

Empirical Analysis of the Difference between Measured and Perceived Inflation in Japan

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Abstract

The paper intends to verify whether perceived inflation rate is consistent with actually measured inflation rate under the present low inflation in Japan. The perceived inflation is measured by opinion polls while the CPI is the most widely recognized indicator of actual consumer price change in Japan.

There are two significant reasons for the gap between perceived and measured inflation. One is that perceptions are formed by price changes without quality adjustments for goods and services. The other is that perceptions are based on a subset of frequently purchased goods and services. The former can be clarified by observing differences in changes between average prices and quality-adjusted indices for items in the CPI. The latter can be articulated by comparing indices for frequently purchased goods and services with the CPI.

This paper provides interpretations on the gap based on those empirical results.

Introduction

This paper¹ addresses a breakdown of the gap between perceived and measured forms of inflation. The paper initially introduces previous research related to the gap between the two forms of inflation in Japan. Next, the paper intends to verify whether perceived inflation tracks measured inflation in a reasonable manner, and shows two factors, namely quality adjustments and frequency of purchases, which influence perceived inflation and generate the gap from measured inflation. Further, this paper presents the traceability of perceived inflation by data for the CPI, comparing data by opinion polls. The benefits of those analyses will be generalized at the bottom line.

¹ The views expressed in this paper are those of the author, and may not necessarily reflect the views of the organization to which he belongs.

I Empirical Analyses in the Past

This chapter introduces preceding empirical analyses concerning the gap between perceived and measured inflation between 1960 and 1980, arranging points of evaluation for perceived inflation and the gap from the change of the CPI, which would be beneficial when analyzing recent phenomena surrounding the gap using present price data, and further, the lost of momentum for such analyses according to the shrinkage of measured inflation after 1990 in Japan.

Analyses concerning the gap between perceived and measured inflation in Japan have been accumulated, during the period of dramatic economic development between 1960 and 1980 in Japan, while changes in the annual CPI ranged from a minimum of 3.7 to a peak of 23.2 percent, and perceived inflation was considered to be higher than the measured inflation. The distribution of annual rates of change of item indices was not symmetric, comprising the mode around zero rates of change, a large number of items with plus rates, but small number of items with minus rates.

Various opinion polls designed to assess individuals' feelings for prices were carried out one after another, some of which included questions concerning comprehension of the CPI. For instance, opinion polls were implemented by the Public Relations Office, Minister's Secretariat, Prime Minister's Office, annually excluding 1977. On July 1974, based on the opinion poll, the level of perceived inflation reached 46.5 percent, 22.7 percentage points higher than the measured inflation and 23.8 percent as an annual change of the monthly CPI, just after the first oil crisis occurred. The gap exceeded three percentage points from 1975 to 1982. Based on the results, research to analyze the gap between perceived and measured inflation was accumulated.

Nagayama (1963) pointed out four factors of the gap. The first is misunderstandings based on the lack of structural knowledge for the indices. People are prone to focus on items with price hikes, while neglecting those with stable or falling prices. The second is the difference between average and individual weights. For example, the rise in university tuition fees influences households with university students more profoundly than those without. The third is the difference in the frequency of purchases. The more frequently items are purchased, the more significantly they influence perceived inflation. Consumers form their inflationary perceptions on the basis of a restricted basket of frequently purchased goods and services, such as bread, meat, milk or medical treatment. The final point is confusion of the CPI with living costs. Many people protest an increase in consumption being regarded as inflation.

Based on the second point, the Statistics Bureau arranged indices in terms of household characteristics, such as the number of members, age and occupation of the household head as well as income and tenure of dwelling for the CPI² because change of an index for a household category with a characteristic can more closely resemble perceived inflation by people belonging to the same household category. Indices

² The indices by the characteristics of households are formed by weights for the categories of households, but with equivalent price data for all households, due to the difficulty of observing prices by the category of purchasers.

by item characteristic, such as the frequency of purchases and expenditure elasticity, were also released. Based on the view of the third point, indices for items purchased frequently and those with low elasticity are useful since changes in indices can resemble perceived inflation more closely.

