the following sections.

[10] As these two series are on a quarterly basis, we interpolated the values in the months not surveyed.
[11] It could be argued that the mean of the inflation expectations is biased upward given that the pronounced skew in their distribution and the long upper tail of the distribution are likely to represent measurement errors. Although we do not present it here to save space, we drew another chart using the median instead of the mean to examine whether this is the case but obtained a similar bias.

4. Empirical Analysis

4.1 Can the Professional Forecasts Serve as an Anchor?

While Figure 1 suggests that the average of professional forecasts provides a more accurate prediction of actual inflation than average household expectations, we want to examine whether professional forecasters are indeed "more rational" than households in their inflation forecasts and whether the mean of professional forecasts can be used as an anchor for reasonable inflation expectations by households.

Using the three "remain the same" intervals discussed in Section 3.1, Table 2 shows the results of our comparison to see how accurate household expectations are (relative to the mean professional forecast). We first calculated the mean absolute errors (MAE) and the root mean square errors (RMSE), on the interval choice basis, for each household as well as for the mean professional forecast. Then, we compare the performance of individual households with that of the mean professional forecast in the same period. Table 2 reports the share of households that outperformed the mean professional forecast. Regardless of our choice of the "remain the same" interval, the majority of households appear to have underperformed the mean professional forecast. This pattern becomes clear especially when we compare the RMSE, indicating that household expectations are very erratic. Although this informal comparison is not conclusive, it suggest that for the majority of households, professional forecasts could serve as an anchor for the formation of more accurate inflation expectations.

The next question that naturally arises is whether professional forecasts have greater forecasting power for future inflation than household expectations. Table 3 presents the results of regressing the realized inflation rate over the next year on the mean of household expectations from the MCCS and the mean of ESPF inflation forecasts, along with the most recent annual inflation statistics available at the time the two surveys were conducted. To take

the above-mentioned measurement problem into account, we report both results based on actual percentage figures, which we used as long as they were available, and results based on the medians of intervals, in which case we used the median value even when actual figures were available.[12] The implications of the regressions are clear: both the mean of household expectations from the MCCS and that of the ESP forecasts are positively associated with future inflation even when controlling for past inflation, but only the mean of ESP forecasts is statistically significant. The regression results that include both household expectations and the professional forecasts indicate that household expectations contain almost no information, while the professional forecasts have very significant predictive power. Note that this finding implies that the household expectations in the MCCS are irrational (using the conventional definition of rational expectations), since it means that household expectations did not incorporate available information that could be used to make a superior forecast.

Another preliminary investigation suggested by the structure of the model is to examine the way professional forecasts affect household expectations. The results for regressing inflation expectations of individual households on professional forecasts are shown in Table 4. Even after controlling for past inflation and past values of the dependent variable, past professional forecasts still had a statistically significant impact on household inflation expectations. Moreover, the size of the coefficient suggests that the impact is also economically significant.

However, the finding that the professional forecasts are more accurate than household expectations does not necessarily imply that the professional forecasts are rational. A recent study (Ashiya 2009) using the ESPF data to examine the rationality of the professional inflation forecasts reports that almost all forecasters and the consensus forecast failed either the

[12] Due to space limitations, for the analysis based on the median of intervals, we only report the results based on the (-0.3,0.3) threshold below. The choice of threshold interval does not qualitatively affect the results.

unbiasedness test, the efficiency test, or the martingale test. Therefore, even the professional forecasts do not look fully rational in Japan. However, it is also correct to say that the ESP forecasts are "more rational" than household expectations in the sense that the former must be employing certain information (that households are not) to make professional forecasts superior to household expectations. Based on the superiority of the professional forecasts, we examine whether household expectations can be well modeled as updating toward the professional forecasts.

4.2 Estimating the Empirical Model

Let us turn to the regressions investigating whether the MCCS data can be well represented by the sticky information model. We begin examining the macro based (time series) model to explain the mean of household expectations by estimating

$$M_t[\pi_{t,t+12}] = \alpha_1 N_t[\pi_{t,t+12}] + \alpha_2 M_{t-1}[\pi_{t-1,t+11}] + \alpha_0 + \varepsilon_t \qquad (8)$$

Comparing this to (2) provides the testable restrictions, i.e., $\alpha_1 + \alpha_2 = 1$ and $\alpha_0 = 0$. We used the mean of the ESPF inflation forecasts and the most recent annual inflation statistics available at the time the expectations were formed as our alternative proxies for $N_t[\pi_{t,t+12}]$.

The results are presented in Table 5. The estimates of α_1 are meaningful with a positive value only when we used the mean of the ESPF as our proxy. While the coefficient on the constant term, α_0, is not significantly different from zero, the point estimates of $\alpha_1 = 0.37$ and $\alpha_2 = 0.92$ lead to the rejection of the restriction $\alpha_1 + \alpha_2 = 1$. Only when we included both of the two alternative proxies for $N_t[\pi_{t,t+12}]$ in our regression, the expanded restriction of $\alpha_{1-1} + \alpha_{1-2} + \alpha_2 = 0$ was accepted. However, it is not easy to put a meaningful interpretation on this expanded regression. While the time series result here demonstrates that the professional forecast dominates the most recent inflation statistics, this provides only weak support for (or

even rejects) the sticky information model, partly because we still have only a limited number of observations.

We now turn to our micro data based regression (7), which examines whether the sticky information model represents the MCCS inflation expectations reasonably well. The testable restrictions here are $\beta_1 = 0$, which examines a necessary condition for rational expectations, and $\beta_1 = \beta_2 = 1$, which implies that the sticky information model describes inflation expectation dynamics. Table 6 presents the regression results. The most indisputable finding from these regressions is the fact that household expectations are far from rational. The restriction $\beta_1 = 0$ is overwhelmingly rejected irrespective of our choice of data type and specification. The joint hypothesis that $\beta_1 = 0$ and $\beta_2 = 1$, meaning that household expectations exactly track the mean of professional forecasts, is also unanimously rejected. The results regarding the relevance of the sticky information model, i.e., the restriction $\beta_1 = \beta_2 = 1$, look somewhat inconclusive. While the hypothesis $\beta_1 = \beta_2 = 1$ is again strongly rejected, probably due to our large sample of more than a hundred thousand observations, the point estimates of $\beta_1 \cong \beta_2 \cong 0.7$ yield the impression that the model is not necessarily a bad approximation of inflation expectation dynamics.

