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Disagreement in households' inflation expectations and its evolution

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One of the aspects characterizing inflation expectations is the degree of *disagreement* or *dispersion* in such expectations, and dispersion in households' inflation expectations is quite substantial. In phases in which inflation expectations alter, the shape of the distribution of inflation expectations, which reflects the dispersion, may change even when other measures of inflation expectations such as the mean and the median remain unchanged. This article examines how the distribution of households' medium-horizon inflation expectations in Japan evolves over time using the *Opinion Survey on the General Public's Views and Behavior*. The analysis shows that during the episode of rising prices since 2013 the expectations distribution has displayed notable changes that were not observed in the phase of rising prices in 2008.

Introduction

Inflation expectations are economic agents' view on future price developments. Inflation expectations are an important economic variable and affect economic and price developments through their impact on real interest rates (the spread between nominal interest rates and inflation expectations) and price- and wage-setting behavior.

There are a variety of measures of inflation expectations, ranging from surveys directly asking people about expected inflation rates to market products such as inflation-indexed government bonds and inflation swaps, which contain information about market inflation expectations. In particular the number of surveys and the breadth of their coverage have increased since the mid-2000s (Chart 1). Such surveys now also target firms and market participants and cover inflation expectations over longer horizons. In March 2014, the *Short-Term Economic Survey of Enterprises in Japan* (*Tankan*) conducted by the Bank of Japan began to survey firms' inflation expectations. This means that it is becoming easier to gauge disagreement with regard to inflation expectations among forecasters and over different forecast horizons.

Nevertheless, analyses of inflation expectations typically tend to focus on measures such as the mean and the median of such expectations. The fact that inflation expectations vary across agents has attracted little attention. Against this background, the aim of this article is to provide an overview of the degree of disagreement in, or dispersion of, inflation expectations and then examine households' inflation expectations and recent notable features therein in terms of the shape of the expectations distribution, which reflects the disagreement.

[Chart 1] Major surveys of inflation expectations

Agent	Example	Horizon	
		Short	Medium and long
Households	Opinion Survey on the General Public's Views and Behavior	1 year	5 years
	Consumer Confidence Survey	1 year	(n.a.)
Market participants and economists	QUICK Bond Monthly Survey	1 and 2 years	10 years
	ESP Forecast	1 and 2 years	2-6 and 7-11 fiscal years
	Consensus Forecast	Each year to 5 years ahead	6-10 years
Firms	Tankan (Bank of Japan)	1 year	3 and 5 years
	Reuters Tankan	1 year	(n.a.)
	QUICK Tankan	1 year	2 and more years ahead

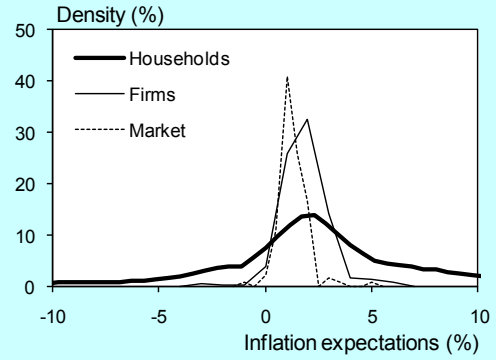
Disagreement in Inflation Expectations

Dispersion among agents

Inflation expectations vary across agents; that is, agents do not necessarily all share the same expectations. Chart 2 plots the distributions of inflation expectations from surveys of households, participants in financial markets, and firms.[1] The

chart shows that in each case expectations are dispersed and do not converge on a certain value. Such dispersion can be observed in each round of the surveys and varies over time, as discussed below.

[Chart 2] Expectations distribution by sector



Note: "Households" indicates the 5-year expectations from the *Opinion Survey*; "Firms" indicates the expectations 2 and more years ahead from the *QUICK Tankan*, and "Market" indicates the 10-year expectations from the *QUICK Bond Monthly Survey*.