Among considerable preceding research, Otsuki (1983) commented in his paper that perceived inflation measured in an opinion poll was influenced by the methodology of the survey, and also that it was influenced by price changes in the shorter term rather than annual changes, but that perceived inflation moves in parallel with measured inflation, based on his long term empirical analyses with opinion polls.

After 1990, opinion polls for prices were integrated in the form of certain questions in more general opinion polls; gauging feelings concerning the economy, consumption or society. The Prime Minister's Office has not carried out any sole opinion polls on price since 1991, while the Tokyo Metropolitan Government stopped issuing questionnaires for the survey classification of perceived inflation in the Annual Public Survey on Life in Tokyo in 2002 when deflation bottomed out.

Momentum for perceived inflation has been creeping up again recently. The Tokyo Metropolitan Government undertook an opinion poll on feelings rather than a quantitative evaluation of price change on February 2008 under the rise of prices of daily commodities.

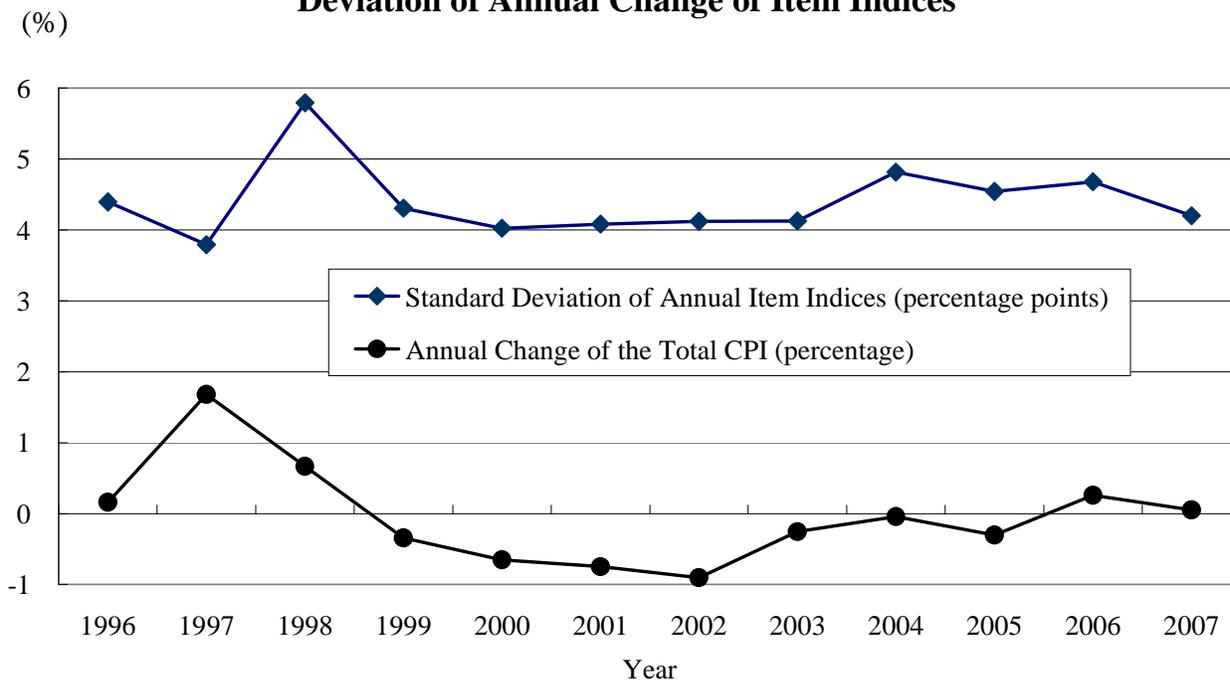
II Characteristics of Recent Change of the CPI

This chapter shows the characteristics of annual rate of change of the CPI³, which is small as an absolute value in total, but composed of rises and falls, shown as annual rates of changes of item indices.