When we tried replacing the mean of the professional forecast variable with the most recent observed inflation rate (column [2] of Table 6) to check whether professional forecasts can serve as an anchor, the point estimates became smaller. And in the "horserace" regression (column [3]) that includes both variables, we obtain larger positive coefficients on the professional forecast based variables and negative coefficients on the most recent inflation based variables. We also expanded our regression specification to include a constant term and obtained significant positive constants. This result again deviates from the baseline sticky information model. However, the estimated size of the coefficients of key interest, β_1 and β_2,

continues to be not far from 1, even after expanding the model to include the constant term. Therefore, the micro data based regressions suggest that the sticky information model captures some real world aspects not captured by the rational expectations model.

4.3 Can Sticky Information Explain Disagreement About Inflation Expectations?

One implication of the simple sticky information model is that inflation expectations vary based only on the time since households' last opportunity to update their expectations. Mankiw et al. (2004) argue that the sticky information model broadly explains the observed disagreement among households about inflation expectations. Therefore, one simple way to examine the usefulness of the model is to estimate a model with dummy variables to capture the date of the last update by individual households. Table 7 reports the results. Row [1] of the table shows the result for this model with time dummies only, which captures the mean of inflation expectations for each expectation period (t). However, the result of main interest is that shown in row [2], in which additional dummy variables are included in the model to control for the date of the last update. This indicates that although the dummies are significant, suggesting that the timing of the updating of expectations plays a role, the explanatory power of the extended model in terms of explaining disagreement among households about inflation expectations increased only modestly. That is, there seem to be some factors other than sticky information that bring about such disagreement.

Another testable issue raised by the sticky information model is the size and determinants of λ, the fraction of the population that obtain new information and update their expectations. The seminal model by Mankiw and Reis (2002) assumes a Poisson process in which λ, the probability that a household changes its inflation expectation, is given as an exogenous constant, regardless of how long it has been since the last update. Early studies using

the U.S. data and employing different identification schemes report that households update their information sets on average once a year (λ is estimated to be around 0.083). However, the probability (or the share of households that change their responses to the inflation expectation question in a survey from their responses in the previous survey) that is directly observable in the Japanese MCCS data set is 0.48, indicating very fickle expectations that, on average, are updated every 2.1 month.[13] Moreover, the observational distribution of the average interval between the expectation updates among individual households is more long-tailed than the pattern generated by the theoretical Poisson process of $\lambda = 0.48$ (see Figure 2), suggesting that λ may vary in accordance with the type of household or with the time since the last update.

Another testable implication of the Carroll (2003) type sticky information model is that in periods when there are more news stories on inflation, the speed of updating should be faster. To examine this point, we run a few probit regressions to investigate the relationship between the updating of inflation expectations (the dependent variable takes one when a household revised its inflation expectation and takes zero when it does not) and the number of price related news stories. Table 8 reports the regression results. First, news stories, especially an increase in the number of news stories, raise the probability that households update their inflation expectations, as predicted by the Carroll model. However, the probability of updating seems to depend more on other, non-news variables. First, the gap between the professional forecast and household expectations before an update appears to have a larger effect on the update probability than the number of news articles (column [2]). Second, the time since the last update also appears to play a role. We tried to capture this by including a variable for the number of months since the last update, expecting that the length of time since the last update would raise the update probability. However, the estimated coefficient on this variable turned

[13] This finding is not necessarily inconsistent with optimizing household behavior, since the cost of processing information for the surveyed households might be negligibly small.

out to be significantly negative (column [3]). Given this counterintuitive result, we additionally included the average number of months between updates for each household (*i*), thereby allowing for the possibility that the average number of months varies across households. The result, shown in column [4], looks reasonable; that is, the coefficient on the average number of months is negative while that on the number of months since the last update is positive. In other words, households which tend to update their expectations less frequently are less likely to update in each period. Moreover, after controlling for the household-idiosyncratic average number of months between updates, the number of months since the last update term has a positive effect, indicating that the probability differs depending on where the household is in its adjustment cycle.

5. Conclusion

Given the agreement among economists that macroeconomic outcomes depend critically on agents' expectations, it is surprising that efforts to test models of expectations using available survey data have been very limited. Following in the spirit of Carroll (2003), and considering the lack of empirical studies on expectation formation in Japan, this paper attempted to examine the properties of inflation expectations by Japanese households, using micro level data that has become available in recent years from the MCCS and the ESPF. Based on the setting of the Carroll model, we derived a micro data based empirical specification to examine both the sticky information model and the rational expectations model.

Our analysis showed that Japanese household expectations are not rational in the sense that they are biased, at least ex post, and that households appear not to instantaneously incorporate information that is freely available from news reports on the views of professional forecasters into their expectations. While the sticky information model seems to partially

explain inflation expectation dynamics among Japanese households, the part of expectation disagreement among households that can be explained by the model is not necessarily large, i.e., real world inflation expectation dynamics are more complex than in the simple setting of a standard sticky information model.

Given that our empirical findings are not necessarily consistent with mainstream economic theory, which assumes a representative rational agent, it seems advisable to be prudent in interpreting subjective responses to survey questions. However, a preliminary examination of the micro data from the MCCS we conducted did not show any systematic patterns that would indicate that the responses of some survey participants were unreliable.[14] In addition, we cleaned the data based on several criteria, dropping any anomalous observations. The sample size decreased by half as a result, but our empirical findings remained qualitatively unaffected. Therefore, while the quality of the MCCS data could certainly be improved, such as by the introduction of a question that asks respondents for a numerical value of the inflation rate they expect, the findings of this paper – although based on somewhat less than perfect data – reveal novel and interesting facets on the nature of inflation expectations.

[14] Interestingly, inflation expectations by individual households are only weakly correlated with household characteristics, while the responses to the other consumer perception questions – probably because of time-varying group-level shocks – are often systematically correlated with the demographic characteristics of respondents. This finding suggests that the pattern of inflation expectations does not result from irregular responses of a small minority of survey participants not replying truthfully or to the best of their knowledge and ability. Another finding of interest is that inflation expectations are positively correlated with unfavorable responses to the other consumer perception questions, such as the expectation of a worsening of the overall standard of living and a decrease in future income growth.