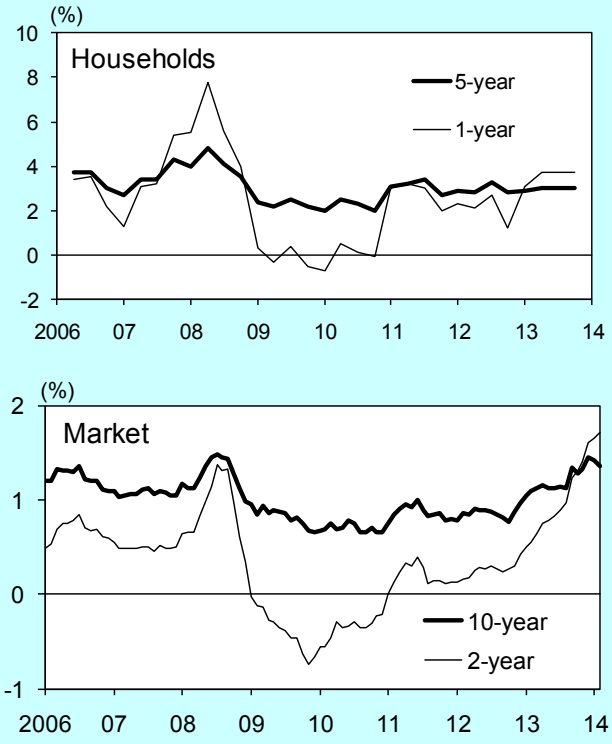
A possible reason for the disagreement in inflation expectations is differences in the information individuals refer to when forming their expectations. In the case of households, for example, each household tends to forecast price developments in light of its own circumstances based on its consumption basket and income level. The information referred to therefore varies across households, which likely contributes to the substantial dispersion of inflation expectations. In contrast, market participants and economists often forecast inflation by entering macroeconomic information into economic forecasting models. For this reason, it has been suggested that the dispersion of their inflation expectations is likely attributable to differences in the forecast accuracy of their models.[2] However, disagreement in market expectations is not as large as that in households' expectations. Specifically, since 2004 the 10-year expectations of half of all market participants have fallen within a very small range of 0.3 percentage points either side of the median. The dispersion of listed firms' expectations is similar to that of market participants. This can be explained by the fact that in particular large firms often refer to economists' forecasts of economic and price developments when they forecast demand in their industry.

Dispersion across forecast horizons

Inflation expectations, even if forecasted by the same agent, can vary depending on the forecast horizon. The different surveys ask about inflation expectations over various forecast horizons, ranging from short horizons such as the coming quarter or year to medium or long horizons such as five or ten years (Chart 1). The inflation expectations for different horizons exhibit different features.

Short-horizon inflation expectations are likely to be affected by temporary factors such as fluctuations in market conditions. On the other hand, medium- and long-horizon expectations are not. Although they may possibly fluctuate when short-horizon expectations become unstable, long-horizon expectations basically reflect economic entities' general view on price developments consistent with fundamental economic and price developments. In fact, the mean of medium- and long-horizon expectations tends to vary much less than that of short-horizon expectations (Chart 3). In monitoring inflation expectations, it is important to take into account these different features in inflation expectations across agents and forecast horizons.

[Chart 3] Inflation expectations for different horizons



Note: Households' expectations are from the *Opinion Survey*, while market expectations are from the *QUICK Bond Monthly Survey*.

Disagreement across Households in Inflation Expectations

Next, we examine household inflation expectations using the *Opinion Survey on the General Public's Views and Behavior* (the *Opinion Survey*). The survey is conducted quarterly by the Bank of Japan. For each survey round, 4,000 individuals aged 20 and over are

randomly sampled in an unbiased manner. The survey asks respondents about their inflation expectations over a medium horizon (the next 5 years) and a short horizon (the next 1 year) as well as inflation perceptions (perceived price changes compared to the last year). Responses are collected both in quantitative and in qualitative terms.

