

Japanese Households' Inflation Attention Thresholds

(Summary)

This study analyzed the rational inattention hypothesis where households' inflation attention become responsive to inflation rates once they exceed a threshold level. Using a threshold model, the following three points were found. First, data derived from the Google Trends analysis of the keyword "inflation" were a successful alternative indicator for households' inflation attention level. A threshold level was found to be +3.0 percent for the U.S. and +1.5 percent for Japan. In Japan, the sampling period needed to include the current inflationary phase, since the economy suffered from a prolonged period of low inflation. In addition, the word "price" in Japanese yielded much more stable threshold level than using "inflation" or "*infure*." (a Japanese word equivalent to "inflation" in the U.S.). Second, threshold levels were calculated for 21 countries. Except for Switzerland and Japan, most developed countries' threshold levels were within the range of +2.5% to +3.5%, which were slightly above the central banks' inflation target (2 percent or 1-3 percent). High correlations were found between the threshold levels and average inflation rates during the sample period, not only among developed countries but also among developing countries with high inflation rates. Third, to check the robustness of the above estimation, threshold levels were estimated by alternative data derived from the share of "don't know" answers contained in household inflation expectations surveys. The resulting threshold levels were consistent with the Google Trends analysis. Lastly, the existence of the threshold levels has implications for monetary policy such as flattening Phillips curve during low inflation periods.

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1. Introduction

The Japanese economy has experienced prolonged periods of low inflation. For example, the consumer price index (CPI), excluding fresh food and the effect of increased consumption tax rates, moved between -2 and +2 percent. This trend suddenly disappeared at the beginning of 2021. The CPI's rate of increase soared to +4.1 percent in January 2023 and remained at a relatively high level of +2.8 percent in August 2024.

Although the recent surge in inflation has caused problems in the Japanese economy, it offers new frontiers for analyzing the economy, such as inflation expectations (IEs). Although IEs play a vital role in the macro economy, their formation processes have not been fully elucidated.

The Infotainment Research Center published two studies on the inflation expectations (IEs) of Japanese households: “Instability of Japanese households inflation expectations during the current inflationary phase” (published in November 2023) and “Japanese households’ inflation perceptions: the formation process and their relationship with the inflation expectation” (published in February 2024). In June 2024, the center published a study on IEs in the corporate sector during the current inflationary phase.

The objective of this report is to study household IEs, focusing on quantitatively analyzing the validity of the rational inattention hypothesis (RIH). RIH is an economic model of inflation expectation formation and argues that “since people’s cognition ability is limited, it is rational to allocate cognitive resources to highly prioritized events and not to low-priority events.” Specifically, RIH implies that households are relatively insensitive to inflation rates below a certain threshold level and become increasingly attentive once they exceed the threshold level.

Few studies have conducted quantitative evaluations of RIH because there are few indicators representing households’ degree of attention to inflation. However, the aforementioned studies used the Google Trends index as a proxy and estimated thresholds using a threshold model. This study follows their approach and applies it to Japanese households using updated data, including data from the current inflationary phase. Following three points were identified.

First, data derived from the Google Trends analysis of the keyword “inflation” were found to be a successful alternative indicator of households’ inflation attention level. The

threshold model indicates that the threshold levels is +3.0 percent for the U.S. and +1.5 percent for Japan. In Japan, extending the sampling period to cover the current inflationary phase was necessary to estimate a robust threshold level because the Japanese economy suffered from a long period of low inflation. In addition, keyword “price” in Japanese yielded much more stable threshold level estimation than using “inflation” or “*infure*.” (a Japanese word equivalent to “inflation” in the U.S.)

Second, threshold levels were calculated for 21 countries. Switzerland (+1.0 percent) has the lowest threshold, followed by Japan (+1.5 percent). However, most developed countries’ threshold levels are within the range of +2.5% to +3.5%, which is slightly above the inflation target of central banks (2 percent or 1-3 percent). In addition, high correlations are found between the threshold levels and average inflation rates during the sample period, both among developed countries and among developing countries with high inflation rates, including Uruguay and Turkey.

Third, to check the robustness of the above estimation, alternative threshold levels were calculated from data using the share of “don’t know” answers contained in the household inflation expectations surveys. The resulting threshold levels were consistent with the Google Trends analysis.

The remainder of the paper is organized as follows. Section 2 estimates the threshold levels for Japan and the U.S. using the Google Trends index as a proxy for household inflation attention. Section 3 estimates the threshold levels for the 21 countries and their relationship with the average inflation rates. Section 4 checks the robustness of the above estimation, using data from the household IE survey. Section 5 discusses the implications of the inflation attention threshold level for monetary policy implementation. Finally, Section 6 presents the conclusions of this study.

2. Estimating threshold level of households’ inflation attention

2.1. Full information rational expectation hypothesis and the reality

IEs play a significant role in household economic activities. For example, they affect the purchasing behavior of consumer goods and services, auto and housing loan rates, and wage negotiations.

IEs are also considered key factors in macroeconomic theory and are often assumed to satisfy full information perfect rationality (FIRE). Under the FIRE, people have full

access to all the information necessary for economic decisions and can make optimal choices based on this information.

However, in reality, households' IEs diverge significantly from professionals' IEs and actual price development. For example, Japanese households' one-year-ahead IEs are +10 percent (median figure), and +5 percent for five-year-ahead IEs². These figures are much higher than the year-on-year increase in the CPI of +2.8 percent in August 2024 or the peak value of +4.1 percent recorded during the current inflationary phase. These relationships indicate that households' IEs do not follow the FIRE, as economic theory assumes.