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Appendix A. The *Monthly Consumer Confidence Survey Covering All of Japan* (MCCS)

A.1. General Information

The MCCS is a nationally representative survey that has been conducted monthly since April 2004. The main purpose of the survey is to gain a quick understanding of shifts in consumer perceptions as a way to evaluate economic trends. The survey covers 6,720 households, sampled using a three-level stratified random sampling method of city/town/village, local unit, and household. The Prime Minister is in charge of the MCCS and has delegated the implementation of the survey to Shin Joho Center, Inc.[A1-1] Shin Joho Center distributes questionnaires to sample households around the 10th of each month, which are expected to fill in the survey by the 15th, and Shin Joho Center then collects the questionnaires by the 20th. [A1-2] Each sample household is surveyed for 15 consecutive months.

A.2. The Questionnaire

Monthly survey questions are broadly classified into three categories: (1) consumer perceptions, (2) price expectations, and (3) household characteristics.

The following five questions in the consumer perception category are used to calculate the consumer confidence index, assigning values from zero to one to the allowed responses shown in brackets:

QOL (Overall Standard of Living): Looking ahead, do you think that half a year from now you will be better off, worse off, or about the same as now? – (1) will be better off, (2) will be somewhat better off , (3) about the same, (4) will be somewhat worse off , or (5) will be worse off.

QIG (Income Growth): Do you think that half a year from now the pace of income growth of your household will increase, decrease, or remain unchanged? – (1) will increase, (2) will somewhat increase, (3) will not change, (4) will somewhat decrease, or (5) will decrease.

QEO (Employment Opportunities): Do you think that half a year from now employment opportunities will be better, worse, or unchanged? – (1) will be better, (2) somewhat better, (3) about the same as now, (4) somewhat worse, or (5) worse.

QDGP (Durable Goods Purchases): Do you think that half a year from now will be a better time or a worse time to buy consumer durable goods? – (1) will be better, (2) somewhat better, (3) about the same as now, (4) somewhat worse, or (5) worse.

QVA (Value of Assets): Do you think that half a year from now the value of your family assets (stocks, real estate, and other assets) will have increased, decreased, or remained the

[A1-1] Shin Joho Center, Inc., is a public service research organization authorized by the Japanese government in 1972, specializing in opinion polls and marketing research.

[A1-2] The survey method changed in April 2007. In the past, the survey was conducted by telephone in months other than March, June, September, and December, while the survey in the four months used the same method as the current one, i.e., direct visits and self-completion questionnaires.

same? – (1) will have increased, (2) will have marginally increased, (3) will be about the same as now, (4) will have marginally decreased, or (5) will have decreased.

The question on price expectations, which used to fall under the questions on consumer perceptions and offer five choices, now is a category in its own right and, to gain a quantitative flavor, offers the eight choices mentioned in Section 3.1.

The third category of questions focuses on the following household characteristics, with the number of choices shown in parentheses: gender of the household head (2), occupation of the household head (5), age of the household head (9), number of household members (5), annual income of the household (7), type of main income source (4), type of residence (5), whether the household has a mortgage (2), etc.

In addition to the regular monthly questions in the three categories above, the following additional questions are included in the survey every three months (March, June, September, and December): (1) planned expenditure on courses, leisure activities, and services; (2) expenditure on travel made or planned; and (3) purchases and possession of principal consumer durables (conducted only in the March survey).

A.3. Characteristics of Respondents

The characteristics of households in the survey are summarized in Table A.1. Eight out of ten household heads are male. Another notable feature is that the surveyed households are rather old: the median age of the household head is 60 compared with an average for Japan – according to the 2005 Census – of 43. This probably also explains why a large share of household heads are "not working" and for a large share the main source of income is "pension benefits." The fact that surveyed households are rather old may also mean that the household size, the number of working members, and the household income are below the national averages. In addition, the table manifests the aging of the population, as indicated by the growing share of households with a head aged over 70.

A.4. Change in the Survey Method

The survey method changed in April 2007. From its inception in April 2004 to March 2007, the survey was conducted in the current manner – consisting of direct visits and self-completion questionnaires – only four times a year, in March, June, September, and December. In the other months, the survey was conducted by telephone. The impact of this change in the survey method on the calculation of the consumer confidence index is discussed by Hashimoto (2007).

Appendix B. Monthly Survey of Japanese Economic Forecasts (ESP Forecast, or ESPF)

The ESPF, the first regular publication to cover economic forecasts produced by business and academic economists in Japan, was launched in May 2004 after a trial survey in April. [A2-1] The Economic Planning Association, a public-service corporation established with the authorization of the Japanese government in 1965, distributes questionnaires to participants around the 25th of each month and publishes the result around the 10th of the following month. Participants are requested to provide their annual forecasts of 16 variables for the current and next fiscal year (from April to March) and their quarterly forecasts of three macro variables during the coming two fiscal years. In addition, the survey contains a number of questions asking for respondents' judgment on certain topical issues (See Table A.2. for details on the questions). The number of participants was 38 at the start and as of early 2009 had remained more or less unchanged.

The design of the ESPF was modeled on the Blue Chip Economic Indicators in the United States. This is reflected in the frequency of publication, the choice of forecasted variables (especially in the annual forecast), and the forecast period of two years. A difference is that the number of variables forecasted quarterly is much smaller in the ESPF than in the Blue Chip Economic Indicators. This is to lighten the burden on forecasters participating in the survey. Another difference is that, in contrast with the Blue Chip survey, the ESPF maintains respondents' anonymity, based on the reasoning that anonymity may make it more likely that participants reveal their true forecasts.

We converted the quarterly forecasts into our monthly forecasts in this paper as follows: first, we assume a quarterly forecast to be a monthly one for the second month of the quarter; second, we calculate monthly figures for the other months in the quarter by taking weighted averages of two consecutive quarterly forecasts. To be more specific, suppose t is February 2008. Then $\pi_{t,t+12}$ is set to equal $\pi_{08Q1,09Q1}$ available in the ESPF. As for the forecast for January 2008, $\pi_{t,t+12}$ is calculated as $(1/3)\times\pi_{07Q4,08Q4}+(2/3)\times\pi_{08Q1,09Q1}$.

[A2-1] The description in this appendix heavily relies on Komine et al. (2009). Refer to the original paper for a more detailed description of the ESPF.

Appendix C. Timing of MCCS and ESPF Publication

Please refer to Table A.3. for the timing of the publication of the MCCS and the ESPF.

