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Households' Medium- to Long-Term Inflation Expectations Formation: The Role of Past Experience and Inflation Regimes

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Abstract

This paper presents a quantitative analysis of how households' medium- to long-term inflation expectations are influenced by individuals' "past inflation experience" and "inflation regime – inflation trend at each point in time," using microdata from the Bank of Japan's *Opinion Survey on the General Public's Views and Behavior*. The results reveal that households who have experienced averagely lower inflation rates over individuals' lifetime tend to form statistically significantly lower inflation expectations. This finding suggests that the "lower experienced inflation rates," particularly among younger generations who have spent most of their lives in a deflationary environment, may have contributed to prolonged low inflation expectations in Japan. On the other hand, the analysis also indicates that the relationship between inflation expectations and past inflation experience is not always constant. During high-volatility inflation regimes (i.e., periods of significant price fluctuations), the relationship with past inflation experience weakens, while the relationship with inflation perceived at each point in time strengthens. Through this non-linear mechanism, the recent surge in actual inflation may have pushed up inflation expectations in Japan. Moreover, the recent increase in inflation has contributed to the rapid increase in experienced inflation rates among younger generations. This implies that the previous situation, where lower experienced inflation rates among these generations had exerted downward pressure on Japan's inflation expectations, is undergoing a shift. It is important to closely monitor how this increase in experienced inflation rates will influence future trends in long-term inflation expectations.

JEL Classification: C34, E31

Keywords: Inflation Expectation, Inflation Regime, Markov Switching Model, Rational Inattention

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1. Introduction

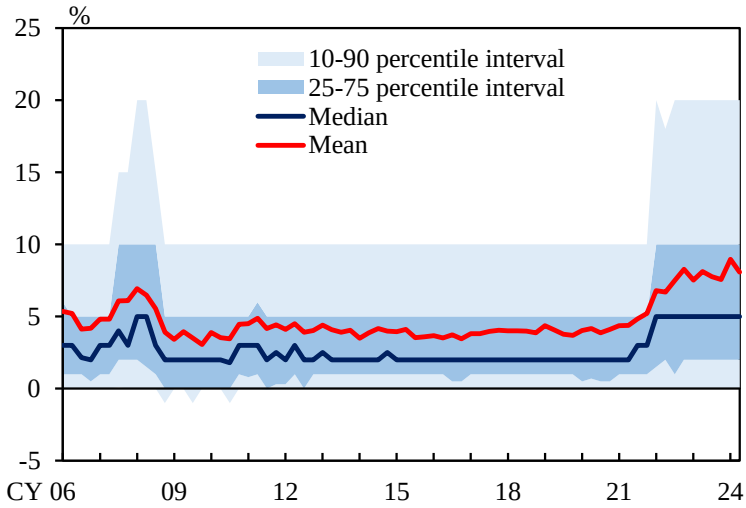
Inflation expectations are a key factor influencing economic activity and price trends, as they affect decision-making by various economic agents (e.g., Mishkin, 2007). Given their significance in understanding price stability and the effectiveness of monetary policy, central banks in many countries monitor inflation expectations, which are measured through various methods for different economic agents (households, firms, and experts) (Bernanke, 2007; Adachi and Hiraki, 2021).

Inflation expectations vary across economic agents in terms of both their levels and their impact on economic activity and price dynamics. Notably, in Japan, where deflation and low inflation persisted for an extended period from the late 1990s, previous research has underscored the significant role of "households' medium- to long-term inflation expectations" (Aoki, Ichiue and Okuda, 2019; Watanabe, 2022, 2024). These studies suggest that households formed low inflation expectations under the assumption that "prices will not increase easily" (Figure 1). As a result, households became more sensitive to product price increases than in the past. Under these circumstances, firms became reluctant to raise their product prices due to concerns about losing demand to competitors. The above research suggests that such a mechanism contributed to Japan's deflation and low inflation. Indeed, a large-scale corporate survey conducted by the Bank of Japan as part of the "Review of Monetary Policy from a Broad Perspective" reveals that numerous respondents cited "price competition" and "consumers' high thriftiness" as key reasons for their difficulty in passing on price increases, reinforcing the idea of the aforementioned mechanism (Figure 2).

However, this situation has been changing in the 2020s. Inflation rates have increased due to the surge in commodity prices and the tightening of the labor market following the COVID-19 pandemic. Under these circumstances, households' medium- to long-term inflation expectations have also shifted upward. Based on the existing literature, the following two factors may have contributed to the recent shift in inflation expectations: the inflation experience of the public, and the inflation trend (inflation regime). In fact, some studies have highlighted the role of past inflation experience in explaining variations in household inflation expectations across cohorts and regions (Malmendier and Nagel, 2016; Pedemonte, Toma and Verdugo, 2023). Others have underscored the importance of inflation regimes from theoretical perspectives such as the rational inattention hypothesis (Gwak, 2022; Weber et al., 2025). These papers indicate that shifts in inflation regime can alter households' attention to prices, which in turn changes the types of information that they prioritize in their expectations formation. The recent surge in inflation rates during the 2020s may have influenced households' inflation expectations through changes in the inflation

experience, as well as increases in attention to prices.

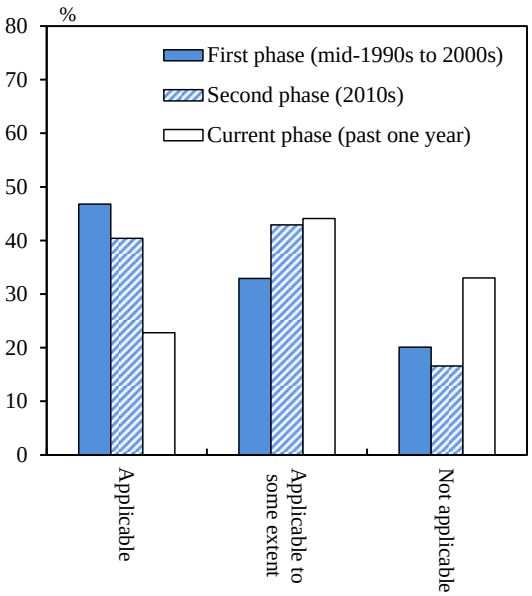
Figure 1: Households' long-term inflation expectations in Japan



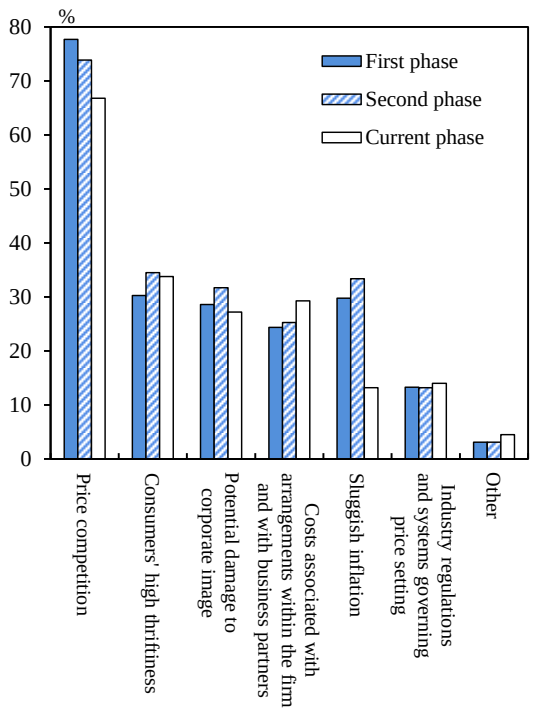
Note: Calculated by the authors from the microdata of the *Opinion Survey on the General Public's Views and Behavior.*
Source: Bank of Japan.

Figure 2: Price setting behavior as observed in a corporate survey

1. Difficulties in passing on higher costs to prices



2. Reasons for the difficulties in passing on higher costs to prices



Notes: 1. For details, see the *Survey regarding Corporate Behavior since the Mid-1990s*.
2. In the second chart, figures are shares of firms that responded "applicable" or "applicable to some extent" in the first chart. Up to three reasons were allowed.
Source: Bank of Japan.

Building on previous studies and shifts in the situation since 2020, this paper presents an empirical analysis of how households' "past inflation experience" and "inflation regimes" influence medium- to long-term inflation expectations formation. The analysis utilizes data from the Bank of Japan's *Opinion Survey on the General Public's Views and Behavior* (hereafter *Opinion Survey*). This quarterly *Opinion Survey* gathers information about Japanese households' perceptions of economic conditions, perceived inflation rates, and inflation expectations (both short-term (1-year-ahead) and long-term (5-years-ahead)). We use microdata from June 2006 to September 2024 to capture the impact of shifts since the COVID-19 pandemic.