Reporting bias and the skew of the expectations distribution

One of the advantages of measuring inflation expectations quantitatively is that this makes it possible to directly grasp what sort of inflation rate households expect. On the other hand, responses include some outliers: high inflation or deflation expectations of 10% or more make up more than one tenth of all responses, which may affect the mean aggregated from those responses. In addition, quantitative measures of inflation expectations in the survey suffer from downward rigidity; that is, participants tend to respond "zero percent" even when they expect prices to fall. Moreover, the survey suffers from reporting biases: many responses are in the form of integers, especially multiples of five. Thus, it is essential to take these reporting biases into account. Comparing the mean of bias-adjusted 5-year inflation expectations from 2006 onward, we find that this is about 1 percentage point lower than that of the original series.[3]

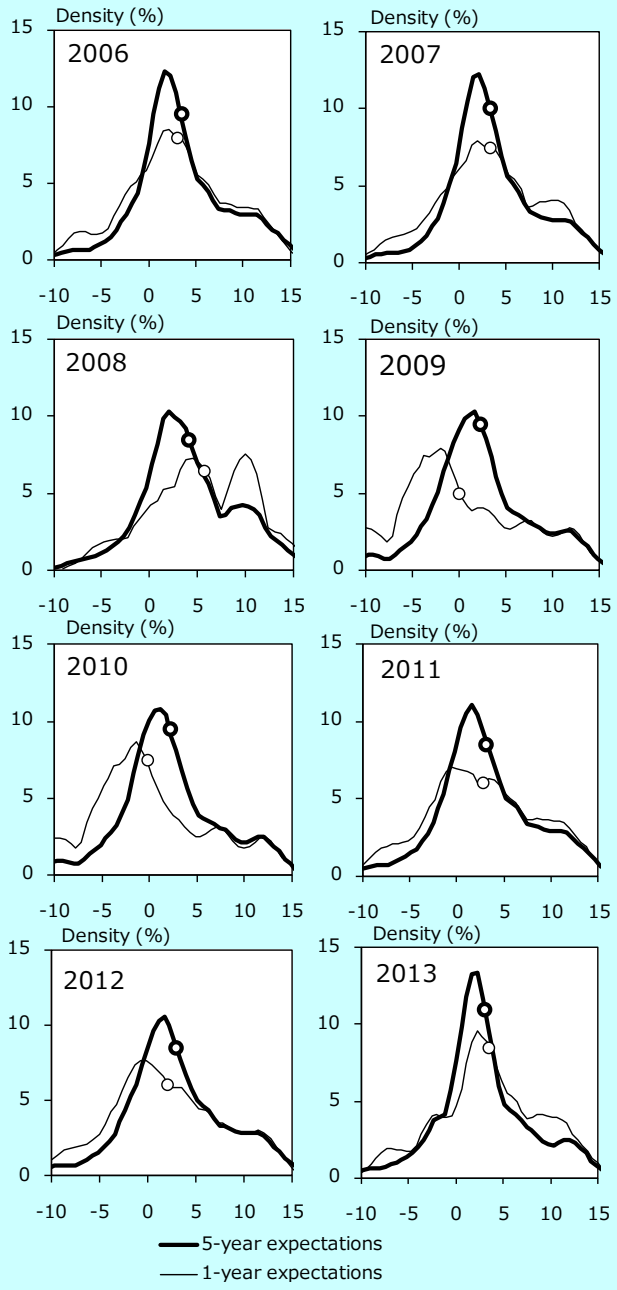
The shape of the distribution of 5-year expectations adjusted for reporting biases still exhibits notable features (Chart 4). First, it is not a symmetric normal distribution. Comparing the left tail of the distribution to the deflationary side with the right tail to the inflationary side, we find that the right tail is always fatter in the survey from 2006 onward. Second, the skew of the distribution varies depending on economic and price developments. Moreover, during phases of significant price movements, such as the rise in prices in 2008 and the decline in prices immediately thereafter, the global peak of the distribution tends to fall. Therefore, the shape of the expectations distribution tells us something about the disagreement in inflation expectations and its evolution, thus offering additional information on inflation expectations that measures such as the mean or the median of expectations do not provide.

Differences in information referred to

One of the factors explaining the disagreement across households in inflation expectations is differences in the information that households refer to when forming their expectations. The prices that the *Opinion Survey* asks respondents about refer not to a specific price indicator such as the consumer price index (CPI); rather, respondents reply referring to the "overall prices of goods and services they purchase." The prices that households think of when answering this question therefore depend on their own consumption basket. This is another factor creating the disagreement across households in inflation expectations.