Table 1. Expected annual inflation (survey responses) and realized annual CPI inflation rate

Case 1: (-0.1, 0.1)		Expected inflation (survey response)								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Marginal
Realized CPI inflation rate	(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(3)	0.11	0.38	1.72	12.15	8.37	4.39	0.93	2.12	30.16
	(4)	0.13	0.47	1.70	12.24	11.01	7.14	1.87	2.65	37.21
	(5)	0.15	0.36	0.80	5.08	6.68	8.49	4.85	1.89	28.30
	(6)	0.03	0.04	0.06	0.20	0.52	1.54	1.65	0.29	4.34
	(7)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Marginal	0.41	1.25	4.28	29.67	26.58	21.57	9.30	6.94	100.00
Case 2: (-0.3, 0.3)		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Marginal
Realized CPI inflation rate	(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(3)	0.00	0.02	0.07	0.56	0.45	0.21	0.04	0.16	1.51
	(4)	0.28	1.01	3.89	27.81	23.08	14.35	3.66	5.59	79.67
	(5)	0.10	0.18	0.26	1.10	2.53	5.46	3.95	0.90	14.49
	(6)	0.03	0.04	0.06	0.20	0.52	1.54	1.65	0.29	4.34
	(7)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Marginal	0.41	1.25	4.28	29.67	26.58	21.57	9.30	6.94	100.00
Case 3: (-0.5, 0.5)		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Marginal
Realized CPI inflation rate	(1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(2)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(4)	0.28	1.04	3.99	28.52	23.86	15.11	3.99	5.83	82.63
	(5)	0.10	0.17	0.23	0.95	2.20	4.92	3.65	0.82	13.04
	(6)	0.03	0.04	0.06	0.20	0.52	1.54	1.65	0.29	4.34
	(7)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Marginal	0.41	1.25	4.28	29.67	26.58	21.57	9.30	6.94	100.00

Table 2. Performance of individual household expectations relative to the mean of professional forecasts

(Share of households that outperformed the mean of professional forecasts on an ex post basis)

Intervals for "remain the same" response	Comparison based on absolute size of calculated bias [1/]	Comparison based on RMSE [2/]
If $\lvert Et[\pi_{t,t+12}] \rvert < 0.1$	33.1%	10.3%
If $\lvert Et[\pi_{t,t+12}] \rvert < 0.3$	19.5%	12.3%
If $\lvert Et[\pi_{t,t+12}] \rvert < 0.5$	29.2%	17.5%

Notes: 1. A household is counted if its average forecast error is smaller than the average forecast error of the mean of professional forecasts.

2. A household is counted if its RMSE (≡squared average forecast error + standard deviation) is smaller than that of the mean of professional forecasts. Forecast errors are calculated on the basis of the selected inflation interval number, which ranges from 1 to 7.

Table 3. Forecasting power of the mean of household expectations and the mean professional forecasts [1/]

Estimated Model : $\pi_{t,t+12} = \beta_1 \times E_t[\pi_{t,t+12}] + \beta_2 \times N_t[\pi_{t,t+12}] + \beta_3 \times \pi_{t-14,t-2} + \beta_0 + \varepsilon_t$

		Actual percentage number basis [2/]			Median of range number basis [3/]		
		[1]	[2]	[3]	[4]	[5]	[6]
Household mean (t)	(β_1)	0.04	0.18		-0.10	0.21	
		(0.16)	(0.15)		(0.20)	(0.21)	
Professional mean (t)	(β_2)	1.24 **		1.29 **	1.32 ***		1.24 ***
		(0.56)		(0.51)	(0.37)		(0.33)
Current inflation (t-2)	(β_3)	-0.30	-0.29	-0.28	-0.26	-0.13	-0.28
		(0.29)	(0.30)	(0.27)	(0.21)	(0.23)	(0.20)
Constant	(β_0)	-0.05	0.09	-0.01	0.01	0.26	-0.09
		(0.24)	(0.24)	(0.17)	(0.30)	(0.33)	(0.22)
Durbin-Watson d-statistic		0.24	0.23	0.23	0.56	0.47	0.58
Number of observations		48	48	48	48	48	48
Adj. R-squared		0.07	-0.01	0.09	0.19	-0.02	0.20
Root MSE		0.73	0.76	0.72	0.94	1.05	0.93

Notes: 1. All regressions were conducted using OLS. Numbers in parentheses are standard errors.
*** and ** indicate significance at the 1 percent and 5 percent level, respectively.
2. As actual percentage numbers are not available for household expectations, we used the median of range value to calculate the household mean.
3. All numbers, including realized inflation, the mean of professional forecasts, and current inflation, were converted to median of range values.

Table 4. The impact of the mean of professional forecasts on individual household expectations

		Dependent variable	Independent variables			Number of observations	Adj. R-squared	Root MSE
			Constant	Sum of coefficients on Ei,t-4($\pi_{t-4,t+8}$)…Ei,t-1($\pi_{t-1,t+11}$)	Sum of coefficients on Nt-4($\pi_{t-4,t+8}$)…Nt-1($\pi_{t-1,t+11}$)			
Real number based regression	[1]	Ei,t($\pi_{t,t+12}$)	0.22 (0.00)	0.80 (0.00)	0.66 (0.00)	158,602	0.42	1.83
Median value based regression	[2]	Ei,t($\pi_{t,t+12}$)	0.16 (0.00)	0.80 (0.000)	0.46 (0.00)	158,602	0.42	1.84

Notes: All regressions were conducted using OLS. Numbers in parentheses are p-values for the exclusion tests.
$N_{t-4}(\pi_{t-4,t+8})…N_{t-1}(\pi_{t-1,t+11})$ in [1] are on an actual percent number basis, while those in [2] are on a median of range basis.

Table 5. Estimating and testing the mean inflation expectations model (8)

Model estimated: $E_t[\pi_{t,t+12}] = \alpha_{1\text{-}1} \times N_t[\pi_{t,t+12}] + \alpha_{1\text{-}2} \times \pi_{t\text{-}14,t\text{-}2} + \alpha_2 \times E_{t\text{-}1}[\pi_{t\text{-}1,t+11}] + \alpha_0 + \varepsilon_t$