The main findings of this paper are as follows. First, households' past inflation experience – average inflation rates that households have experienced during their lives – has a statistically significant positive impact on their medium- to long-term inflation expectations. This result suggests that lower experienced inflation rates, particularly among younger generations who had spent most of their lives in a deflationary environment, may have partly resulted in the persistent stagnation in inflation expectations of Japanese households, despite the rise in inflation rates due to the large-scale monetary easing since 2013. Second, the relationship between inflation expectations and experienced inflation rates is not always constant and varies depending on the inflation regime at each point in time. During high-volatility regimes (periods of large price fluctuations), the relationship with past experiences weakens, while the relationship with inflation perceived at each point in time strengthens. This finding is consistent with results from previous studies, such as Weber et al. (2025). Through this non-linear mechanism, the recent surge in actual inflation may have contributed to the rise in inflation expectations in Japan. Moreover, the recent increase in inflation has contributed to the rapid increase in experienced inflation rates among younger generations. This implies that the previous situation, where lower experienced inflation rates among these generations had exerted downward pressure on Japan's inflation expectations, is undergoing a shift. It is important to closely monitor how this increase in experienced inflation rates will influence future trends in long-term inflation expectations.

The structure of this paper is as follows. Section 2 surveys the previous literature on the formation mechanisms of household inflation expectations. Section 3 provides an overview of the microdata used in our study. Section 4 presents the empirical analysis framework and the results, followed by a discussion of the implications. Section 5 conducts robustness checks. Section 6 concludes.

2. Literature review

Our analysis is closely related to previous research on mechanisms underlying medium- to long-term inflation expectations formation among households. This section reviews relevant studies and discusses the contributions of this paper.

There is no clear consensus on the theoretical mechanisms underlying inflation expectations formation among agents (Coibion, Gorodnichenko and Kamdar, 2018; Okuda, 2018). Many theoretical models have assumed that agents' expectations formation follows the full-information rational expectations (FIRE) hypothesis. However, there is considerable skepticism regarding the validity of FIRE, and alternative theories with more relaxed assumptions have emerged.[1] A notable alternative is the rational inattention hypothesis (Sims, 2003; Maćkowiak and Wiederholt, 2009). This hypothesis assumes that agents have limited information-processing capacity and that they allocate their resources to process more important information. As a result, information deemed less important is not reflected in expectations.[2]

While keeping these theories in mind, empirical studies have focused on individual elements that can influence inflation expectations formation. In particular, this paper is closely related to research that highlights: (1) how experienced inflation rates influence expectations formation, and (2) how the formation mechanisms of households' expectations may change depending on the inflation trend (inflation regime) at each point in time.[3]

First, the influence of experienced inflation rates on inflation expectations has been highlighted in many studies (Johannsen, 2014; Malmendier and Nagel, 2016; Diamond, Watanabe and Watanabe, 2020; Hajdini et al., 2022; Braggion et al., 2024; Pedemonte, Toma, and Verdugo, 2023). A seminal study by Malmendier and Nagel (2016) conducted an analysis using survey data spanning over 57 years of U.S. households, and reported that households who have experienced averagely higher inflation rates over individuals' lifetime tend to form higher inflation expectations. Similarly, Hajdini et al. (2022) conducted an

[1] Hori and Kawagoe (2013) conducted empirical analysis targeting Japanese households' inflation expectations and pointed out that they are not forming completely rational expectations in two senses: (1) household inflation expectations are biased upward on average, and (2) they do not immediately incorporate all available information (reports, etc.) into their expectations.

[2] Other representative theories include the sticky information hypothesis (Mankiw and Reis, 2002) and the adaptive learning hypothesis (Evans and Honkapohja, 1999, 2001).

[3] This paper does not directly analyze the relationship between monetary policy or central banks' price stability targets and household inflation expectations. For empirical research on this point in Japan, see, for example, Ueda (2010), Nakazono, Shiohama and Tamaki (2013), Ichiue et al. (2019), and Niizeki (2023).

international survey covering 15 countries and reached a similar conclusion. Among studies focusing on Japan, Diamond, Watanabe and Watanabe (2020) is a relevant paper on this topic. They implemented their original survey to assess households' inflation expectations and linked the survey data with actual purchasing data of households. Based on this unique dataset, they carried out a detailed empirical analysis of the relationship between age, shopping experiences, and inflation expectations. They found that older generations tend to have higher inflation expectations, while prolonged exposure to low inflation may have exerted downward pressure on inflation expectations, particularly among younger generations.[4]

Second, recent studies also consider how the expectation formation process, or learning process, may change in response to the inflation trend at each point in time (Gwak, 2022; Weber et al., 2025). Informed by the rational inattention hypothesis, these studies propose the following mechanisms. Given the costs of information collection and analysis, individuals may not pay attention to price dynamics when prices are stable and instead focus on other matters. Consequently, in these periods, new information about price developments is not incorporated into expectation formation, and expectations are predominantly formed based on past personal experience. In contrast, during periods of large price fluctuations, individuals tend to focus more on price dynamics. In this case, people actively gather information about prices, and current price movements are more heavily incorporated into their expectations. When such mechanisms are at play, the information that households prioritize in forming expectations will vary over time.[5] Several studies have pointed out a strong correlation between people's attention to prices and the magnitude of price fluctuations (Korenok, Munro and Chen, 2023; Bracha and Tang, 2024; Pfäuti, 2023). In light of these points, Gwak (2022) built a learning model in which the parameters of the household inflation expectation function change according to price dynamics, and applied it to U.S. household survey data. The paper points out that in periods of high inflation with large fluctuations, people tend to focus more on price information at each point in time when

[4] Diamond, Watanabe and Watanabe (2020) use individual purchase data to report that consumption baskets differ by age group, which reflects differences in the actual inflation rates they face. They point out that even after controlling for these factors, the level of inflation expectations by age group still differs significantly.

[5] For example, Weber et al. (2025) use a theoretical model assuming that households can optionally access information about next period's inflation rate, but there is a certain cost associated with obtaining information. In this model, households decide their current consumption and saving levels based on their expectations of the next period's inflation rate. However, when there is high uncertainty about inflation rates, the benefit from information collection increases because there is a higher possibility of making decisions that greatly deviate from the optimal level. When the benefits exceed the costs of information acquisition, more households will access information.

forming expectations. Similarly, Weber et al. (2025) found the same results using randomized controlled trials (RCTs) in the U.S., Europe, and other countries. In Japan, Ueno (2014) reported that during periods of large inflation fluctuations, households increase their attention to price dynamics and update their inflation expectations more frequently.

In addition to these two points, other studies using microdata on household inflation expectations have also highlighted the significant cross-sectional variance (Kamada, 2013; Arioli et al., 2017). The factors contributing to this variance include heterogeneity in households' perceived inflation rates (perceived inflation),[6] as well as sociodemographic factors (Cavallo, Cruces and Perez-Truglia, 2017; D'Acunto et al., 2021; Doh, Lee and Park, 2025). For instance, D'Acunto et al. (2021) point out that heterogeneity in household shopping experiences across different households can both influence inflation perceptions and, ultimately, inflation expectations. Other factors such as gender, income, education level (D'Acunto, Malmendier and Weber, 2023), financial assets and liabilities, perceptions of macroeconomic conditions (Ehrmann, Pfajfar and Santoro, 2017), and household sentiment about their own living and employment conditions (Del Giovane, Fabiani and Sabbatini, 2009) have also been shown to affect the formation of inflation expectations. These studies highlight the need to control for such factors in microdata analyses.

Moreover, this paper is related to previous studies using the microdata of the *Opinion Survey*. Nishiguchi, Nakajima and Imakubo (2014) noted that medium- to long-term inflation expectations derived from this survey are more sensitive to price changes in frequently purchased items, and that the introduction of the price stability target of 2% has had the effect of narrowing the distribution of inflation expectations toward 2%. Kamada, Nakajima and Nishiguchi (2015) estimated latent distributions by removing biases from the microdata and discussed their properties in detail.

Our contributions are summarized in two points. First, research analyzing the impact of past experiences on inflation expectations in Japan is limited. One of the few prior studies, Diamond, Watanabe and Watanabe (2020), focused on short-term inflation expectations and used data from around 2012-2014, which does not account for the price increases observed since 2021. This paper contributes by providing empirical analysis that reflects the current situation, thus complementing previous research. Second, to the best of our knowledge, no study has explicitly discussed the relationship between inflation regimes and inflation expectations in Japan. This paper represents the first attempt to quantitatively assess this relationship in Japan, adding new insights to the existing literature.

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[6] For detailed analysis of inflation perceptions in Japan, see Takahashi and Tamanyu (2022).

3. Data

3.1. Overview of the *Opinion Survey on the General Public's Views and Behavior*

In this paper, we conduct an analysis using microdata from the *Opinion Survey on the General Public's Views and Behavior* (*Opinion Survey*). This survey, conducted since 1993, aims to understand the public's perception of their current living conditions and the impact of changes in the financial and economic environment on their awareness and behavior, in order to inform the Bank's monetary policy and operations. The survey covers 4,000 individuals aged 20 and above nationwide, with new participants selected in each survey round.[7] Therefore, the survey samples vary across each wave, and the dataset is structured as repeated cross-sectional data. For our analysis, we use quarterly data from approximately 75 survey rounds conducted between June 2006 and September 2024, ensuring comparability by considering changes in survey methods.[8]

The *Opinion Survey* investigates both qualitative and quantitative aspects of household perceptions regarding current and future inflation. Quantitative data collected includes: (1) perceived inflation at each point in time (perceived changes in prices from one year ago to the present), (2) short-term inflation expectations (expected changes in prices over the next year), and (3) medium- to long-term inflation expectations (expected changes in prices over the next five years).[9] In addition, sociodemographic factors such as gender, age, income, and sentiment, which may influence inflation expectations (as noted in previous studies in Japan, including Kikuchi and Nakazono, 2023; Ichiue et al., 2019), are also collected, providing the advantage of controlling for these factors in the analysis.