To quantitatively examine differences in the information that households refer to when forming inflation expectations, we conducted time series analysis. Specifically, we estimated a vector

[Chart 4] Distribution of households' expectations



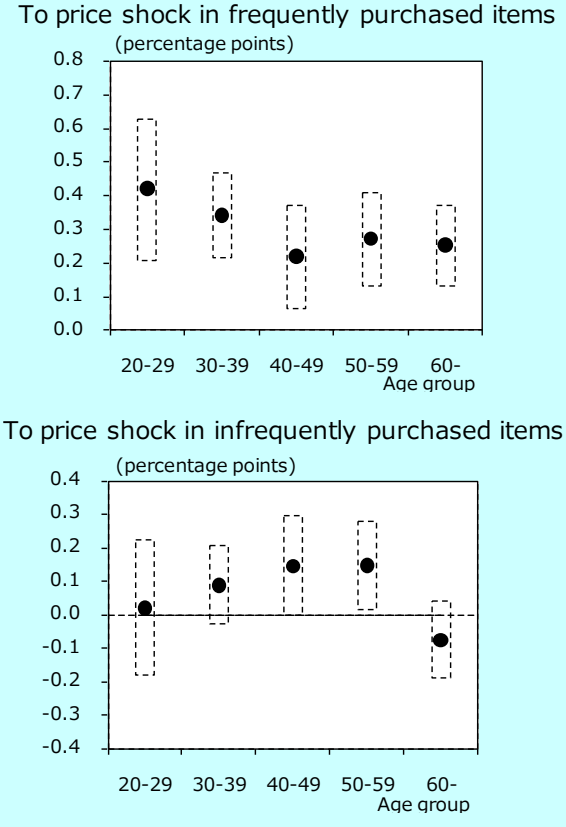
Note: Each panel summarizes the survey results for each year. The horizontal axes represent inflation expectations (%). Circles indicate the mean of each distribution.

autoregressive (VAR) model with four variables separately for different age groups. The four variables are: (1) price information on frequently purchased items; (2) price information on infrequently purchased items; (3) inflation perceptions; and (4) 5-year expectations. We then examined to what extent 5-year expectations change across age groups in response to two types of upward price shocks.

The estimation results reveal two major patterns (Chart 5). First, every age group revises their 5-year expectations up in response to a rise in prices of frequently purchased items (food and energy). In particular, the upward revision is more pronounced among the young, indicating that the young tend to place greater importance on the prices of these items. Second, in response to a rise in prices of infrequently purchased items (all goods and services excluding food and energy), the middle-aged revise up their 5-year expectations, while the 5-year expectations of the young and the elderly remain unchanged. This suggests that the middle-aged pay attention not only to price information on frequently purchased items but also on a wider range of items which better reflect fundamental price developments. This finding indicates that even when the price information available is the same for all households, differences in information referred to in forming expectations contribute to the disagreement across households in inflation expectations.

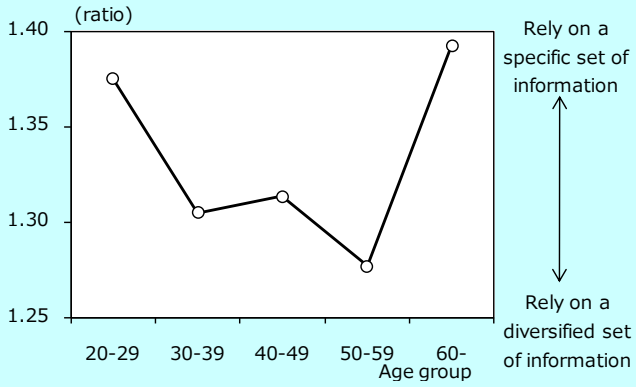
These patterns are confirmed by the results of a special survey in the *Opinion Survey* conducted in September 2013. The survey directly asked what information respondents referred to when forming their 5-year expectations. Specifically, respondents were asked to choose three from eleven options consisting of various types of information on prices, macroeconomic information, and information on monetary policy. Chart 6 depicts the extent of the dispersion of information respondents in each age group referred to represented in terms of the Herfindahl-Hirschman Index calculated from the survey results. The dispersion of the information referred to is relatively low among the young and the elderly, suggesting that they rely on specific sets of information. In contrast, the dispersion of the information referred to by the middle-aged is relatively large, suggesting that the group uses a diverse set of information. A possible explanation of this pattern is that middle-aged households are more likely to be nursing children and/or caring for parents, and tend to have higher income levels. The consumption baskets of such households therefore likely are more diverse than those of younger or older households, so that they refer to a wider range of information.