In addition, if households follow the FIRE, their IEs should converge to the same level, but they diverge significantly, ranging from 0 percent to more than 10 percent. The following three factors are pointed out as reasons why households do not follow FIRE. First, households lack the basic knowledge of and interest in inflation and macroeconomics, which are necessary to formulate reliable IEs. For example, in Japan, only 26 percent of surveyed households knew that the Bank of Japan had set inflation targets at +2 percent. Similarly, only 32 percent answered that they had "interest in" the activity of the Bank of Japan³. Second, households' price perceptions are significantly upward biased against the actual CPI. Their price perceptions are strongly influenced by the prices of frequently purchased goods such as food and gas. Such upwardly biased price perceptions naturally distort household IEs. Third, IEs differ significantly depending on socioeconomic attributes such as gender, income level, academic background, and financial literacy. If households follow the FIRE, then these attributes should not affect their IEs.

Overall, these points indicate that households are relatively inattentive to IEs and do not act according to the FIRE. Taking this point seriously, economists proposed new economic theories, such as the RIH⁴ and the sticky information hypothesis⁵.

As explained in Section 1, under RIH, household attention to inflation changes in a nonlinear or discontinuous manner as inflation rates increase. The following sections

² Data is based on "Opinion Survey" conducted by the Bank of Japan in June 2024.

³ See footnote 2 for the data source.

⁴ Sims (2003) is the one of early studies of RIH. Kitamura and Tanaka (2019) discuss two hypothesis jointly.

⁵ Sticky information hypothesis assumes that due to cost attached to acquiring information, households only obtain price information infrequently. This will cause considerable time lag before price information is reflected in IEs, thus diverging significantly from the FIRE assumption.

check whether RIH holds in Japan and the U.S. and, if so, estimate the threshold level for each country.

2.2. Empirical estimation of the RIH

Empirical studies on RIH are limited, particularly those that use quantitative analyses. However, the development of recent inflation rates offers favorable conditions for identifying the validity of RIH. In developed countries, a prolonged low-inflation period emerged after the global financial crisis from 2008 to 2009. Japan and other countries suffered from mild deflation at that time. According to RIH, households pay little attention to price development and fall into rational inattention in such circumstances.

From 2021 to 2022, however, inflation rates began to significantly increase on a global scale owing to both increased demand and shortage in supply caused by Covid 19 and the invasion of Russia into Ukraine. If the RIH holds in such circumstances, households should change their attitude from the inattention phase to the increasing attention phase.

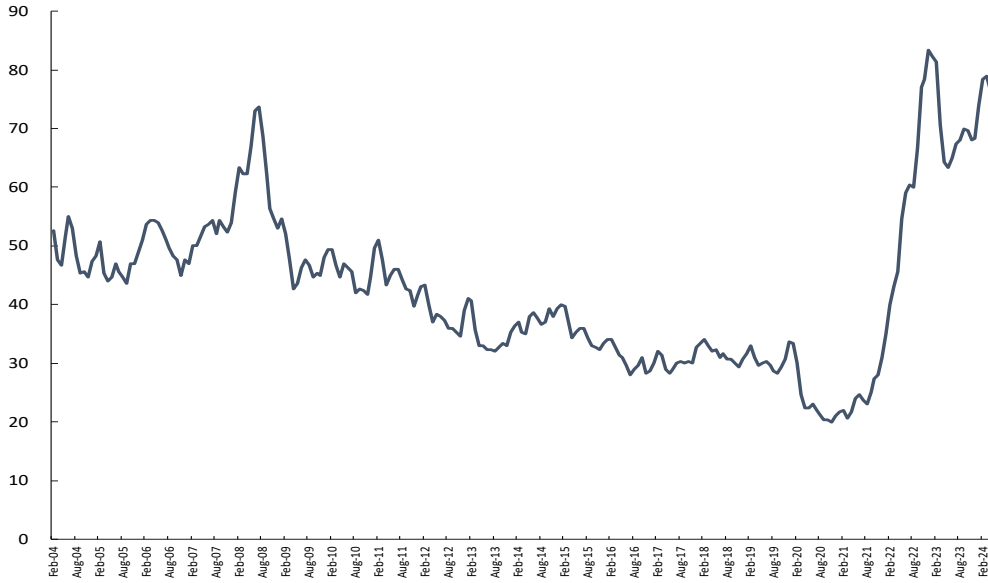
The major problem in empirically analyzing the RIH is quantifying households' attention to inflation. Recent studies suggested using the Google Trends' keyword search of "inflation" as a proxy for inflation attention level⁶. Web searching can be considered an active information-seeking activity compared with passively receiving information by watching TVs or reading newspapers. In addition to inflation attitudes, Google Trends keyword searches have contributed significantly to many research fields such as automobile sales, unemployment, seriousness of Covid 19 infections.

Figure 1 shows the results of Japanese households' inflation attention as indicated by Google Trends. The Google Trends index ranges from 0 to 100, depending on the level of search activity. The sample period is from January 2004 to June 2024, and the peak value is marked in December 2022, coinciding with the highest CPI during the current inflationary phase.

As for the keywords, instead of using "inflation" in Japanese "*infureshon*," or "*infure*" (a shortened version), "price" in Japanese was used due to its superior performance as described in the latter section.

⁶ Korenok et al. (2022), Buelens (2023).