While these advantages exist, it has been pointed out that perceived inflation and inflation expectations derived from household surveys exhibit certain characteristics (Kamada, 2013; Weber et al., 2022; D'Acunto and Weber, 2024; D'Acunto et al., 2024). Specifically, it has been observed that perceived inflation and inflation expectations tend to

[7] The response rate for each survey round is generally around 50-60%.

[8] From 1993 to 1997, the survey was conducted once a year, and from 1998 to 2003, twice a year, so quarterly data is not available. Additionally, before the March 2006 survey, the questionnaire was collected using a visit-and-leave method, while from March 2006 onwards, a mail survey method was used, and it is known that these differences in survey methods can affect the nature of responses (Kamada, 2013). Therefore, this paper's analysis uses data from March 2006 onwards.

[9] A feature of this survey is that it does not specify a particular price measure (such as CPI) that respondents should keep in mind when answering. Therefore, each household is permitted to respond to the survey with different price measures in mind. For example, regarding long-term inflation expectations, responses are collected through the question, "By what percent do you think prices will change per year on average over the next five years?"

be upward biased when compared with the consumer price index (CPI) or expert forecasts at the same point in time. Furthermore, due to the frequent reporting of upward-biased values, the cross-sectional variance of the data tends to be substantial, and responses often cluster around round numbers (such as 0% or 5%), resulting in non-smooth distributions. These characteristics should be taken into account when interpreting the results of the analysis in this paper.[10]

3.2. Summary statistics

The summary statistics of the variables used in the analysis are presented in Table 1. To account for the characteristics of the survey discussed in the previous section, we exclude samples with perceived inflation and long-term inflation expectations that fall outside the upper or lower 0.5% percentiles of the distribution in each survey round, treating them as outliers.

[10] Taking these data characteristics into consideration, Kamada, Nakajima and Nishiguchi (2015) attempt to estimate a latent distribution that removes biases from responses.

Table 1: Summary statistics

	Mean	Standard deviation	Min	Max
Long-term inflation expectation	4.691	7.184	-20	100
Perceived inflation	5.682	8.513	-30	150
Sociodemographics				
Age group				
20-29	0.096	0.294	0	1
30-39	0.147	0.354	0	1
40-49	0.178	0.382	0	1
50-59	0.181	0.385	0	1
60-69	0.197	0.398	0	1
70 or over	0.202	0.401	0	1
Gender				
Male	0.479	0.500	0	1
Female	0.521	0.500	0	1
Employment situation				
Working in agriculture, forestry, or fisheries	0.021	0.144	0	1
Self-employed	0.092	0.289	0	1
Regular employee	0.377	0.485	0	1
Non-regular employee	0.157	0.364	0	1
Other	0.353	0.478	0	1
Annual income				
No income	0.032	0.176	0	1
Less than 3 million yen	0.369	0.482	0	1
3 to 5 million yen	0.290	0.454	0	1
5 to 10 million yen	0.243	0.429	0	1
10 million yen or greater	0.066	0.248	0	1
Composition of household				
Single-person household	0.119	0.324	0	1
Married-couple household	0.275	0.447	0	1
Two-generation household	0.504	0.500	0	1
Other	0.102	0.302	0	1
Sentiment				
Evaluation of current economic conditions				
Favorable	0.105	0.307	0	1
Difficult to say	0.555	0.497	0	1
Unfavorable	0.340	0.474	0	1
Concerns about employment				
Not particularly concerned	0.181	0.385	0	1
Slightly concerned	0.488	0.500	0	1
Quite concerned	0.331	0.471	0	1

Note: Calculated by the authors from the microdata of the *Opinion Survey on the General Public's Views and Behavior*. In each survey, the top 0.5% and bottom 0.5% of inflation expectations and perceived inflation are excluded as outliers.
Source: Bank of Japan.

4. Empirical analysis

In this section, we conduct an empirical analysis based on previous studies, focusing on the role of past inflation experience and the impact of the inflation regime on expectation formation in Japan.

4.1. Relationship between past experiences and long-term inflation expectations

In this section, we examine the relationship between experienced inflation rates and medium- to long-term inflation expectations. First, we quantify each households' past inflation experience, employing methodologies derived from prior research. Subsequently, we conduct a quantitative analysis to investigate how these past experiences influence long-term inflation expectations.

4.1.1. Quantification of past inflation experience

In previous studies, past inflation experience is often measured as the long-term average inflation rate from adulthood to the survey point (Pedemonte, Toma and Verdugo, 2023; Hajdini et al., 2022). Based on these studies, this paper firstly estimates the birth year of each respondent in the *Opinion Survey*. We then calculate their lifetime average inflation rates – the average of the year-on-year CPI inflation rates during the period from their 20th year to each point in time.[11]

Figure 3 illustrates the lifetime average inflation rates by birth year. Notably, individuals born in 1980 or 1990, whose adulthood coincided with periods of deflation or low inflation, have a lower lifetime average inflation rate compared to other generations. Moreover, following the price increases that began in 2021, younger generations born after 1990 have experienced a marked increase in their lifetime average inflation rates.

Figure 4 shows the lifetime average inflation rates by age group in 2013 and 2023. In 2013, there was a strong positive correlation between age and past experience. This indicates that older generations, having lived through high-inflation periods such as the oil shocks, had higher experienced inflation rates, while younger generations accumulated experiences in low-inflation environments. However, by 2023, the recent surge in inflation led to a sharp increase in the inflation rate experienced by younger generations, causing the relationship between age and past inflation experiences to shift to a U-shaped pattern. This marks a

[11] Birth years are estimated as follows. From the *Opinion Survey* responses, age can be obtained in 10-year brackets, such as 20s, 30s, etc. Using this information, a household that responded as being in their 30s in the March 2010 survey, for example, is assumed to be 35 years old and born in 1975/1Q. Then, the simple average of year-on-year change of CPI from 1995/1Q to 2009/4Q is calculated and considered to be the inflation rate experienced by that household.

change in the long-standing trend in Japan, where older generations historically experienced higher inflation rates than younger generations. The following section presents an empirical analysis of how the accumulation of such experiences influences the formation of long-term inflation expectations.

Figure 3: Lifetime average inflation rate by birth year

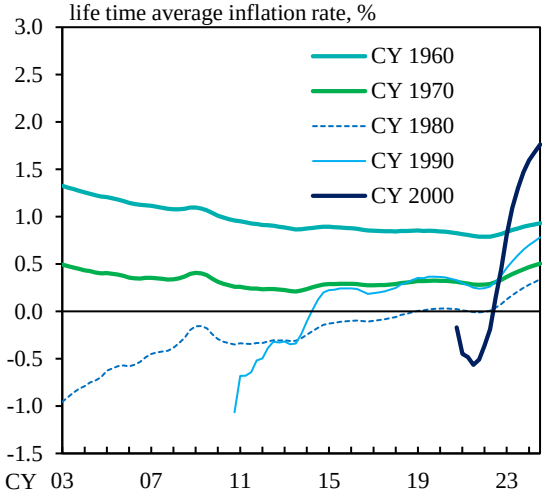
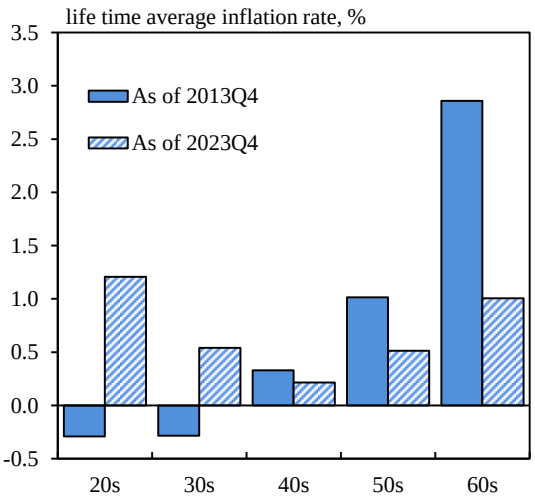


Figure 4: Lifetime average inflation rate: Comparison with 10 years ago



Note: Calculated by the authors using the CPI (all items less imputed rent). The CPI excludes the effects of consumption tax hikes, etc.
Source: Ministry of Internal Affairs and Communications.