[Chart 5] Response of expectations



Note: Initial response of 5-year expectations to an upward price shock. Dashed lines denote 90% confidence intervals.

[Chart 6] Diversity of information referred to



Note: Herfindahl-Hirschman Index based on the information referred to, denoted as the ratio to the reference value.

Recent Features of Expectations Distribution

From early 2013, two changes in the features of the distribution of households' 5-year expectations could be observed (Chart 4). First, the skew to the deflationary side has considerably diminished. As discussed in more detail in the Box, a similar change

can be observed in the distribution of market expectations. Second, the left tail to the deflationary side as well as the right tail to the inflationary side both have contracted and the spike around 2% expectations has become sharper. This means that there has been a decrease in the share of respondents expecting deflation or higher inflation and a substantial increase in the share of respondents expecting inflation of around 2%. What are the reasons for these two changes?

Reasons for the reduced skew to the deflationary side

The first change, the reduced skew to the deflationary side, seems to be largely due to price information relating to the past. To confirm this, we ran a simulation using the time series model introduced above. Specifically, we compared the simulated distribution of 5-year expectations that each household made by referring only to price information to date with the actual distribution of 5-year expectations.[4] If the shape of the actual distribution were determined solely by information relating to the past, the simulated and the actual distribution should be identical. In other words, if the two distributions diverge, this suggests that households also refer to some information other than that relating to the past when forming their inflation expectations.

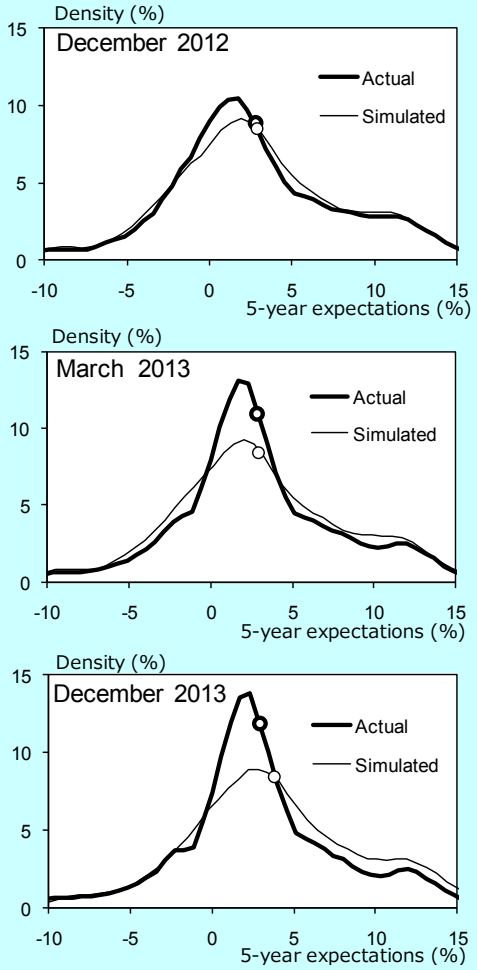
The results indicate that information relating to the past can explain most of the first aforementioned change, namely, the reduction of the skew to the deflationary side in 2013 (Chart 7). Both the actual and the simulated distributions show a thinner left tail, indicating a decline in the share of respondents expecting deflation.