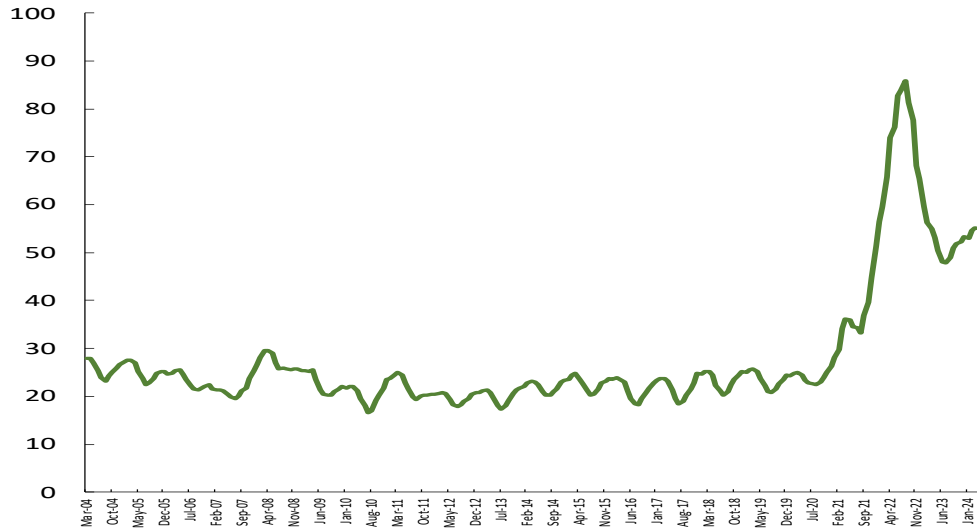
(Figure 1) The Google Trends search result of “price” in Japan



(Source) Google Trends, From January 2004 to June 2024, 3month moving average.

Figure 2 is the search result of the word “inflation” in the U.S. The contrast between the low-inflation era and the current high-inflation phase is more striking than in Japan, as indicated in Figure 1, although regular fluctuations during the low-inflation period imply seasonal patterns.

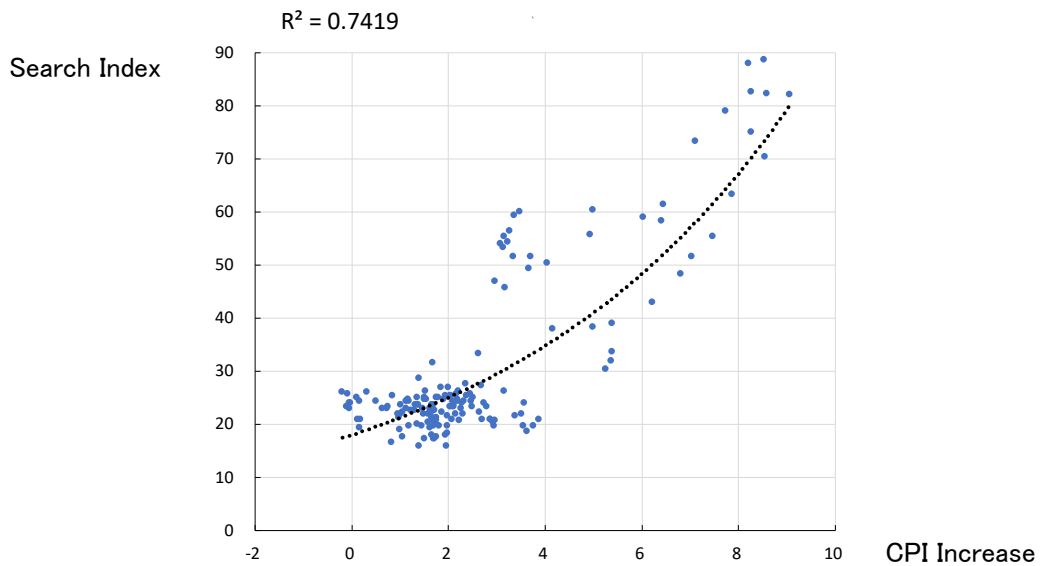
(Figure 2) The Google Trends search result of “inflation” in the U.S.



(Source) Google Trends, From January 2004 to June 2024, 5month moving average.

Figure 3 shows the U.S. relationship between the Google Trends index on the vertical axis and the year-on-year increase in the CPI on the horizontal axis.

(Figure 3) non-linearity of the relationship between the Google Trends search and the CPI in the U.S.



(Source) Google Trends and Bureau of Labor Statistics. From January 2004 to June 2024. Search Index is 3 month moving average.

In Figure 3, a considerable number of dots are concentrated on the bottom-left side because the increasing rate of the CPI remained at 0 to 3 percent in the low inflation era. However, during the current inflationary phase, the dots moved toward the right upper-side area. The relationship between these two variables was nonlinear, as indicated by a well-fitted exponential function⁷. This pattern indicates that households' attention to inflation increases nonlinearly as the inflation rate increases. This observation is consistent with the RIH, which assumes that households move out of inflation inattention as inflation rates increase.

2.3. Estimating Thresholds level

This section empirically analyses the validity of RIH according to the estimation method described by Korenok et al. (2022) (Korenok). It uses a threshold model to statically verify that inflation attention (Google Trends search index) increases nonlinearly as the inflation rate increases. Specifically, (1) when the inflation rate is low, households are inattentive to inflation and remain low responsive to an increase in the inflation rate; (2) once inflation rates exceed a certain inflation level, which is called the threshold level, households' inflation attention starts to increase as inflation rises. The threshold model presented below can quantitatively estimate the threshold level:

$$y_t = \alpha + \beta_1 x_t (x_t < \gamma) + \beta_2 x_t (x_t > \gamma) + e_t$$

where y_t denotes search index at t period ranging from 0 to 100, x_t represents year-on-year increase rate of CPI, $(x_t < \gamma)$ is a dummy variable which takes 1 when CPI increasing rate is less than the threshold level γ and 0 otherwise, $(x_t > \gamma)$ is another dummy variable which takes 1 when CPI increasing rate is larger than the threshold level γ and 0 otherwise. β_1 and β_2 are the coefficient of each dummy variable. Korenok requires (1) a null hypothesis of $\beta_1 = 0$ should not be rejected, (2) a null hypothesis of $\beta_2 = 0$ should be rejected and take a positive value.