4.1.2. Estimation equation

In this section, we examine the impact of past experience on medium- to long-term inflation expectations, utilizing the lifetime average inflation rates quantified in Section 4.1.1. Drawing upon prior research, including Takahashi and Tamanyu (2022) and Kikuchi and Nakazono (2023), we estimate the following equation:

$$\pi^{e}_{i(t)} = \alpha + \beta_1 \pi^{perceived}_{i(t)} + \beta_2 \pi^{experienced}_{i(t)} + \gamma X_{i(t)} + \epsilon_{i(t)} \quad (1)$$

where $\pi^{e}_{i(t)}$, $\pi^{perceived}_{i(t)}$, and $\pi^{experienced}_{i(t)}$ represent, respectively, household i's long-term inflation expectations, perceived inflation, and lifetime average inflation rates (hereafter past experience) at time t. $X_{i(t)}$ denotes the control variables, which include the respondent's demographic attributes such as gender, income level, family composition, and age, as well as time and regional dummy variables. α is the constant term, and $\epsilon_{i(t)}$ is the error term.

4.1.3. Estimation results

Table 2 presents the estimation results based on Equation (1). The first column shows the

estimation without control variables and time/regional dummies, the second column includes control variables, and the third column includes both control variables and time/regional dummies.

Table 2: Estimation results: The effect of past experience

Dependent variable: long-term inflation expectations (5-year)			
	(1)	(2)	(3)
Perceived inflation (β_1)	0.359 ***	0.344 ***	0.343 ***
	(0.006)	(0.006)	(0.006)
Past experience (β_2)	-0.072 ***	0.325 ***	0.357 ***
	(0.013)	(0.032)	(0.044)
Constant (α)	4.272 ***	2.518 ***	3.518 ***
	(0.174)	(0.148)	(0.230)
Time-region fixed effects	No	No	Yes
Control variables	No	Yes	Yes
Adj. R-squared	0.181	0.183	0.189
Observations	138,962	132,493	132,493

Note: *** indicates significance at the 1% level. Numbers in parentheses are robust standard errors.

Comparing the results between the first and second columns, we observe that the coefficient on past experience varies significantly with the inclusion of control variables. This suggests that excluding control variables may lead to a biased estimate, as household demographic characteristics, such as age and past experience, are strongly correlated and are likely absorbed in the error term. When comparing the second and third columns, the increase in the adjusted R-squared indicates that the inclusion of time and regional dummies improves the model fit. Therefore, the following discussion will focus on the results from the third column, which includes both fixed effects and control variables.

Looking at the results from the third column, we observe that the parameter related to past experience (β_2) is positive and statistically significant, indicating a positive correlation between past experience and inflation expectations. Specifically, when past experience increases by 1 percentage point, household inflation expectations increase by 0.357 percentage points.[12] This suggests that the prolonged period of deflation and low inflation in Japan since the late 1990s may have reduced the inflation rates experienced by each generation, which, in turn, contributed to the stagnation of inflation expectations. Furthermore, the recent increase in experienced inflation rates, particularly among younger

[12] As mentioned earlier, it should be noted that the dispersion of response values for inflation expectations is relatively large compared to the CPI.

generations, may sustain higher levels of inflation expectations for this groups in the future.

4.2. Inflation regime and inflation expectations

In this section, we examine whether changes in the relationship between medium- to long-term inflation expectations and perceived inflation are influenced by the inflation regime – inflation trend at each point in time. First, we identify the inflation regime using statistical methods. Then, based on the identified regimes, we create dummy variables and incorporate them into the estimation equation to assess the impact of the inflation regime.

4.2.1. Identification of inflation regimes using statistical methods

To identify Japan's inflation regime at each point in time, we use a single-variable Markov switching (MS) model, wherein the year-on-year rate of change in the CPI serves as an endogenous variable.[13] The MS model assumes that the relationships between variables can change in response to factors such as business cycles and policy changes. Therefore, in the MS model, there can exist multiple states (regimes) of the economy. These states are determined by latent variables. In this analysis, we estimate a two-state AR(4) model, following the methodology of Arndt and Enders (2024). Specifically, we assume that the regime follows the dynamics outlined below:

$$P = \begin{pmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{pmatrix}, \qquad where \;\; p_{ij} = \Pr(\, s_{t+1} = j \mid s_t = i \,) \tag{3}$$

where s_t represents the state at time t, with $s_t \in \{1,2\}$, and P is the transition matrix between states, with p_{ij} denoting the probability of transitioning from state i at time t to state j at time t+1. Based on this, the year-on-year change in CPI ($\triangle CPI_t$) is assumed to follow the dynamics below:

$$\triangle CPI_t = \begin{cases} \nu_1 + a_{11} \triangle CPI_{t-1} + \cdots + a_{14} \triangle CPI_{t-4} + e_{1t}, & if \;\; s_t = 1 \\ \nu_2 + a_{21} \triangle CPI_{t-1} + \cdots + a_{24} \triangle CPI_{t-4} + e_{2t}, & if \;\; s_t = 2 \end{cases} \tag{4}$$

where $a_{s_t1}, \ldots, a_{s_t4}$ are the autoregressive parameters, ν_{s_t} is the constant term, and $e_{s_t t} \sim N(0, \sigma^2_{s_t})$ is the error term. As evident from the equations, the model allows for changes in the autoregressive parameters, the constant term, and the error term variance depending on the regime. The parameters and regime probabilities for each period are estimated using Bayesian inference methods.[14]

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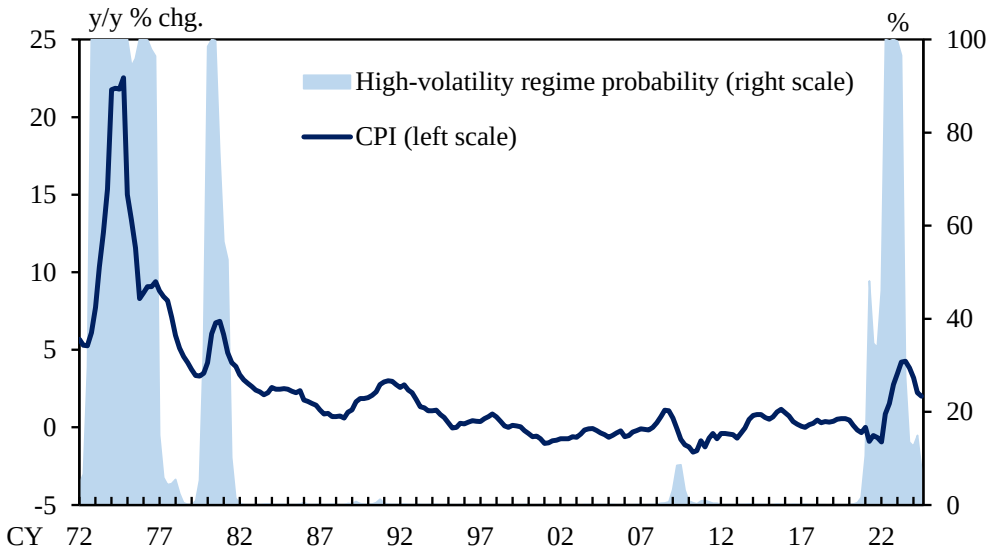
[13] For an explanation of Markov switching models, see, for example, Okimoto (2014).

[14] For an overview of the algorithm used for estimation, see the appendix.

Table 3: Estimation results of the Markov switching model

	AR(1)	AR(2)	AR(3)	AR(4)	Constant	Variance of the error term
Regime 1 (High-volatility regime)	1.15	-0.05	-0.06	-0.07	-0.17	4.38
Regime2 (Low-volatility regime)	0.97	-0.02	-0.01	-0.01	0.01	0.07

Figure 5: Estimated inflation regimes



Note: The CPI figures are all items less fresh food and energy, excluding the effects of consumption tax hikes, etc.
Source: Ministry of Internal Affairs and Communications.

Table 3 presents the estimation results of the MS model. Among the estimated parameters for each state, a significant difference is observed in the variance of the error terms. This difference suggests that the two estimated regimes represent "periods with large and unstable fluctuations in inflation" and "periods with small and stable fluctuations in inflation," respectively. Therefore, a period in which the probability of the economy being in state 1 exceeds 50% is classified as a "high-volatility regime."

Figure 5 shows the time series of state probabilities derived from the MS model estimation results. It is evident from the figure that Japan experienced a prolonged low-volatility regime following the two oil shocks during the 1970s and 1980s. More recently, in the second quarter of 2022, a shift to a high-volatility regime occurred, driven by a global rise in energy and food prices, marking the first transition to a high-volatility regime in about 40 years.

4.2.2. Estimation equation

In this section, we create a dummy variable for the inflation regime based on the inflation regime identified in the previous section. Using the following equation, we examine how changes in the inflation regime affect the relationship between long-term inflation expectations and perceived inflation rates:

$$\pi^{e}_{i(t)} = \alpha + \beta_1 \pi^{perceived}_{i(t)} + \beta_2 regime_t + \beta_3 \left(\pi^{perceived}_{i(t)} \times regime_t\right) + \gamma X_{i(t)} + \epsilon_{i(t)} \quad (5)$$

where, $regime_t$ is a dummy variable that is equal to one during a period identified as a high-volatility regime in the previous section, and zero during other periods (henceforth referred to as the high-volatility regime dummy). By examining the significance of the coefficient β_3 for the interaction term between perceived inflation rates and the high-volatility regime dummy, we test the impact of the inflation regime on the formation of inflation expectations.