		Real number based regressions						Median value based regressions					
		[1]		[2]		[3]		[4]		[5]		[6]	
Mean of professional forecasts (t)	($\alpha_{1\text{-}1}$)	0.37	***			0.31	**	0.25	***			0.24	***
		(0.14)				(0.12)		(0.08)				(0.08)	
Current inflation (t-2)	($\alpha_{1\text{-}2}$)			-0.33	***	-0.30	***			-0.16	**	-0.14	**
				(0.08)		(0.08)				(0.07)		0.06	)
Mean of household expectations (t-1)	(α_2)	0.92	***	1.12	***	1.07	***	0.93	***	1.03	***	0.99	***
		(0.04)		(0.05)		(0.05)		(0.03)		(0.04)		(0.04)	
Constant	(α_0)	0.06		-0.12		-0.13		0.01		0.64	**	0.52	**
		0.07		(0.08)		(0.08)		(0.07)		(0.25)		(0.23)	
Test whether $\alpha_{1\text{-}1} + \alpha_2 = 1$ (F-statistic)		5.50	***					5.64	**				
Test whether $\alpha_{1\text{-}2} + \alpha_2 = 1$ (F-statistic)				16.83	***					6.49	**		
Test whether $\alpha_{1\text{-}1} + \alpha_{1\text{-}2} + \alpha_2 = 1$ (F-statistic)						0.41						0.98	
Number of observations		58		58		58		58		58		58	
Adj. R-squared		0.94		0.95		0.96		0.95		0.94		0.95	
Root MSE		0.27		0.26		0.24		0.27		0.28		0.26	

Notes: All regressions were conducted using OLS. Numbers in parentheses are standard errors.
*** and ** indicate significance at the 1 percent and 5 percent level, respectively.

Table 6. Micro data based regressions of inflation expectation dynamics

(Assuming that professional forecasts in t-1 are available when households form their expectations in t-1)

Panel A: Percentage number based regression

		Dependent variable: Percentage point change in inflation expectations by individual households from t-1 to t.					
		[1]	[2]	[3]	[4]	[5]	[6]
Gap between professional forecast and household expectation in t-1	($\beta_{1\text{-}1}$)	0.702 ***		1.589 ***	0.800 ***		1.122 ***
		(0.002)		(0.012)	(0.003)		(0.013)
Gap between current inflation and household expectation in t-1	($\beta_{1\text{-}2}$)		0.622 ***	-0.858 ***		0.755 ***	-0.315 ***
			(0.002)	(0.012)		(0.003)	(0.013)
Change in the mean of professional forecasts (from t-1 to t)	($\beta_{2\text{-}1}$)	0.705 ***		1.407 ***	0.682 ***		1.271 ***
		(0.004)		(0.015)	(0.003)		(0.015)
Change in current inflation rate (from t-1 to t)	($\beta_{2\text{-}2}$)		0.624 ***	-0.681 ***		0.598 ***	-0.571 ***
			(0.003)	(0.014)		(0.003)	(0.014)
Constant	(β_0)				0.569 ***	0.693 ***	0.563 ***
					(0.005)	(0.005)	(0.006)
Test of rational expectations [1/]		$\beta_{1\text{-}1}$=0 & $\beta_{2\text{-}1}$=1	$\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=1	$\beta_{1\text{-}1}$=0 & $\beta_{2\text{-}1}$=1 & $\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=0	$\beta_{1\text{-}1}$=0 & $\beta_{2\text{-}1}$=1 & β_0=0	$\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=1 & β_0=0	$\beta_{1\text{-}1}$=0 & $\beta_{2\text{-}1}$=1 & $\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=0 & β_0=0
(F-statistic)		1.2e+5 ***	1.2e+5 ***	62320 ***	90142 ***	91876 ***	54976 ***
Test of sticky information model		$\beta_{1\text{-}1}$=1 & $\beta_{2\text{-}1}$=1	$\beta_{1\text{-}2}$=1 & $\beta_{2\text{-}2}$=1	$\beta_{1\text{-}1}$=1 & $\beta_{2\text{-}1}$=1 & $\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=0	$\beta_{1\text{-}1}$=1 & $\beta_{2\text{-}1}$=1 & β_0=0	$\beta_{1\text{-}2}$=1 & $\beta_{2\text{-}2}$=1 & β_0=0	$\beta_{1\text{-}1}$=1 & $\beta_{2\text{-}1}$=1 & $\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=0 & β_0=0
(F-statistic)		7271 ***	12203 ***	1.3e+5 ***	9883 ***	14892 ***	6324 ***
Number of observations		161,321	161,321	161,321	161,321	161,321	161,321
Adj. R-squared		0.334	0.290	0.355	0.386	0.359	0.392
Root MSE		1.773	1.830	1.744	1.701	1.737	1.692

Notes: All regressions were conducted using OLS. Numbers in parentheses are standard errors.
*** indicates significance at the 1 percent level.

Table 6. Micro data based regressions of inflation expectation dynamics (continued)

Panel B: Multiple choice based regression

Dependent variable: Change in the inflation expectations range by individual households from t-1 to t.

		[1]	[2]	[3]	[4]	[5]	[6]
Gap between professional forecast and household expectation in t-1	($\beta_{1\text{-}1}$)	0.810 ***		0.823 ***	0.827 ***		0.723 ***
		(0.002)		(0.004)	(0.002)		(0.004)
Gap between current inflation and household expectation in t-1	($\beta_{1\text{-}2}$)		0.554 ***	-0.013 ***		0.658 ***	0.114 ***
			(0.002)	(0.004)		(0.002)	(0.004)
Change in the mean of professional forecasts (from t-1 to t)	($\beta_{2\text{-}1}$)	0.794 ***		0.773 ***	0.782 ***		0.736 ***
		(0.004)		(0.005)	(0.004)		(0.047)
Change in current inflation rate (from t-1 to t)	($\beta_{2\text{-}2}$)		0.546 ***	0.023 ***		0.529 ***	0.047 ***
			(0.003)	(0.004)		(0.003)	(0.004)
Constant	(β_0)				0.114 ***	0.293 ***	0.159 ***
					(0.002)	(0.003)	(0.003)
Test of rational expectations [1/]		$\beta_{1\text{-}1}$=0 & $\beta_{2\text{-}1}$=1	$\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=1	$\beta_{1\text{-}1}$=0 & $\beta_{2\text{-}1}$=1 & $\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=0	$\beta_{1\text{-}1}$=0 & $\beta_{2\text{-}1}$=1 & β_0=0	$\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=1 & β_0=0	$\beta_{1\text{-}1}$=0 & $\beta_{2\text{-}1}$=1 & $\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=0 & β_0=0
(F-statistic)		1.2e+5 ***	1.2e+5 ***	61763 ***	84735 ***	93369 ***	51294 ***
Test of sticky information model		$\beta_{1\text{-}1}$=1 & $\beta_{2\text{-}1}$=1	$\beta_{1\text{-}2}$=1 & $\beta_{2\text{-}2}$=1	$\beta_{1\text{-}1}$=1 & $\beta_{2\text{-}1}$=1 & $\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=0	$\beta_{1\text{-}1}$=1 & $\beta_{2\text{-}1}$=1 & β_0=0	$\beta_{1\text{-}2}$=1 & $\beta_{2\text{-}2}$=1 & β_0=0	$\beta_{1\text{-}1}$=1 & $\beta_{2\text{-}1}$=1 & $\beta_{1\text{-}2}$=0 & $\beta_{2\text{-}2}$=0 & β_0=0
(F-statistic)		3046 ***	18790 ***	1561 ***	3059 ***	17811 ***	2021 ***
Number of observations		161,321	161,321	161,321	161,321	161,321	161,321
Adj. R-squared		0.404	0.264	0.405	0.415	0.318	0.418
Root MSE		0.821	0.913	0.821	0.814	0.879	0.812

Notes: All regressions were conducted using OLS. Numbers in parentheses are standard errors.
*** indicates significance at the 1 percent level.