On the other hand, the simulated distribution has a lower peak with a gentler slope and does not display the sharp spike in inflation expectations around 2% observed in the actual distribution in 2013. In addition, while the simulated distribution has an increasingly fatter right tail to the inflationary side resulting in an increase in the mean of expectations, the mean of the actual expectations does not show any change (see also Chart 3). This indicates that information relating to the past alone is insufficient to fully explain the second change, the sharp spike of the distribution in 2013.

Reasons for the sharper spike

The evidence presented above suggests that some information other than that relating to the past may play an important role in the evolution of the expectations distribution from early 2013. That is, while information on the past (a rise in actual inflation) has shifted the distribution in the direction of inflation, some other information may have caused inflation expectations to converge around 2% since early 2013.

[Chart 7] Recent distribution of expectations



Note: Circles indicate the mean of each distribution.

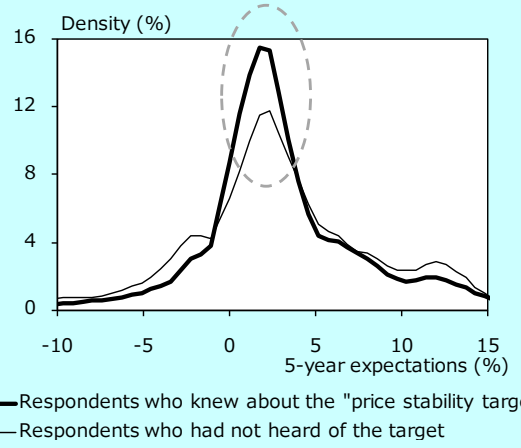
A sharp spike in the expectations distribution was not observed toward 2008, another phase of a price rise (Chart 4). At that time, the skew to the deflationary side decreased from mid-2007 and the distribution as a whole shifted in the direction of inflation. And in 2008, the distribution did not show a sharp spike but became less steep to form two local peaks: one of moderate inflation expectations and another of higher inflation expectations.

Not only did the distribution during the previous episode of rising prices in 2008 not show a sharp spike like the one observed in the distribution of 5-year expectations in 2013, the distribution of 1-year expectations in 2013 also does not display such a spike (Chart 4). Rather, the distribution of 1-year expectations as a whole has shifted in the direction of inflation and expectations are not highly concentrated

on a specific level. Further, taking a closer look at developments in the distribution of 5-year expectations shows that the spike was not formed gradually over time but appeared suddenly in early 2013. Taken together, these facts suggest that certain new medium-term factors affecting only 5-year expectations may be responsible for the sharper spike in the distribution from early 2013.

Although the above analysis cannot identify what these medium-term factors are, a candidate is perceptions regarding monetary policy. The September and December 2013 rounds of the *Opinion Survey* contained a question asking respondents whether they were aware of the "price stability target" of 2% inflation in terms of the year-on-year change in the CPI. Chart 8 shows the distribution of 5-year expectations depending on whether respondents knew about the target. The expectations distribution of households that knew about the target has a sharp spike centered around 2%, while the distribution for households that had not heard of the target has a lower peak and fatter tails on both sides. This contrast suggests that communication of monetary policy can help to collect various inflation expectations of households into 2%.[5]

[Chart 8] Expectations distribution depending on awareness of monetary policy



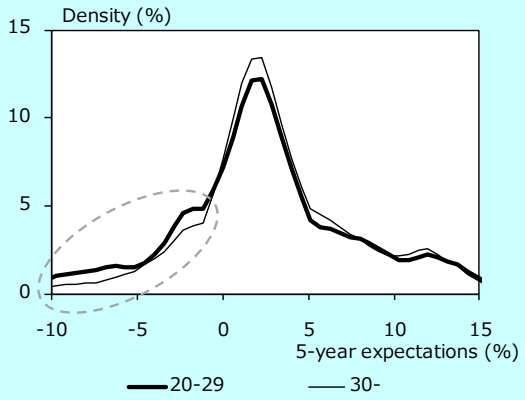
Note: The panel summarizes the survey results for September and December 2013.