As regards γ , the Korenok estimate optimal value by minimizing RMSE. This study instead searches optimal γ by inserting CPI by 0.5 percent point interval to maximize R^2 .

Table 1 shows the estimation results for the threshold level for U.S. households.

⁷ R^2 of exponential function was 0.7419, which were higher than R^2 of 0.6985 when using OLS.

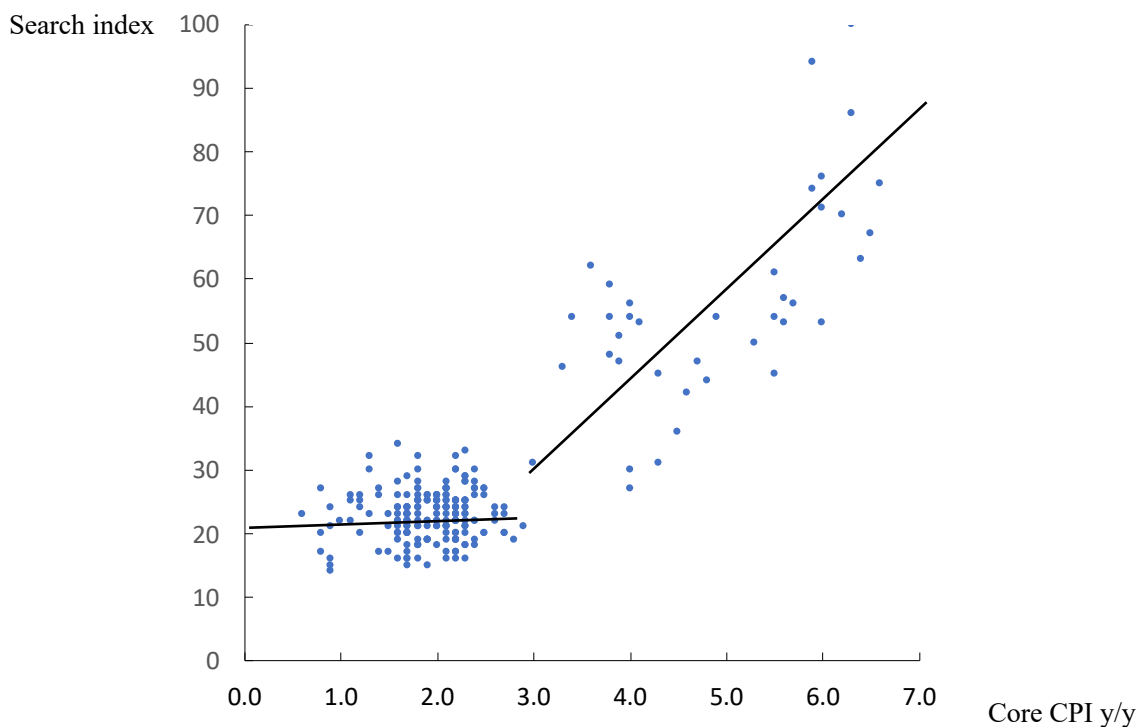
(Table 1) Inflation attention threshold level for U.S. households

Threshold level	1.5%	2.0%	2.5%	<u>3.0%</u>	3.5%	4.0%	4.5%
R ²	0.51	0.54	0.70	<u>0.80</u>	0.78	0.70	0.69

(Source) Author's calculation

Table 1 shows that the threshold level for U.S. households is +3.0%, using the core CPI as an inflation indicator. Coefficients for +3.0 percent threshold level are $\beta_1=5.952$ (t value = 28.104), $\beta_2=0.454$ (t value = 1.385). Figure 5 plots both variables with the estimation results of the threshold model at +3.0 percent threshold. When the core CPI is under 3 percent, the trend line is nearly flat, whereas when the CPI exceeds 3 percent, the trend line shows a clear upward slope. As the RIH suggests, the threshold level divides the low-attention phase from the increasing-attention phase.

(Figure 5) Estimated threshold level for the U.S. households



(Source) Author's calculation

Korenok estimated the U.S. households' threshold value as + 3.55 percent, which is 0.55 percent point higher than our estimates. This difference can be attributed to two factors. First, Korenok used the headline CPI as inflation rates, whereas this study employed the core CPI. Second, the sample period for the Korenok ended in May 2022, whereas this study extends it to June 2024.

The same estimation method was applied to Japanese household data. At first, we estimated the threshold value using keyword of “inflation” in Japanese and “*infure*,” an abbreviated word for the “inflation.” The sample period is the same as that for the U.S., from January 2004 to June 2024. The CPI excludes fresh food and is adjusted for consumption tax rate increases.

(Table 2) Inflation attention threshold level for Japanese households (Case 1)

Threshold level	0.5%	1.0%	<u>1.5%</u>	2.0%	2.5%	3.0%
R ² for “ <i>infure</i> ”	0.322	0.348	<u>0.395</u>	0.350	0.255	0.247
R ² for “inflation”	0.336	0.323	0.298	0.305	0.296	0.326

(Source) Author's calculation

Threshold level for “*infure*” was +1.5%. In case of “inflation,” in Japanese, the threshold level was indetermined, since multiple peak R² emerged at +0.5 percent, +2.0 percent and +3.0 percent. This could be related to the fact that the word “*infure*” is more often used than the “inflation.”

As a next step, threshold level was re-estimated using more neutral keyword “price.” Although it differs in meaning compared to “inflation,” the motivation behind the re-estimation was that the Japanese households experienced a prolonged low inflation or even mild deflation during the significant portion of the sample period so that they might have searched for more neutral words such as “price” rather than “inflation.”