Table 7. How well can the sticky information model explain disagreement in inflation expectations?

$E_{i,t}[\pi_{t,t+12}] = \Sigma \beta_{1,t}$ Year-Month-Dummy $_t + \Sigma \beta_{2,s}$ Update Year-Month Dummy $_{s(i,t)} + \beta_0 + \varepsilon_{i,t}$

	P-values for exclusion F tests				
	All $\beta_{1,t}$=0	All $\beta_{2,s}$=0	Number of observations	Adj. R-squared	Root MSE
[1]	F(58, 322737) = 1337.06 Prob > F = 0.0000		322,796	0.194	2.241
[2]	F(58, 322679) = 661.45 Prob > F = 0.0000	F(58, 322679) = 90.88 Prob > F = 0.0000	322,796	0.206	2.224

Notes: All regressions were conducted using OLS.

s(*i*,*t*) denotes the (*past)* period in which household i's inflation expectation in period t was updated. By definition, s(*i*,*t*)≦t always holds.

Table 8. Probit model of inflation expectation updates

The dependent variable takes one if a household revised its inflation expectation in period *t* and takes zero if it did not.

	[1]		[2]		[3]		[4]		[5]	
log(no. of media articles)	0.007	**	0.004		-0.004		0.002		-0.003	
	(0.003	)	(0.003	)	(0.004	)	(0.004	)	(0.004	)
⊿log(no. of media articles)	0.039	***	0.039	***	0.061	***	0.070	***	0.057	***
	(0.005	)	(0.005	)	(0.005	)	(0.005	)	(0.005	)
$E_{i,t}[\pi_{t-1,t+11}]-N_t[\pi_{t-1,t+11}]$			0.009	***	0.003	***	0.004	***	0.007	***
			(0.000	)	(0.001	)	(0.001	)	(0.001	)
Months since the last update					-0.076	***	0.013	***		
(a)					(0.001	)	(0.001	)		
Average no. of months between updates							-0.254	***		
(b)							(0.002	)		
(a)÷(b)									0.037	***
									(0.001	)
Number of observations	267,269		267,269		224,379		224,379		219,092	
Pseudo R-squared	0.0003		0.001		0.046		0.144		0.007	

Notes: Reported coefficients are estimated marginal effects, that is, the change in the probability for a change in each independent variable.
Numbers in parentheses are standard errors.
*** and ** indicate significance at the 1 percent and 5 percent level, respectively.

Figure 1. Average inflation expectations and actual inflation by survey (from 2001 to 2009)