³ The CPI of Japan is rebased every five years to set the reference periods to years ending with 0 or 5.

Recently, change over the previous year of the CPI in Japan has been hovering around zero⁴. It is, however, a composite phenomenon caused by rises and falls of many item indices. The standard deviation of annual rate of change of item indices has been constantly around four to five percent, except for nearly six percent on 1998⁵ since 1996. (Figure 1)

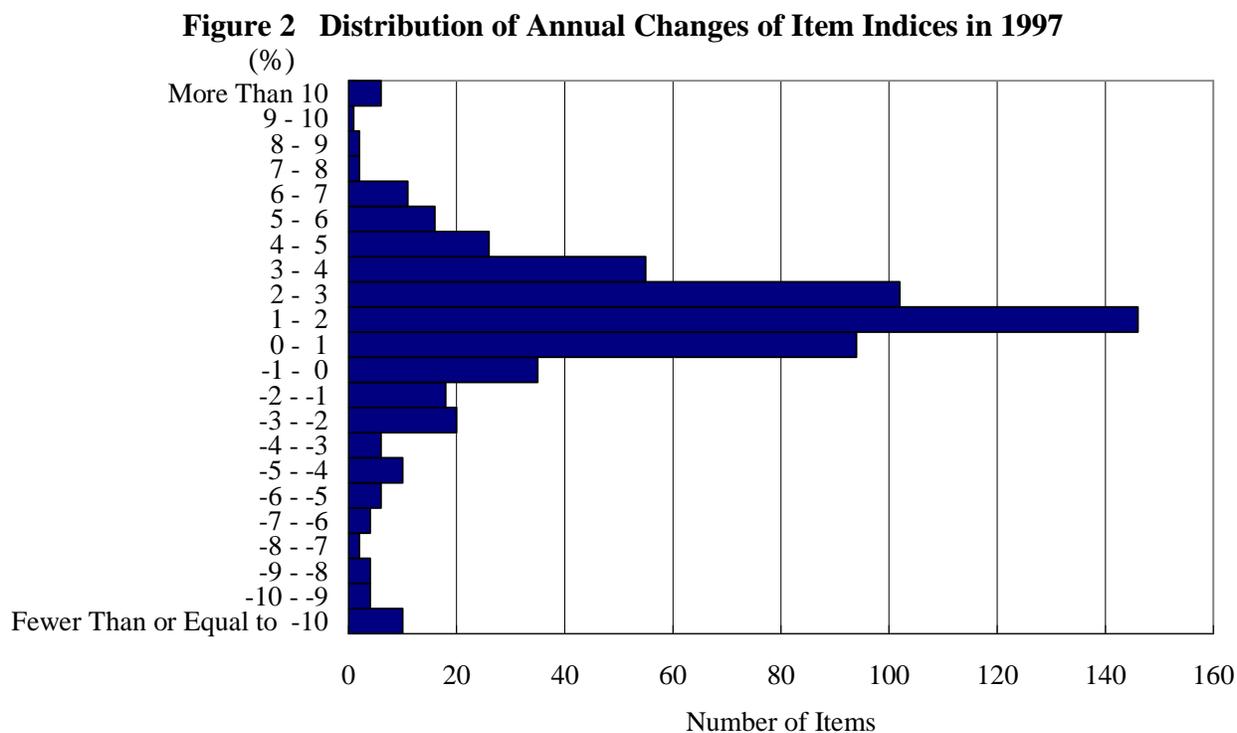
Figure 1 Annual Change of the Total CPI and Standard Deviation of Annual Change of Item Indices



⁴ The change over the previous year of the annual CPI was less than two percent after 1991 when it reached 3.3 percent, remaining on a minus trend with width of less than one percent during 1999-2005. The change over the previous year of the monthly CPI was more than minus two percent and less than plus three percent after 1991, especially more than minus one percent and less than plus two percent from May 2002.