(Table 3) Inflation attention threshold level for Japanese households (Case 2)

	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
R ² for “ <i>infure</i> ”	0.322	0.348	<u>0.395</u>	0.350	0.255	0.247
R ² for “inflation”	0.336	0.323	0.298	0.305	0.296	0.326
R ² for “price”	0.393	0.464	<u>0.515</u>	0.466	0.494	0.327

(Source) Author’s calculation

Table 3 above showed that the threshold level for “price” was +1.5 percent, same as the result for “*infure*.” Compared to “*infure*,” R² jumped up from 0.395 to 0.515. Judging from the estimation results, Japanese households’ inflation attention threshold level is estimated at approximately +1.5 percent.

The +1.5 percent threshold level is lower than the +2 percent inflation target set by the Bank of Japan. Such a low threshold level could have been affected by a prolonged low inflation period. The next section discusses the relationship between the threshold level and the average inflation rate in more detail.

Figure 6 indicated the dot diagram showing estimation result of the threshold model based on the keyword “price” in Japanese. Compared to the U.S. estimate, R² is lower, the dots are more dispersed, and the trend line has a slightly negative slope in the low-attention area. Therefore, although the Japanese estimation result satisfied Korenok’s condition, it was less textbook-like. The estimated equation for Figure 6 is as follows:

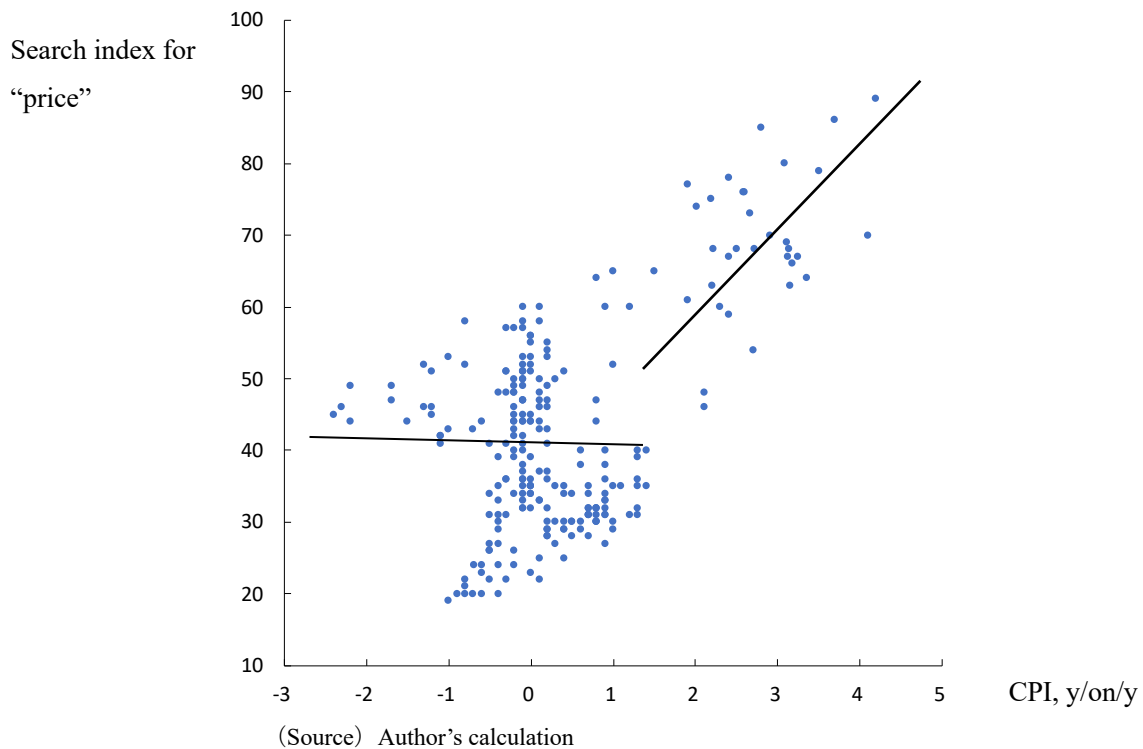
$$y_t = 33.01 - 1.81x_t (x_t < 1.5) + 10.79x_t (x_t > 1.5) + e_t$$

(-1.80)

(15.93)

() indicates t value.

(Figure 6) Estimated threshold level for the Japanese households



Korenok estimated the threshold levels for 37 developed and developing countries. The average value of the threshold level for the 37 countries was + 2.09, much lower than that of the U.S. In addition, the study divides the estimation results of 37 countries into the following three categories: (1) consistent with the U.S., (2) intermediate, and (3) inconsistent with the U.S.

Japan was categorized in “inconsistent with the U.S.” and their estimated threshold level for Japan was 0.27, very low value compared to other countries. Switzerland also has a low threshold value of 0.36. Nonlinearities were not observed in either country. The study inferred from the above results that both countries’ relatively low peak inflation rates indicate that they never entered the high-attention mode during the sample period.

To show that this inference was correct, the Japanese threshold model was re-estimated using a shortened sample period of January 2004 to December 2021 (Table 4). The results showed that although the peak R^2 was marked at +1.5 percent, the R^2 was quite low and the estimation results were unreliable.

(Table 4) Inflation attention threshold level for Japanese households (Case 3)

Thresholds	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
R ² for “price” Sample period Jan.2004- Dec.2021	0.030	0.108	0.188	0.091	0.008	0.008

(Source) Author’s calculation

3. The relationship between the threshold level and the average inflation rates

The last section reveals that the inflation attention threshold levels differ among countries, such as +3.5 percent for the U.S. and +1.5 percent for Japan. This section estimates the threshold levels of the 21 countries using the method described in the previous section (Table 5). Countries with undermined threshold levels were omitted from the table. The sample period was from January 2004 to May or June 2024, depending on the data availability. The keywords used for estimation were “inflation” translated to each country’s official language. In some countries, the Google Trends index shows unnatural responses such as a continuing zero value. In such case, “inflation” in English was alternatively used.