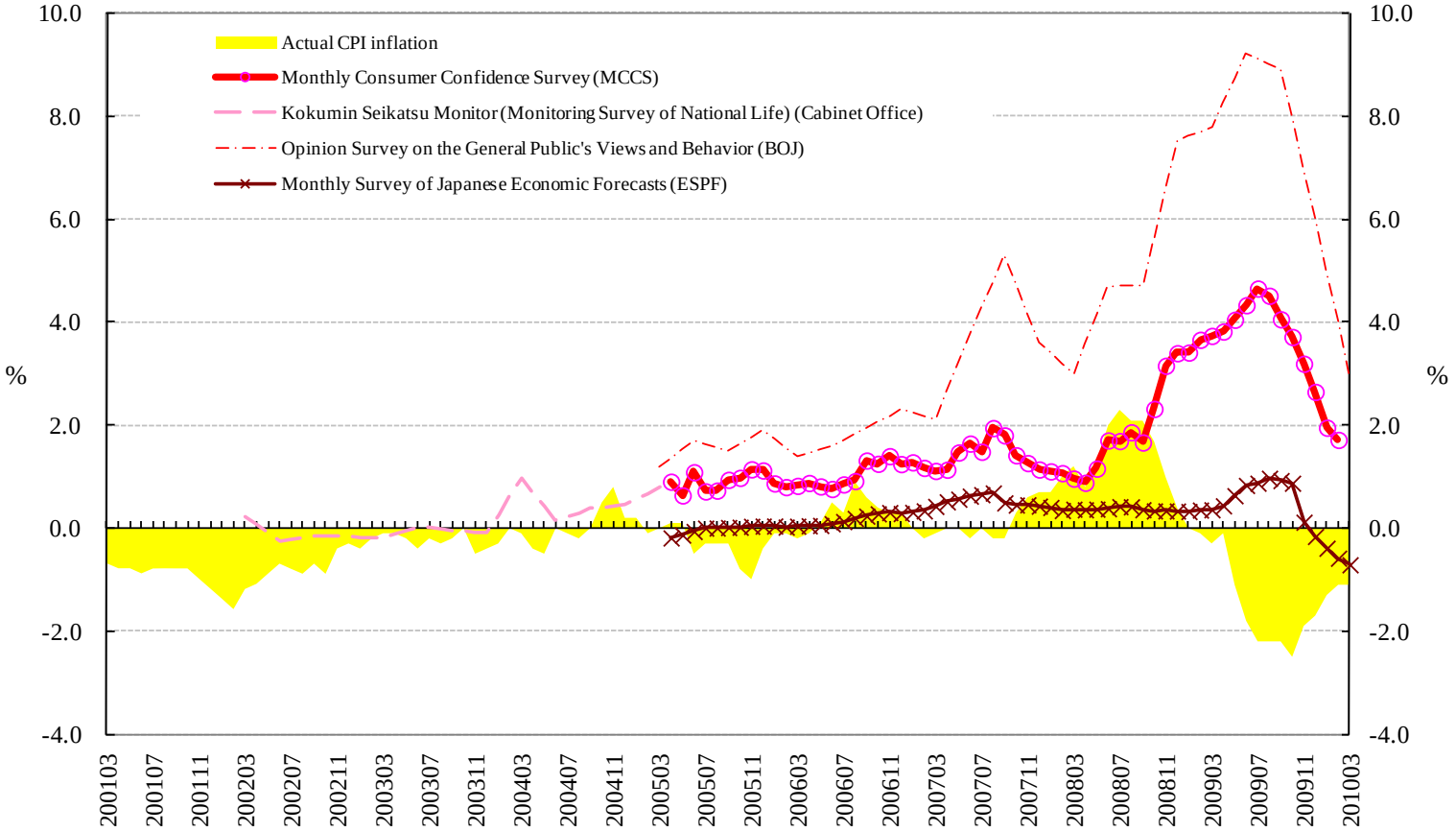
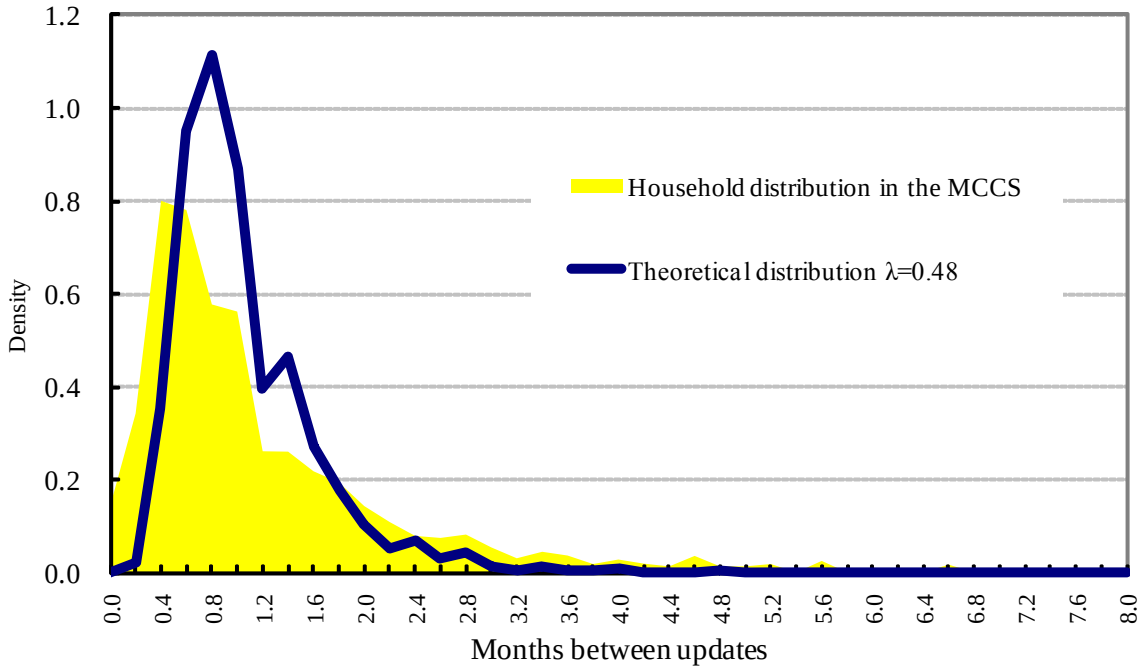


Figure 2. Distribution of the average no. of months between expectation updates



Note: To identify the average number of months between expectation updates for each individual household, we dropped observations of each household before its first update.

Table A.1. Basic statistics of the characteristics of the households surveyed

(%)

	Total	FY2004	FY2005	FY2006	FY2007	FY2008
Sex						
Male	80.9	82.3	81.8	81.1	79.9	78.1
Work status						
No job	34.1	32.6	33.1	34.3	35.2	36.1
Farmer	1.3	1.2	1.3	1.2	1.3	1.2
Employee	42.7	43.4	42.9	42.8	42.1	41.8
Self-employed	17.4	18.5	18.0	17.5	17.0	15.1
Others	4.6	4.3	4.6	4.2	4.4	5.7
Age of household head						
18 to 20	0.2	0.3	0.3	0.2	0.2	0.2
21 to 30	5.7	5.3	5.8	6.0	5.7	5.6
31 to 40	10.9	11.2	10.2	11.2	11.4	10.5
41 to 50	14.2	14.7	14.8	13.9	13.7	13.2
51 to 60	20.5	22.0	20.8	19.9	20.0	19.3
61 to 70	24.3	24.8	24.7	24.0	23.6	24.2
71 to 80	18.6	16.9	18.2	19.1	19.2	20.4
81 to 90	5.3	4.4	4.9	5.4	5.9	6.2
91 or above	0.3	0.3	0.3	0.4	0.5	0.4
Number of household members						
1	26.9	25.0	24.9	24.8	29.0	33.0
2	26.8	26.9	27.2	28.1	26.2	24.9
3	17.9	18.6	18.8	18.2	16.7	16.7
4	15.6	16.3	15.9	15.4	15.8	14.5
5+	12.8	13.3	13.2	13.5	12.3	10.9
Number of working household members						
0	25.3	23.5	24.4	25.1	26.3	28.5
1	41.0	41.7	41.2	40.5	40.5	40.7
2	23.6	24.5	23.8	24.1	23.3	21.6
3+	10.1	10.3	10.7	10.3	9.9	9.1
Household annual income						
Less than 3 million yen	34.0	32.3	32.6	33.6	34.6	38.2
3 to 4 million yen	17.8	17.9	18.1	18.4	17.4	16.5
4 to 5.5 million yen	16.3	16.2	16.5	16.5	15.9	16.2
5.5 to 7.5 million yen	14.5	15.0	15.0	14.0	14.7	13.0
7.5 to 9.5 million yen	8.7	9.1	8.7	8.8	8.5	8.2
9.5 to 12 million yen	5.1	5.4	5.1	5.0	5.3	4.7
More than 12 million yen	3.7	4.0	4.0	3.7	3.5	3.1
Main income source						
Salary	52.0	53.4	53.0	51.7	50.9	50.5
Business income	12.4	13.2	12.8	12.9	12.4	10.1
Pension	31.4	29.1	30.3	31.7	32.6	34.8
Other	4.1	4.4	3.9	3.6	4.1	4.7
House						
Owner-occupied, detached	69.9	69.7	71.5	70.5	69.5	67.7
Owner-occupied, condominium	4.4	4.2	3.8	4.5	4.6	4.9
Publicly provided	2.8	2.1	2.1	2.4	2.8	5.0
Employer-provided	2.4	2.4	2.4	2.3	2.5	2.2
Private rental	20.6	21.6	20.2	20.2	20.6	20.2
Housing loan						
Yes	21.7	22.1	22.0	21.7	21.4	20.7