Reasons for sticky deflation expectations

The left tail of the distribution extending into negative territory has not completely disappeared since early 2013. This suggest that deflation expectations still linger despite the fact that recent circumstances mean that moderate inflation over the medium horizon has become more likely.

These sticky deflation expectations may possibly reflect households' experience of inflation. Chart 9 shows the distribution of 5-year expectations for different age groups. In the distribution for those aged 20-29, the peak is lower and the left tail is fatter, which means that this age group is more likely to forecast deflation than older age groups. Those aged 20-29 in 2013 were too young to have consciously experienced inflation before the onset of deflation. This suggests that the hypothesis that households form inflation expectations taking their own inflation experience into account also holds in Japan.[6] This, in turn, means that households' own experience of inflation is another factor contributing to the skew in the distribution of 5-year expectations.

[Chart 9] Expectations distribution by age group



Note: The panel summarizes the survey results for 2013.

But inflation experience is not written in stone. In the case of the United States, until the mid-1980s, the young and the middle-aged at the time only possessed high-inflation experience and hence tended to forecast higher inflation than the elderly. However, with all households in the United States subsequently experiencing low and stable inflation (the Great Moderation), the dispersion of inflation expectations across age groups has diminished since the 2000s. Thus, given that inflation experience changes as circumstances change, the deflation expectations as a result of Japan's past experience may gradually change depending on future developments in prices.

Concluding Remarks

Disagreement in, or dispersion of, inflation expectations is a key element that can help to understand inflation expectations. In phases in which inflation expectations alter, the shape of the distribution of inflation expectations, which reflects the dispersion, may change even when the mean or the median of expectations remain unchanged. In fact, in the recent episode of rising prices since 2013, the distribution of households' inflation expectations has displayed notable changes in its shape although the mean and the median of households' expectations

have remained more or less unchanged. Further research on disagreement in inflation expectations and its evolution over time can help to provide important insights into the variability and the stability of inflation expectations.

Box: Disagreement in Market Expectations on Inflation

The *QUICK Bond Monthly Survey* reports market expectations on inflation (Chart 1). The survey is conducted monthly by the QUICK Corporation. Each round of the survey has about 200 respondents, consisting mainly of bond market participants from securities houses and institutional investors. The survey provides forecasts of the CPI (less fresh food) for 1, 2, and 10 years ahead.

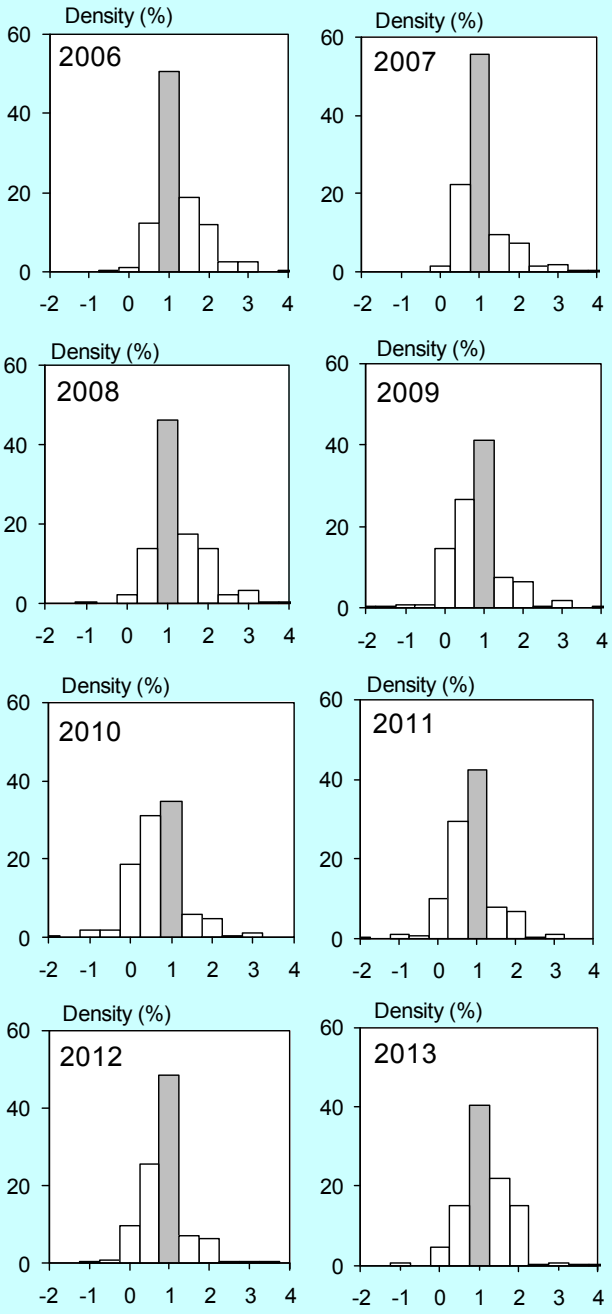
The shape of the distribution of market expectations on inflation also has notable features and evolves over time. The Box Chart shows that for the years 2006 to 2013 the 10-year expectations of market participants are concentrated around 1% and that the distribution is skewed either to the left or to the right.[7] Although the skew to the inflationary side temporarily increased when prices were rising toward 2008, the distribution then became skewed to the deflationary side again for a considerable period following the Lehman shock in September 2008 as deflationary concerns deepened once again. This implies that more market participants forecasted inflation below the sample mean, i.e., they expected deflation or low inflation below 1%.