The estimation results indicate that Switzerland has the lowest threshold level (+1.0 %), followed by Japan (+1.5%). Most of the other developed countries’ threshold levels lie within the range of +2.5% to +3.5%, which is slightly above the inflation target range of 2% or 1-3%, set by their central banks. The threshold level for developing countries such as Uruguay, Argentina, and Turkey exceeded 5%, while the latter two countries showed double-digit figures. These three countries also have high inflation rates.

The Korenok paper categorized Japan and Switzerland as “inconsistent with the U.S.” However, extending the sample period to June 2024 enabled us to estimate stable threshold levels. These results imply that to derive stable results, the estimation periods should contain both low- and high-attention periods.

(Table 5) Inflation attention threshold level for 21 countries

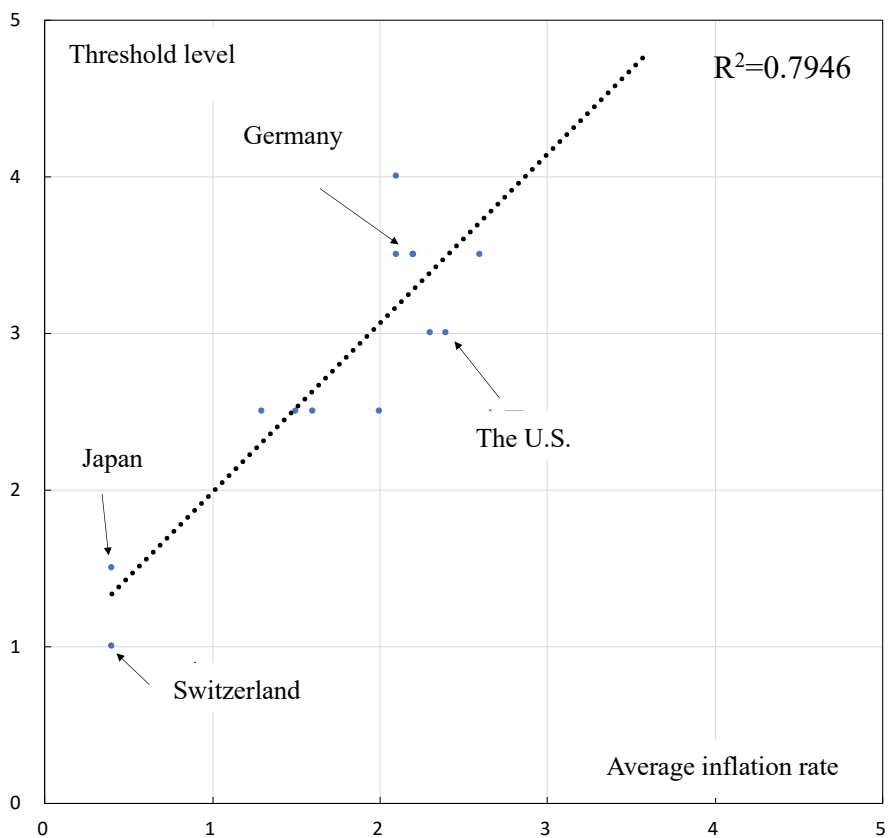
Country Name	Threshold level
Switzerland	1.0%
Japan	1.5%
Colombia	2.0%
Israel*	2.5%
France*	2.5%
Italy*	2.5%
Canada	2.5%
U.K.	3.0%
U.S.	3.5%
Spain	3.5%
Germany	3.5%
Austria	3.5%
Holland	4.0%
Sweden	4.0%
Mexico	4.0%
Norway	6.0%
Hungary	6.3%
India*	6.7%
Uruguay	8.5%
Turkey	35.0%
Argentina	55.0%

(Source) Author's calculation. A mark "*" at the end of country name indicates keyword search was conducted on "inflation" in English rather than each country's native language.

The country order indicated in Table 5 and their inflation conditions imply that the threshold level and the inflation rate are correlated, as Korenok points out. Figure 7 plots

the variables for the developed countries in Table 5⁸.

(Figure 7) The relationship between the threshold level and the average inflation rates



(Source) Author's calculation. See footnote 8 for countries shown.

Figure 7 shows a relatively high R^2 value of 0.795. Japan is located at the left end near the trend line. Switzerland's threshold level was lower than Japan and less than their central bank's inflation target "less than 2 percent."

During the sample period, the Japanese CPI increase rate, adjusted for the consumption tax increase, exceeded the threshold level only twice: (1) just before the global financial crisis and (2) the current inflation phase, or just 12.5 percent of the sample period (Figure 8).

⁸ Japan, the U.S., Germany, Italy, Canada, Switzerland, Sweden, Spain, Norway, the U.K., Austria, the Netherlands, and Israel.