4.2.3. Estimation results

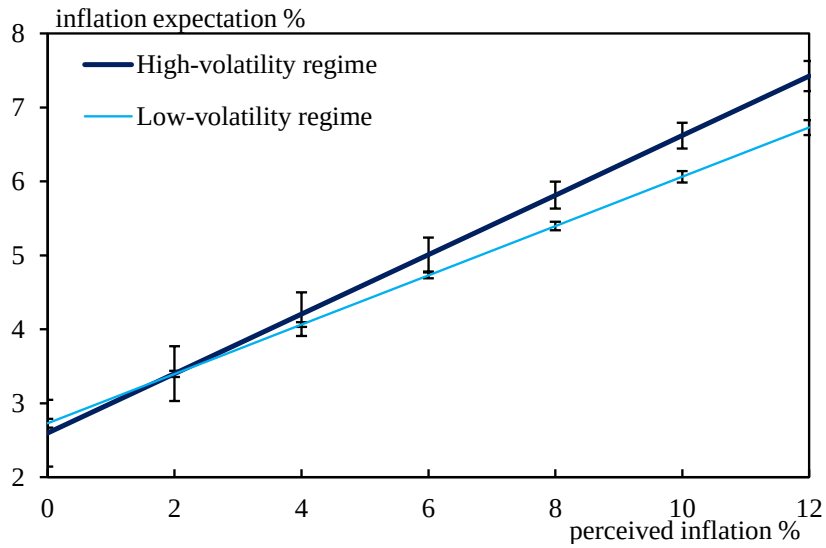
Table 4 presents the estimation results based on Equation (5). Similar to Section 4.1., the table presents three results obtained through different specifications in terms of control variables and fixed effects. Focusing on the coefficient (β_3) for the interaction term between the high-volatility regime dummy and perceived inflation, it is positive and significant in all equations. This result suggests that during periods of high price volatility, households are more likely to incorporate increases in inflation perception into their inflation expectations.

Table 4: Estimation results: The effect of inflation regimes

Dependent variable: long-term inflation expectations (5-year)			
	(1)	(2)	(3)
Perceived inflation (β_1)	0.345 ***	0.330 ***	0.333 ***
	(0.006)	(0.006)	(0.006)
High-volatility regime dummy	-0.257	-0.090	-2.53 ***
(β_2)	(0.223)	(0.221)	(0.364)
High-volatility regime dummy	0.073 ***	0.068 ***	0.078 ***
× perceived inflation (β_3)	(0.023)	(0.023)	(0.023)
Constant (α)	2.680 ***	2.545 ***	3.875 ***
	(0.027)	(0.149)	(0.227)
Time-region fixed effects	No	No	Yes
Control variables	No	Yes	Yes
Adj. R-squared	0.174	0.183	0.189
Observations	138,962	132,493	132,493

Note: *** indicates significance at the 1% level. Numbers in parentheses are robust standard errors.

Figure 6: Effect of perceived inflation on expectations by inflation regime



Note: The figures show marginal effects of perceived inflation on long-term inflation expectations, calculated based on Table 4(3). Error ranges represent 95% confidence intervals.

Figure 6 illustrates the difference in the elasticity of inflation expectations with respect to inflation experience – i.e., the extent to which inflation expectations change in response to changes in inflation experience – between low-volatility and high-volatility regimes. The figure is based on the result of Table 4 (3), which includes control variables and fixed effects. For instance, the figure shows that when perceived inflation is 10% (the median response in the September 2024 survey), the impact on inflation expectations in the low-volatility regime is about 6%, whereas is about 7% in the high-volatility regime. That is, shifts of the regimes may influence inflation expectations. This result suggests that, when households experience large fluctuations in prices, they are more likely to regard it as an important signal of a rise of inflation in the medium- to long-run and finally incorporate it into their expectations formation.

4.3. Relative importance of inflation regime, perceived inflation, and past experience

In the previous section, we confirmed that differences in inflation regimes can lead to variations in how current inflation information is reflected in long-term inflation expectations. In this section, we extend the analysis from the previous section and attempt a quantitative examination of how the relative importance between current inflation information (perceived inflation) and past experience, which was also found to be important for expectation formation in Section 4.1, changes across different inflation regimes.

4.3.1. Estimation equation

For the analysis, we use the following equation:

$$\pi^{e}_{i(t)} = \alpha + \beta_1 \pi^{perceived}_{i(t)} + \beta_2 \pi^{experienced}_{i(t)} + \beta_3 regime_t + \beta_4 (\pi^{perceived}_{i(t)} \times regime_t) + \beta_5 (\pi^{experienced}_{i(t)} \times regime_t) + \gamma X_{i(t)} + \epsilon_{i(t)} \quad (6)$$

Equation (6) is an extension of Equation (1), which incorporates the high-volatility regime dummy and the interaction terms between perceived inflation and past inflation experience. By examining the sign and significance of the two interaction terms (β_4 and β_5), we aim to determine whether the relative importance of perceived inflation and past experience in shaping inflation expectations varies across different inflation regimes.

4.3.2. Estimation results

Table 5 presents the estimation results based on Equation (6). Examining the interaction term (β_4) between perceived inflation and the high-volatility regime dummy, it is positive and significant, consistent with the results obtained in Section 4.2. In contrast, it can be confirmed that the interaction term (β_5) between past experience and the high-volatility regime dummy is negative and significant.

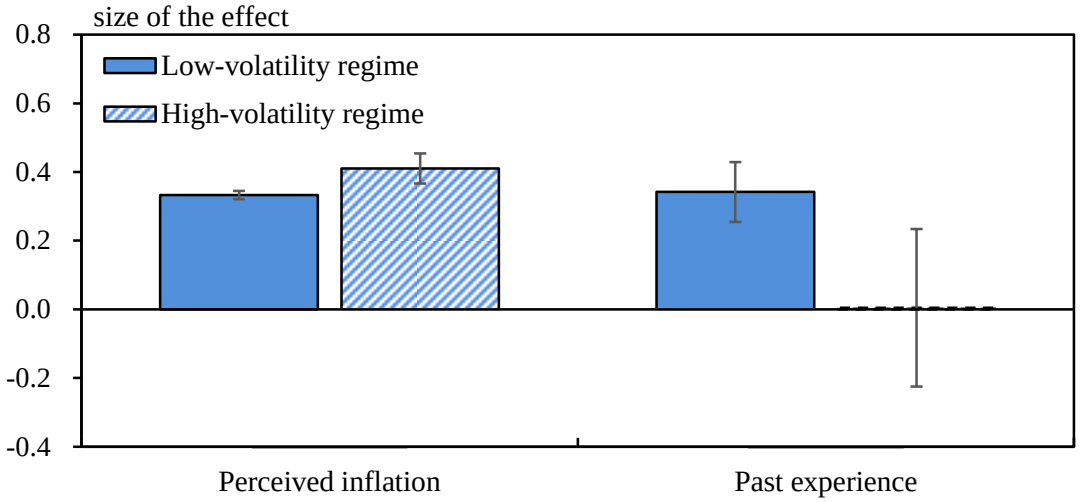
Table 5: Estimation results: Interaction between inflation regimes and perceived inflation/ past experience

Dependent variable: long-term inflation expectations (5-year)			
	(1)	(2)	(3)
Perceived inflation (β_1)	0.344 ***	0.332 ***	0.333 ***
	(0.006)	(0.006)	(0.006)
Past experience (β_2)	-0.014	0.374 ***	0.342 ***
	(0.012)	(0.032)	(0.044)
High-volatility regime dummy (β_3)	0.301	0.438 **	-1.777 ***
	(0.219)	(0.243)	(0.381)
High-volatility regime dummy × perceived inflation (β_4)	0.072 ***	0.065 ***	0.077 ***
	(0.023)	(0.023)	(0.023)
High-volatility regime dummy × past experience (β_5)	-0.588 ***	-0.354 ***	-0.337 ***
	(0.103)	(0.106)	(0.106)
Constant (α)	2.698 ***	2.485 ***	3.562 ***
	(0.032)	(0.149)	(0.230)
Time-region fixed effects	No	No	Yes
Control variables	No	Yes	Yes
Adj. R-squared	0.175	0.184	0.190
Observations	138,962	132,493	132,493

Note: *** and ** indicate significance at the 1% and 5% levels, respectively. Numbers in parentheses are robust standard errors.