Features of distribution in 2013

Market concerns over deflation have subsequently weakened. Since early 2013, more respondents have forecasted price increases than price declines and the skew of the distribution has shifted to the inflationary side again. This indicates that market participants' perceptions regarding price developments over a long horizon have changed and an increasing share of market participants are forecasting inflation above 1%. Although the market expectations considered here cannot be directly compared to the household expectations examined in the main text due to the different forecast horizons, both show a diminishing of the skew to the deflationary side.

Nevertheless, relatively few market participants forecast inflation of 2% and the mean of 10-year expectations remains below the "price stability target" of 2%. This suggests that many market participants still think there is a risk of deflation or zero inflation in the future, leaving the left tail of the distribution in negative territory. Given that deflation expectations remain in markets, the mean of market expectations is unlikely to rise.

[Box Chart] Distribution of market expectations



Note: Each panel summarizes the survey results for each year. The horizontal axes represent the 10-year inflation expectations (%). Gray bars indicate the mode of each histogram.

[1] The household inflation expectations plotted in Charts 2-4 and 7-9 are bias-adjusted following the approach suggested by Kamada [2013] (see also footnote 3). The plots in Charts 2, 4, and 7-9 are smoothed using the Kernel method after the bias adjustment.

Kamada [2013] "Downward rigidity in households' price expectations: an analysis based on the Bank of Japan's 'Opinion Survey on the General Public's Views and Behavior'," Bank of Japan Working Paper Series, No.13-E-15.

[2] See: Carroll [2003] "Macroeconomic expectations of households and professional forecasters," Quarterly Journal of Economics, Vol.118, No.1, pp.269-298.

[3] To adjust for these biases, we estimated parameters employing the Kahn test that reproduce the features of the histograms of the quantitative responses (i.e., many responses that are zero or a multiple of five) and then obtained the "underlying distribution" that would be observed without these biases.

[4] The procedure of the simulation is as follows. We first calculated the simulated value of 5-year expectations for each group of households by entering the price information to date and the inflation perceptions into VAR equations for 5-year expectations. We then aggregated these simulated values to obtain the distribution.

[5] Apart from perceptions regarding monetary policy, other factors that may sharpen the spike of the expectations distribution are employment situation. The results of the *Opinion Survey* show the following pattern. While the expectations distribution for those who are quite worried about their employment situation has a fatter right tail, that of those who are not worried has a sharp spike. Thus, easing concerns about the employment situation due to improvements in business conditions in 2013 may be another reason for restraining from increasing the skew of the distribution to the inflationary side and generating the spike.

[6] For details see: Malmendier and Nagel [2013] "Learning from inflation experiences," presented at the NBER Summer Institute 2013.

[7] For this analysis, panel data on individual forecasts were kindly provided by the QUICK Corporation.

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