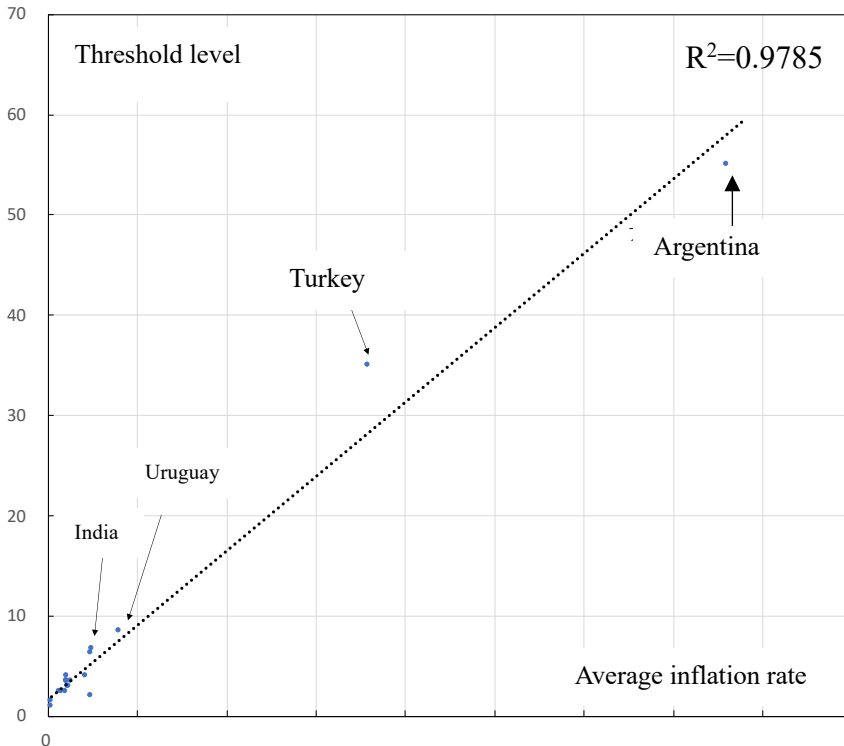
(Figure 8) Japanese CPI and the threshold level



(Source) Cabinet Office. Shaded area indicates CPI less than the threshold level.

Figure 9 shows the data from 21 countries, including high-inflation countries. A strong correlation between the threshold level and average inflation rates was observed, even in these countries. This figure shows that the threshold level at which households turn to the high-attention mode is significantly affected by actual inflation rates.

(Figure 9) Threshold level and inflation rates including high inflation countries



(Source) Author's calculation. See Table 5 for countries shown.

4. Robustness checks

4.1. Alternative threshold level estimation using DK answers

The last section uses the Google Trends index as a proxy for household inflation attention. To check the robustness of the estimation in the previous section, we use other variables representing the degree of households' attention to inflation.

As a robustness check, the Korenok paper relied on the X (former twitter), especially volume of using "inflation." These results confirm the robustness of the Google Trends estimation results. This study relied on the method used by Bracha and Tang (2022) (BT Paper). BT Paper used the share of respondents choosing "don't know" answer (DT ratio) in household IE survey as a proxy for households' degree of attention to inflation. The DT ratio remains high when inflation rates are below the threshold level and households are inattentive to inflation. However, once inflation rates exceed the threshold level and household attitudes change to the high attention mode, the DT ratio begins to fall. For the U.S. households, DT ratio is derived from the "Survey of Consumers" published by the Michigan University. The sample period and type of CPI were matched to the Google Trends estimation (Table 6).

(Table 6) U.S. households' threshold level for inflation attitude (Estimated from the DK ratio)

Threshold level	1.5%	2.0%	2.5%	<u>3.0%</u>	3.5%	4.0%	4.5%
R ² for DK ratio Jan. 2004 to June 2024	0.230	0.254	0.242	<u>0.281</u>	0.270	0.240	0.231

(Source) Michigan University and author's calculation.

Although R² was lower than that of the Google Trends index, the threshold level derived from the DK ratio was +3.0%, similar to the Google Trends estimation. This result confirms that the U.S. threshold level was approximately +3.0%.

In case of Japan, although the "Opinion Survey" conducted by the Bank of Japan does not allow "don't know" choice, Cabinet Office's "Consumer Confidence Survey" has such option. Threshold model was run by sample period from April 2004 to June 2024 and CPI was consumption tax rate increase adjusted base. Table 7 shows the estimation results.

(Table 7) Japanese households' inflation attention threshold by DK ratio estimation

Threshold level	0.5%	1.0%	<u>1.5%</u>	2.0%	2.5%	3.0%
R ² for DK ratio April 2004 to June 2024	0.391	0.430	<u>0.432</u>	0.408	0.410	0.400

(Source) Cabinet Office and Athor's calculation. The sample period is from April 2004 to June 2024.

The estimated threshold level was +1.5%, matching the results obtained using the Google Trends index shown in Table 3. Therefore, the robustness of the estimation was confirmed and the threshold level for Japan was estimated to be approximately +1.5%.

The central banks in both countries set their inflation targets at 2 percent. Interestingly, in Japan, households become highly attentive before the CPI reaches the policy target, while in the U.S., changes in attitude begin 1 percent above the inflation target. If households trust the policy target, then the U.S. type of threshold, which is located above the policy target, seems natural.

4.2. Threshold level by households' attribution

The Consumer Confidence Survey" publishes DK ratios by socioeconomic attributes, which enables us to estimate the threshold levels by different attributes (Table 8).

For every class sorted by sex and income level, the threshold levels were identical at +1.5 percent. According to the employment type, the threshold level for the unemployed was 0.5 percentage point higher than the average of +2.0 percent. According to household classification, the threshold level of single-person households was 0.5 percent point lower than the average of +1.0 percent. Based on the household head's age classification, the estimation results were unstable. For example, the class age 20-29 was unable to estimate the threshold level owing to the small sample size, and the class age 40-49' s threshold level was relatively low at +0.5 percent. The threshold level for the classes of age 60-69 and 70 and over was +2.5 percent, which was much higher than for other age classes. This could have been influenced by cohort effects, as people in these age categories experienced periods of high inflation in the early 1970s.

The estimation results in Table 8 are consistent with the initial estimate of the Japanese threshold level shown in Table 3, since more than half of the classifications

showed a +1.5 percent threshold level.