Figure 7 illustrates the elasticity of inflation expectations with respect to both perceived inflation and past experience, based on the estimation results (3) from Table 5, which include

Figure 7: Estimation results: Interaction between inflation regimes and perceived inflation/past experience



Note: The figures indicate the impact on inflation expectations resulting from a one percentage point increase in perceived inflation and past experience, as estimated from Table 5(3). Error ranges represent 95% confidence intervals.

control variables and fixed effects. This implies that the impact of changes in inflation experience on inflation expectations increases slightly when transitioning to a high-volatility regime (low-volatility regime: 0.33, high-volatility regime: 0.41). This result is consistent with the findings in Section 4.2. In contrast, regarding the elasticity of past experience, it is clearly positive and significant in a low-volatility regime, but in a high-volatility regime, it is close to zero and insignificant (low-volatility regime: 0.34, high-volatility regime: 0.01).

This result suggests that the mechanism of household expectation formation can vary significantly depending on the price trend at each point in time. During periods of low and stable price fluctuations, for instance, households tend to form their inflation expectations focusing not on the inflation trend at the time, but on their own inflation experience accumulated over their lifetime. In contrast, during periods of high price volatility, households pay more attention to price developments at the time. As a result, their inflation expectations are more strongly influenced by perceived inflation at the time. This can be considered consistent with the rational inattention hypothesis, which argues that during stable inflation periods, agents regard price-related information as relatively unimportant and become inattentive to actual price developments at the time, as a result of their rational judgement.

5. Robustness analysis

In this section, we verify the robustness of the estimation results obtained in Section 4 (hereafter referred to as the baseline estimations). Specifically, we examine the impact on the results when: (1) the threshold for outlier treatment is modified, and (2) the method for calculating the past experience indicator is changed.

5.1. Change in the threshold for outlier treatment

In the baseline estimations, observations with inflation expectations or inflation experience above the top 0.5% or below the bottom 0.5% are excluded for each survey round. However, as shown in Table 1, even after this treatment, relatively large values are still included for both inflation experience and expectations (for example, the maximum value of inflation experience is 150 even after outlier treatment). Therefore, in this section, we examine the impact on the results when a larger proportion of the sample is excluded as outliers.

Table 6: Estimation results: Outlier treatment modification

Dependent variable: long-term inflation expectations (5-year)			
	Eq.(1)	Eq.(5)	Eq.(6)
Perceived inflation (β_1)	0.270 ***	0.265 ***	0.266 ***
	(0.003)	(0.003)	(0.003)
Past experience (β_2)	0.208 ***	-	0.200 ***
	(0.030)		(0.030)
High-volatility regime dummy (β_3)	-	-0.743 ***	-0.273
		(0.226)	(0.242)
High-volatility regime dummy × perceived inflation (β_4)	-	0.036 ***	0.036 ***
		(0.012)	(0.012)
High-volatility regime dummy × past experience (β_5)	-	-	-0.239 ***
			(0.075)
Constant (α)	3.234 ***	3.432 ***	3.250 ***
	(0.160)	(0.158)	(0.160)
Time-region fixed effects	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Adj. R-squared	0.190	0.190	0.191
Observations	118,292	118,292	118,292

Note: *** indicates significance at the 1% level. Numbers in parentheses are robust standard errors.

Table 6 summarizes the estimation results when observations above the top 5% and below the bottom 5% are excluded.[15] Due to the change in the outlier treatment method, the number of observations decreases from about 140,000 in the baseline estimations to about 120,000. We present the estimation results with fixed effects and control variables

[15] As a result of this modification, the range of perceived inflation has been reduced to -10% to 50%, while the range of long-term inflation expectations has been reduced to -5% to 30%.

corresponding to Equations (1), (5), and (6) from the previous section. These results confirm that the key implications of the estimations remain unchanged.

5.2. Change in the calculation method for past inflation experience

Next, this section examines the impact on the estimation results when we modify the calculation method for past inflation experience. In Section 4, we defined and used "lifetime average inflation rates" as the simple average of the inflation rates experienced by each household since the age of 20 in the estimations. This approach assumes that both distant and recent inflation experience have an equal influence on expectation formation. However, this assumption is not necessarily valid. For instance, memories of past experience may fade over time, diminishing their influence on current expectations. On the other hand, it is also possible that inflation rates experienced at a younger age – when individuals have not yet accumulated much experience – has a disproportionate influence on expectations formation.

To address these potential issues, we create past experience indicators based on multiple methods and examine how the estimation results change. Specifically, drawing on equations used by Malmendier and Nagel (2011) and Conrad, Enders and Glas (2022), we calculate a variable representing past inflation experience ($\pi(\lambda)_{i(t)}^{experienced}$) as follows:

$$\pi(\lambda)_{i(t)}^{experienced} = \frac{\sum_{k=1}^{age_{i(t)}-1} w_{i(t)}(k,\lambda) * \pi_{t-k}}{\sum_{k=1}^{age_{i(t)}-1} w_{i(t)}(k,\lambda)}, \quad where \;\; w_{i(t)}(k,\lambda) = \left(\frac{age_{i(t)} - k}{age_{i(t)}}\right)^{\lambda} \quad (7)$$

where $age_{i(t)}$ represents the elapsed period since household *i*'s adulthood at time *t*, and π_t is the inflation rate at time *t*.[16] The function $w_{i(t)}(k,\lambda)$ defines the weight of the inflation rates experienced by the household in each period, where the value of λ determines the relative importance of experiences from different periods.

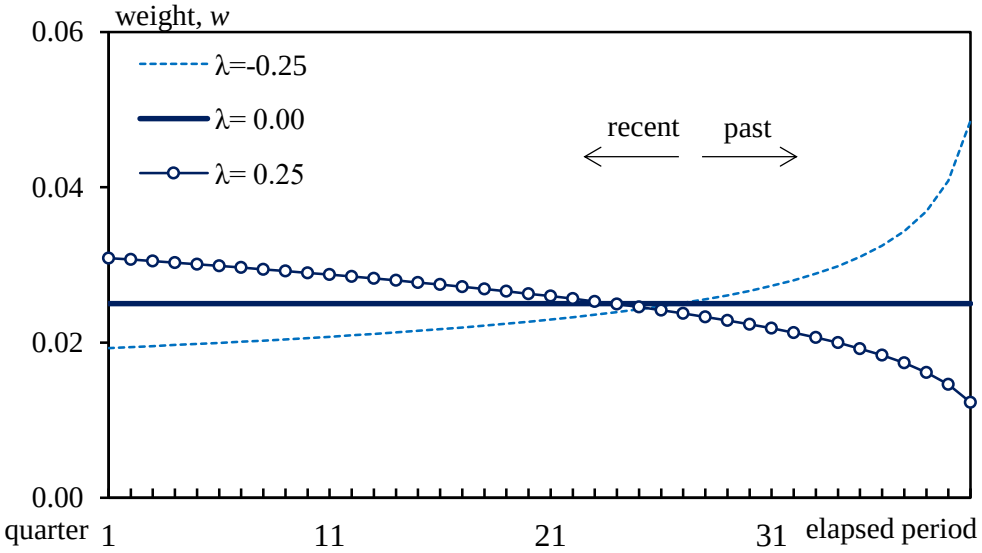
Figure 8 illustrates the weights assigned to inflation rates in each period when changing the value of λ as per equation (7). When $\lambda > 0$, the weight on the most recent inflation rate increases, whereas when $\lambda < 0$, the weight on inflation rates experienced during earlier years of an individual's lifetime becomes higher. When $\lambda = 0$, all periods have equal weight, resulting in the same outcome as using the simple average.

Table 7 summarizes the estimation results using past experience indicators constructed with the three distinct weights depicted in Figure 8. Figure 9 illustrates the elasticity of inflation expectations with respect to both perceived inflation and past experience, calculated

[16] For example, a household aged 30 in period t would have $age_{i(t)} = (30 - 20) \times 4 = 40$.

using the coefficients from each case presented in Table 7. Across all cases, albeit with variations in magnitude, the results indicate that, past experience exerts a corresponding influence on inflation expectations in the low-volatility regime. In contrast, in the high-volatility regime, inflation expectations are more strongly influenced by perceived inflation at each point in time than by past experience. These results are consistent with the baseline estimation (λ=0).[17]

Figure 8: Weights variation with λ (for household aged 30)



Note: This figure illustrates the weights associated with inflation rates in each period when varying the value of λ in Equation (7).