Table A.2. Questions in the ESPF

1. Fiscal year based projection			
(1)	Nominal GDP (percent change from the previous fiscal year)	(9)	Consumer price index excluding fresh food (percent change from the previous fiscal year)
(2)	Real GDP (percent change from the previous fiscal year)	(10)	Unemployment rate (percent)
(3)	Real private final consumption expenditure (percent change from the previous fiscal year)	(11)	Euroyen TIBOR - 3 month (average during the period)
(4)	Real non-residential investment (percent change from the previous fiscal year)	(12)	10-year JGB yield (average during the period)
(5)	Export volumes of goods and services (percent change from the previous fiscal year)	(13)	Stock prices - NIKKEI 225 (average during the period)
(6)	Import volumes of goods and services (percent change from the previous fiscal year)	(14)	Money stock (percent change from the previous fiscal year)
(7)	Indices of industrial production (percent change from the previous fiscal year)	(15)	Yen-dollar exchange rate (average during the period)
(8)	Current account balance (trillion yen)	(16)	U.S. growth rate (percent change from the previous calendar year)
2. Quarterly based projection			
(1)	Real GDP (seasonally adjusted annualized growth rate)	(3)	Unemployment rate (percent)
(2)	Consumer price index excluding fresh food (percent change from the previous year)		
3. Other questions			

Table A.3. Timing of the surveys: ESPF (professional) vs. MCCS (households)

Survey month	ESP Forecast survey			Monthly Consumer Confidence Survey Covering All of Japan		
	Survey period		Published	Survey date 1/	Published	Method 2/
200404				20040415	20040512	telephone
200405	20040426	20040506	20040514	20040515	20040611	direct-visit
200406	20040528	20040608	20040515	20040615	20040714	telephone
200407	20040628	20040705	20040715	20040715	20040810	telephone
200408	20040727	20040804	20040811	20040815	20040910	direct-visit
200409	20040830	20040906	20040915	20040915	20041014	telephone
200410	20040928	20041005	20041015	20041015	20041110	telephone
200411	20041027	20041104	20041110	20041115	20041210	direct-visit
200412	20041122	20041130	20041206	20041215	20050117	telephone
200501	20041224	20050106	20050114	20050115	20050214	telephone
200502	20050131	20050207	20050214	20050215	20050311	direct-visit
200503	20050228	20050307	20050315	20050315	20050415	telephone
200504	20050329	20050405	20050412	20050415	20050516	telephone
200505	20050425	20050506	20050513	20050515	20050609	direct-visit
200506	20050530	20050606	20050615	20050615	20050712	telephone
200507	20050628	20050705	20050712	20050715	20050906	telephone
200508	20050728	20050804	20050810	20050815	20050915	direct-visit
200509	20050829	20050905	20050909	20050915	20051012	telephone
200510	20050928	20051005	20051012	20051015	20051111	telephone
200511	20051026	20051102	20051109	20051115	20051212	direct-visit
200512	20051124	20051201	20051207	20051215	20060117	telephone
200601	20051226	20060106	20060113	20060115	20060209	telephone
200602	20060130	20060206	20060210	20060215	20060313	direct-visit
200603	20060227	20060306	20060310	20060315	20060417	telephone
200604	20060327	20060405	20060411	20060415	20060516	telephone
200605	20060426	20060508	20060512	20060515	20060612	direct-visit
200606	20060529	20060605	20060609	20060615	20060711	telephone
200607	20060628	20060705	20060711	20060715	20060810	telephone
200608	20060727	20060803	20060809	20060815	20060912	direct-visit
200609	20060828	20060904	20060908	20060915	20061012	telephone
200610	20060928	20061005	20061012	20061015	20061113	telephone
200611	20061027	20061106	20061110	20061115	20061211	direct-visit
200612	20061122	20061130	20061206	20061215	20070117	telephone
200701	20061225	20070105	20070112	20070115	20070213	telephone
200702	20070129	20070205	20070209	20070215	20070312	direct-visit
200703	20070226	20070305	20070309	20070315	20070417	direct-visit
200704	20070329	20070405	20070411	20070415	20070516	direct-visit
200705	20070425	20070507	20070511	20070515	20070612	direct-visit
200706	20070604	20070608	20070626	20070615	20070711	direct-visit
200707	20070628	20070706	20070717	20070715	20070810	direct-visit
200708	20070724	20070731	20070809	20070815	20070912	direct-visit
200709	20070827	20070903	20070906	20070915	20071012	direct-visit
200710	20070925	20071002	20071009	20071015	20071112	direct-visit
200711	20071026	20071102	20071109	20071115	20071211	direct-visit
200712	20071122	20071203	20071206	20071215	20080118	direct-visit
200801	20071220	20080104	20080110	20080115	20080213	direct-visit
200802	20080128	20080204	20080212	20080215	20080312	direct-visit
200803	20080225	20080303	20080311	20080315	20080418	direct-visit
200804	20080327	20080403	20080410	20080415	20080516	direct-visit
200805	20080424	20080502	20080513	20080515	20080613	direct-visit
200806	20080524	20080602	20080610	20080615	20080711	direct-visit
200807	20080625	20080702	20080710	20080715	20080812	direct-visit
200808	20080727	20080804	20080812	20080815	20080916	direct-visit
200809	20080825	20080901	20080909	20080915	20081014	direct-visit
200810	20080925	20081002	20081009	20081015	20081112	direct-visit
200811	20081027	20081104	20081111	20081115	20081212	direct-visit
200812	20081125	20081202	20081208	20081215	20090120	direct-visit
200901	20081224	20090107	20090113	20090115	20090210	direct-visit
200902	20090126	20090202	20090210	20090215	20090313	direct-visit
200903	20090223	20090302	20090310	20090315	20090417	direct-visit
200904	20090330	20090406	20090414	20090415	20090518	direct-visit
200905	20090430	20090512	20090518	20090515		direct-visit

Notes: 1. MCCS questionnaires are distributed to survey households around the 10th of the survey month and collected by the 20th.

2. The survey method changed in April 2007. In the past, the survey was conducted by telephone in months other than March, June, September, and December; in those four months, the survey was conducted in the current manner consisting of direct visits and self-completion questionnaires.