(Table 8) Japanese households' threshold level by attributions

sex	male	1.5%
	female	1.5%
income level	0-3 Million Yen	1.5%
	300-400 Mil. Yen	1.5%
	400-550 Mil. Yen	1.5%
	550-750 Mil. Yen	1.5%
	750-950 Mil. Yen	1.5%
	950-1250 Mil. Yen	1.5%
employment type	employed	1.5%
	self-employed	1.5%
	unemployed	2.0%
household classification	single person	1.0%
	multi persons	1.5%
household head's age class	20-29	—
	30-39	1.5%
	40-49	0.5%
	50-59	1.5%
	60-69	2.5%
	70-	2.5%

(Source) Cabinet Office and author's calculation. Sample period: April 2004-June 2024

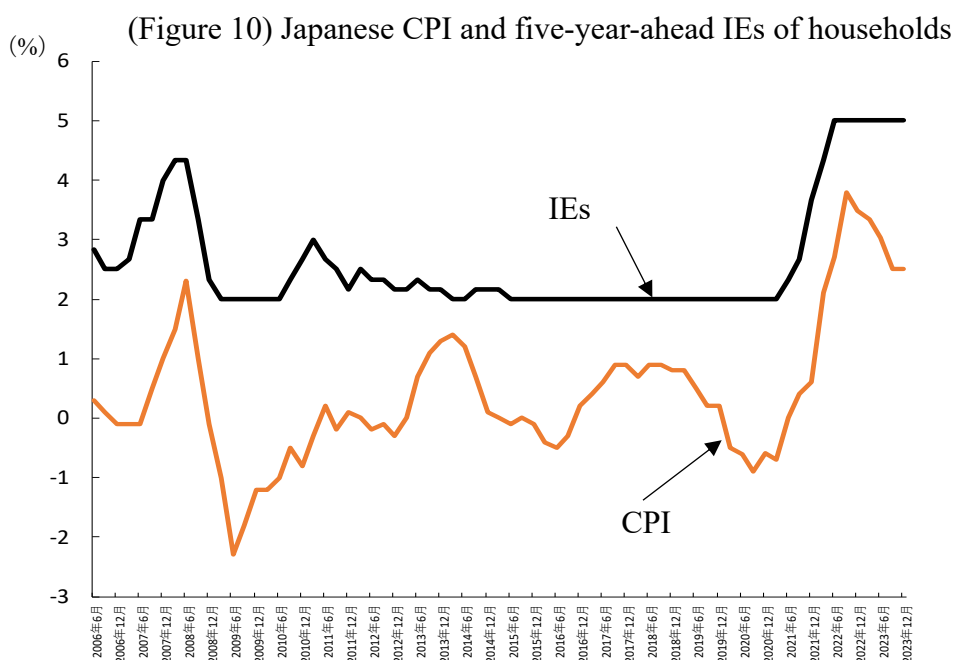
5. Implication for the monetary policy

The above estimate shows that households' attention to inflation has a threshold level and a nonlinear relationship with inflation. These findings have implications for monetary policy.

First, when the inflation rate is low and households are in the low-attention mode, their response to inflation is low. This indicates that, in such circumstances, the slope of the Phillips curve becomes flatter. In fact, when developed countries faced continuously

low inflation after the global financial crisis, the flattened Phillips curve became widely debated.

Second, when households are in the high-attention mode, such as during the current inflationary phase, they become sensitive to inflation development. Even after inflation rates peak, IEs may remain high or take longer than usual to return to normal levels. In fact, Japanese households' five-year-ahead IEs have remained at 5 percent for the past two years, even though CPI increase rates have been declining since the fourth quarter of 2022 (see Figure 10). In addition, in the high-attention mode, pass-through from increased inflation rate to wages and price-setting behavior also increases.



(Source) Cabinet Office and the Bank of Japan. CPI is adjusted for increased rates of consumption tax

Third, central banks' communication with the public should consider the existence of a threshold level. When the inflation rate is lower than the threshold level and central banks must introduce a non-traditional monetary policy, households' responses to communication decline. For example, forward guidance and quantitative easing rely significantly on the IEs. When inflation rates move above the threshold level, effective central bank communication, in addition to a policy interest rate hike, is necessary to reduce household IEs. Therefore, communicative policies should consider household attention to inflation rates.

6. Conclusion

This study analyzed the RIH, according to which households' inflation attention becomes responsive to inflation rates once they exceed a threshold level. Recent studies started using the Google Trends index as a proxy for households' degree of attention to inflation and succeeded in estimating the threshold level. Our study applied this method to Japanese households using updated data, including the current inflationary phase. The following three points were identified.

First, data derived from the Google Trends analysis of the keyword "inflation" were a successful alternative indicator of households' inflation attention level. The threshold model yielded the U.S. and Japanese household threshold levels of +3.0 percent and +1.5%, respectively. In Japan, extending the sampling period to cover the current inflationary phase was necessary to estimate a robust threshold level because the Japanese economy suffered from a prolonged period of low inflation. In addition, keyword "price" in Japanese yielded much more stable threshold level estimation than using "inflation" or "*infure*." (a Japanese word equivalent to "inflation" in the U.S.).

Second, the threshold levels were calculated for 21 countries. Switzerland (+1.0 percent) had the lowest threshold, followed by Japan (+1.5 percent). However, most developed countries' threshold levels were within the range of +2.5% to +3.5%, which is slightly above the inflation target of central banks (2 percent or 1-3 percent). In addition, high correlations are found between the threshold levels and average inflation rates during the sample period, among developed countries and among developing countries with high inflation rates, including Uruguay and Turkey.

Third, to check the robustness of the above estimation, threshold levels were estimated by alternative data derived from the share of "don't know" answers contained in household inflation expectations surveys. The resulting threshold levels were consistent with the Google Trends analysis.

Households' threshold level for inflation attention also has the following implications for monetary policy: central banks should (1) be aware of the flattening Phillips curve during low inflation periods, (2) properly implement monetary policy when households are in a high-attentive mode, and (3) consider households' inflation attitudes when communicating with the general public.

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