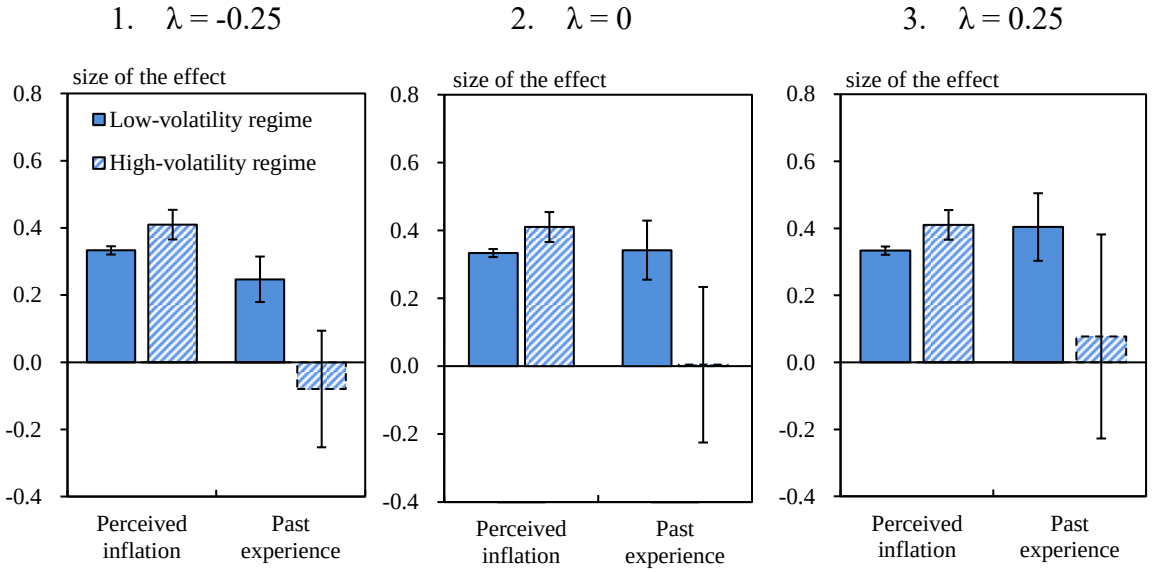
[17] Gennaioli et al. (2024) point out the importance of "selective memory" mechanisms when considering the relationship between past experiences and inflation expectations. Selective memory is a model that assumes meaningful experiences from the past are selected and recalled, including the "recency effect" where recent experiences are more easily remembered, and the "primary effect" where experiences from personality formation periods are reinforced by being repeatedly recalled. If these effects work strongly, the weights of past experiences may not be a monotonic increasing or decreasing function, but could take a U-shape, with higher weights for both recent periods and early adulthood.

Table 7: Estimation results: Changes in the calculation method of past experience

Dependent variable: long-term inflation expectations (5-year)			
	λ = -0.25	λ = 0	λ = 0.25
Perceived inflation (β_1)	0.333 ***	0.333 ***	0.333 ***
	(0.006)	(0.006)	(0.006)
Past experience (β_2)	0.247 ***	0.342 ***	0.404 ***
	(0.035)	(0.044)	(0.051)
High-volatility regime dummy	-1.771 ***	-1.777 ***	-1.858 ***
(β_3)	(0.379)	(0.381)	(0.384)
High-volatility regime dummy	0.077 ***	0.077 ***	0.077 ***
× perceived inflation (β_4)	(0.023)	(0.023)	(0.023)
High-volatility regime dummy	-0.326 ***	-0.337 ***	-0.326 **
× past experience (β_5)	(0.082)	(0.106)	(0.141)
Constant (α)	3.624 ***	3.562 ***	3.540 ***
	(0.229)	(0.230)	(0.231)
Time-region fixed effects	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Adj. R-squared	0.190	0.190	0.190
Observations	132,493	132,493	132,493

Note: *** indicates significance at the 1% level. Numbers in parentheses are robust standard errors.

Figure 9: Effect of λ on elasticity of inflation expectations



Note: The figures show the impact on inflation expectations when perceived inflation and past experience increase by 1 percentage point, calculated based on Table 7. Error ranges represent 95% confidence intervals.

6. Conclusion

This paper conducts an empirical analysis by estimating individual households' experienced inflation rates and inflation regime from CPI data and then combines these estimates with microdata from the *Opinion Survey*.

The key findings are as follows: First, inflation experience significantly influences households' medium- to long-term inflation expectations. This result suggests that despite some increase in inflation due in part to the Bank's large-scale monetary easing since 2013, lower experienced inflation rates, especially among younger generations who had spent most of their lives in a deflationary environment, may have contributed to the stagnation of households' inflation expectations in Japan. Second, the relationship between inflation expectations and past inflation experience is not always constant but can vary depending on the inflation regime at each point in time. Specifically, in high-volatility regimes (periods with substantial price fluctuations), the relationship between perceived inflation at the time and inflation expectations strengthens, outweighing the influence of past experience. This indicates a potential non-linear mechanism driving the recent increase in inflation expectations.

This paper adds a new perspective to the concept of "adaptive expectations" that has been emphasized in Japan. The nature of inflation expectations formation may vary significantly, depending on whether they are adaptive to actual inflation trends at each point in time or past inflation experience accumulated over an extended period. Our analysis reveals that such adaptive expectation mechanisms can be time-varying due to factors such as actual inflation trends and agents' attention to prices at the time. From the perspective of policy-making, it is important to consider not only actual inflation rates at the time but also factors influencing expectation formation, such as households' attention to prices and generational differences in inflation experience. Notably, average experienced inflation rates among younger generations, which have likely contributed to the stagnant trend in Japan's inflation expectations so far, are rapidly increasing in response to recent inflation trends. It is essential to monitor how these changes affect the future evolution of inflation expectations.

Meanwhile, it is important to note that our analysis does not account for the role of forward-looking expectation formation. Similar to the observed non-linearity in adaptive expectation formation across different regimes, the impact on expectation formation of central bank inflation targeting and various communication strategies can be state-dependent. These issues will be pivotal areas for future research.

References

Adachi, K., and K. Hiraki (2021), "Recent Developments in Measuring Inflation Expectations: With a Focus on Market-based Inflation Expectations and the Term Structure of Inflation Expectations," Bank of Japan Research Laboratory Series, 21-E-1.

Arioli, R., C. Bates, H. Dieden, I. Duca, R. Friz, C. Gayer, G. Kenny, A. Meyler, and I. Pavlova (2017), "EU Consumers' Quantitative Inflation Perceptions and Expectations: An Evaluation," ECB Occasional Paper Series, 186.

Arndt, S., and Z. Enders (2024), "The Transmission of Supply Shocks in Different Inflation Regimes," Bank of France Working Papers, 938.

Aoki, K., H. Ichiue, and T. Okuda (2019), "Consumers' Price Beliefs, Central Bank Communication, and Inflation Dynamics," Bank of Japan Working Paper Series, 19-E-14.

Bank of Japan (2024), *Results of the Survey regarding Corporate Behavior since the Mid-1990s*, Regional Economic Report Annex.

Bernanke, B. S. (2007), "Inflation Expectations and Inflation Forecasting," Speech at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts.

Bracha, A., and J. Tang (2024), "Inflation Levels and (In)Attention," *The Review of Economic Studies*, rdae063.

Braggion, F., F. von Meyerinck, N. Schaub, and M. Weber (2024), "The Long-Term Effects of Inflation on Inflation Expectations," NBER Working Paper Series, 32160.

Carter, C. K., and R. Kohn (1994), "On Gibbs Sampling for State Space Models," *Biometrika*, 81(3), 541–553.

Cavallo, A., G. Cruces, and R. Perez-Truglia (2017), "Inflation Expectations, Learning, and Supermarket Prices: Evidence from Survey Experiments," *American Economic Journal: Macroeconomics*, 9(3), 1–35.

Coibion, O., Y. Gorodnichenko, and R. Kamdar (2018), "The Formation of Expectations, Inflation, and the Phillips Curve," *Journal of Economic Literature*, 56(4), 1447–1491.

Conrad, C., Z. Enders, and A. Glas (2022), "The Role of Information and Experience for Households' Inflation Expectations," *European Economic Review*, 143, 104015.

D'Acunto, F., E. Charalambakis, D. Georgarakos, G. Kenny, J. Meyer, and M. Weber (2024), "Household Inflation Expectations: An Overview of Recent Insights for Monetary Policy," NBER Working Paper Series, 32488.

D'Acunto, F. and M. Weber (2024), "Why Survey-Based Subjective Expectations Are Meaningful and Important," *Annual Review of Economics*, 16, 329–357.

D'Acunto, F., U. Malmendier, J. Ospina, and M. Weber (2021), "Exposure to Grocery Prices and Inflation Expectations," *Journal of Political Economy*, 129(5), 1615–1639.

D'Acunto, F., U. Malmendier, and M. Weber (2023), "What Do the Data Tell Us about Inflation Expectations?" *Handbook of Economic Expectations*, 133–161.

Del Giovane, P., S. Fabiani, and R. Sabbatini (2009), "What's Behind 'Inflation Perceptions'? A Survey-Based Analysis of Italian Consumers," *Giornale degli Economisti e Annali di Economia*, 68(1), 25–52.

Diamond, J., K. Watanabe, and T. Watanabe (2020), "The Formation of Consumer Inflation Expectations: New Evidence from Japan's Deflation Experience," *International Economic Review*, 61(1), 241–281.

Doh, T., J. H. Lee, and W. Y. Park (2025), "Heterogeneity in Household Inflation Expectations and Monetary Policy," *Journal of Financial Econometrics*, 23(1), nbae034.

Ehrmann, M., D. Pfajfar, and E. Santoro (2017), "Consumers' Attitudes and Their Inflation Expectations," *International Journal of Central Banking*, 47, 225–259.

Evans, G. W., and S. Honkapohja (1999), "Learning Dynamics," *Handbook of Macroeconomics*, 1, 449–542.

Evans, G. W., and S. Honkapohja (2001), *Learning and Expectations in Macroeconomics*, Princeton University press.

Gennaioli, N., M. Leva, R. Schoenle, and A. Shleifer (2024), "How Inflation Expectations De-Anchor: The Role of Selective Memory Cues," NBER Working Paper Series, 32633.

Gwak, B. (2022), "State-dependent Formation of Inflation Expectations," *Macroeconomic Dynamics*, 26(8), 1994–2028.

Hajdini, I., E. S. Knotek II, J. Leer, M. Pedemonte, R. Rich, and R. Schoenle (2022), "Indirect Consumer Inflation Expectations: Theory and Evidence," *Journal of Monetary Economics*, 145, 103568.

Hori, M., and M. Kawagoe (2013), "Inflation Expectations of Japanese Households: Micro Evidence from a Consumer Confidence Survey," *Hitotsubashi Journal of Economics*, 54, 17–38.

Ichiue, H., M. Koga, T. Okuda, and T. Ozaki (2019), "Households' Liquidity Constraint, Optimal Attention Allocation, and Inflation Expectations," Bank of Japan Working Paper Series, 19-E-8.

Johannsen, B. K. (2014), "Inflation Experience and Inflation Expectations: Dispersion and Disagreement within Demographic Groups," Finance and Economics Discussion Series, 2014-89, Board of Governors of the Federal Reserve System.

Kamada, K. (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, 13-E-15.

Kamada, K., J. Nakajima, and S. Nishiguchi (2015), "Are Household Inflation Expectations Anchored in Japan?," Bank of Japan Working Paper Series, 15-E-8.

Kikuchi, J., and Y. Nakazono (2023), "The Formation of Inflation Expectations: Microdata Evidence from Japan," *Journal of Money, Credit and Banking*, 55(6), 1609–1632.

Korenok, O., D. Munro, and J. Chen (2023), "Inflation and Attention Thresholds," *Review of Economics and Statistics*, 1–28.

Maćkowiak, B., and M. Wiederholt (2009), "Optimal Sticky Prices under Rational Inattention," *American Economic Review*, 99(3), 769–803.

Malmendier, U., and S. Nagel (2011), "Depression Babies: Do Macroeconomic Experiences Affect Risk Taking?" *The Quarterly Journal of Economics*, 126(1), 373–416.

Malmendier, U., and S. Nagel (2016), "Learning from Inflation Experiences," *The Quarterly Journal of Economics*, 131(1), 53–87.

Mankiw, N. G., and R. Reis (2002), "Sticky Information versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve," *The Quarterly Journal of Economics*, 117(4), 1295–1328.

Mishkin, F. S. (2007), "Inflation Dynamics," *International Finance*, 10(3), 317–334.

Nakazono, Y., T. Shiohama, and K. Tamaki (2013), "Relationship between Monetary Policy and Inflation Expectations: Comparison among Japan, the United States, and the United Kingdom," *Monetary Policy: Roles, Forecasting and Effects*, Nova Science Publishers,

Inc., 51–84.

Niizeki, T. (2023), "Trust in the Central Bank and Inflation Expectations: Experimental Evidence," *Economics Letters*, 231, 111296.

Nishiguchi, S., J. Nakajima, and K. Imakubo (2014), "Disagreement in households' inflation expectations and its evolution," Bank of Japan Review Series, 2014-E-1.

Okimoto, T. (2014), "Markov-Switching Models with Applications in Macroeconomics and Finance," Journal of the Japan Statistical Society, 44(1), 137-157 (in Japanese).

Okuda, T. (2018), "Noise Information Models and Inflation Dynamics," Financial Research, 37(4), 69-120 (in Japanese).

Pfäuti, O. (2023), "The Inflation Attention Threshold and Inflation Surges," arXiv preprint arXiv:2308.09480.

Pedemonte, M., H. Toma, and E. Verdugo (2023), "Aggregate Implications of Heterogeneous Inflation Expectations: The Role of Individual Experience," FRB of Cleveland Working Paper, 23-04.

Sims, C. A. (2003), "Implications of Rational Inattention," *Journal of Monetary Economics*, 50(3), 665–690.

Takahashi, Y., and Y. Tamanyu (2022), "Households' Perceived Inflation and CPI Inflation: the Case of Japan," Bank of Japan Working Paper Series, 22-E-1.

Ueda, K. (2010), "Determinants of Households' Inflation Expectations in Japan and the United States," *Journal of the Japanese and International Economies*, 24(4), 503–518.

Ueno, Y. (2014), "Updating Behavior of Inflation Expectations: Evidence from Japanese Household Panel Data," CIS Discussion Paper Series, 617, Center for Intergenerational Studies, Institute of Economic Research, Hitotsubashi University.

Watanabe, T. (2022), *What Are Prices?* Kodansha Ltd. (in Japanese).

Watanabe, T. (2024), *Thinking about Prices: The Mystery of Deflation and Inflation*, Nikkei Publishing (in Japanese).

Weber, M., B. Candia, H. Afrouzi, T. Ropele, R. Lluberas, S. Frache, B. Meyer, S. Kumar, Y. Gorodnichenko, D. Georgarakos, O. Coibion, G. Kenny, and J. Ponce (2025), "Tell Me Something I Don't Already Know: Learning in Low- and High-Inflation Settings," *Econometrica*, 93(1), 229–264.

Weber, M., F. D'Acunto, Y. Gorodnichenko, and O. Coibion (2022), "The Subjective Inflation Expectations of Households and Firms: Measurement, Determinants, and Implications," *Journal of Economic Perspectives*, 36(3), 157–184.

Appendix. Details of the Markov regime switching model

This appendix explains the details of the Markov regime switching model. First, we assume that the economy has two states (regimes). Under this assumption, the dynamics of inflation rates in each regime $s_t \in \{1,2\}$ are assumed to be described as follows:

$$\triangle CPI_t = \begin{cases} v_1 + a_{1,1} \triangle CPI_{t-1} + \cdots + a_{1,4} \triangle CPI_{t-4} + e_{1,t}, & if \ \ s_t = 1 \\ v_2 + a_{2,1} \triangle CPI_{t-1} + \cdots + a_{2,4} \triangle CPI_{t-4} + e_{2,t}, & if \ \ s_t = 2 \end{cases} \quad \text{(A1)}$$

where $e_{1,t} \sim N(0, \sigma_1^2)$ and $e_{2,t} \sim N(0, \sigma_2^2)$. Additionally, the regime s_t follows the dynamics:

$$P = \begin{pmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{pmatrix}, \qquad where \ \ p_{i,j} = \Pr(s_{t+1} = j \mid s_t = i) \quad \text{(A2)}$$

P is the transition matric between regimes, and $p_{i,j}$ represents the probability of transitioning from state *i* at time *t* to state *j* at time *t*+1.

For simplicity, we define the coefficient vector $\beta_{s_t} = [a_{s_t,1}, a_{s_t,2}, a_{s_t,3}, a_{s_t,4}, v_{s_t}]$ and the vector representing the regimes for each period $\tilde{s} = [s_1, \ldots, s_t]$. Based on this, the parameters to be estimated can be classified into four blocks: $\beta_{s_t}, \sigma_{s_t}, P, \tilde{s}$.[18] Sampling for each parameter is conducted using on the Gibbs sampler, as follows:

Step 1: Set initial values and prior distributions

First, the initial values for the transition probabilities are set to $p_{11} = 0.95$ and $p_{22} = 0.95$. Subsequently, assuming that the regime at time T is 1, the regimes are estimated backward and the initial values for s are generated. For β_{s_t} and σ_{s_t}, initial values are estimated using OLS on subsamples from each regime.

The prior distributions are specified as $\beta_{s_t} \sim N(0,1)$ and $\sigma_{s_t} \sim IG(5,0.2)$. For the transition probabilities, the prior distributions are $p_{11} \sim Beta(990,10)$ and $p_{22} \sim Beta(990,10)$, ensuring a high probability of remaining in the same regime, consistent with the priors used in standard regime-switching studies.

Step2：Sampling β_{s_t}

Given σ_{s_t}, P, and $\tilde{s}$, sample β_{s_t}.

Step3：Sampling σ_{s_t}

[18] To be precise, $\tilde{s}$ is a latent variable, not a parameter; however, for the purposes of this analysis, it is treated as a parameter, as it is to be estimated from observed data.

Given β_{s_t}, σ_{s_t}, and $\tilde{s}$, sample σ_{s_t}.

Step4：Sampling P

Given β_{s_t}, σ_{s_t}, and $\tilde{s}$, sample P.

Step5：Sampling $\tilde{s}$

Given β_{s_t}, σ_{s_t}, and P, sample $\tilde{s}$ using the multi-move sampler of Carter and Kohn (1994).

Step6：Iteration

We repeat Steps 2 through 5 for 6,000 iterations. The first 1,000 samples are discarded as a burn-in period, and the remaining 5,000 samples are used for estimation.