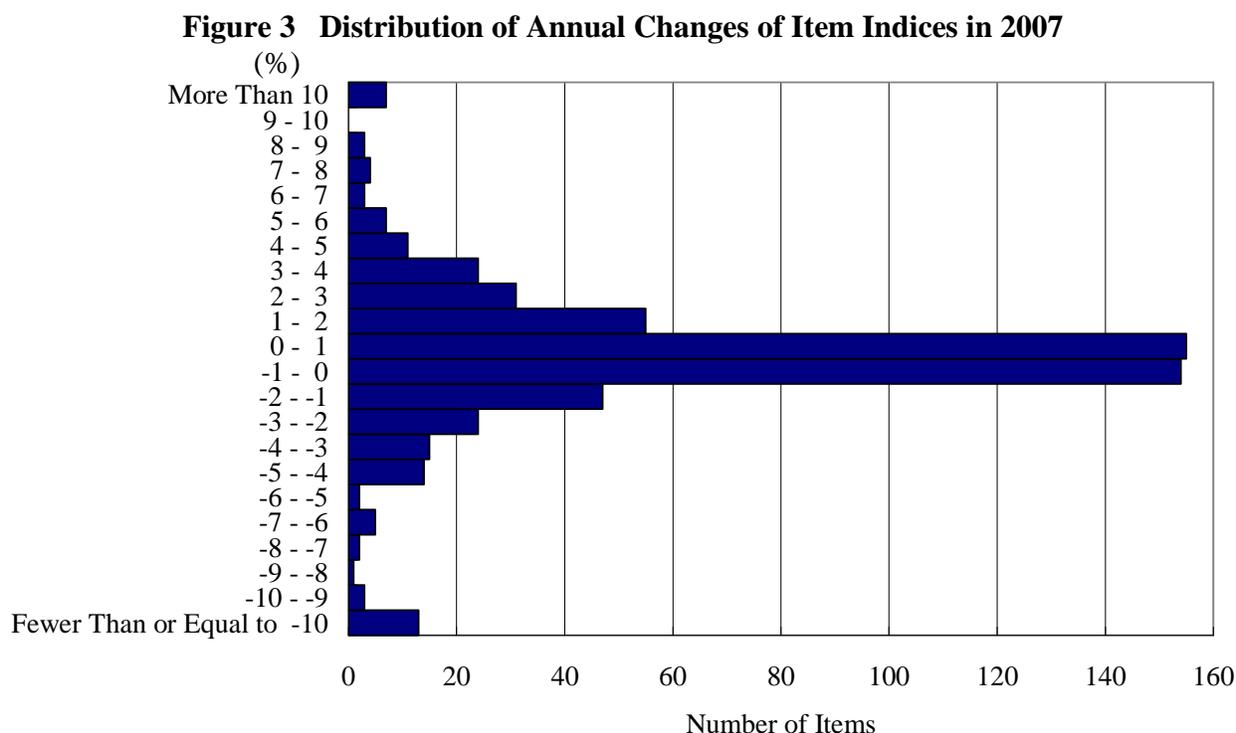
⁵ In 1998, prices for fresh vegetables rose dramatically, based on long rains and hurricanes.

Figure 2 shows the frequency distribution of item indices by annual rate of change in 1997⁶. The figure shows that the mode of the annual rate of change is one to two percent, and that the distribution is almost symmetrical.



⁶ The measured inflation peaked during these 16 years depending on the increase of the consumption tax from three to five percent in 1997.

Figure 3 is the same distribution chart for 2007, resembling Figure 2. The mode lowered from one to two percent to zero to one percent, while the standard deviation rose from 3.8 to 4.2 percentage points, the number of items with more than 10 percent increasing from six to seven, that with fewer than or equal to 10 percent increasing from 10 to 13 from 1997 to 2007⁷. Owing to the drop of the mode with symmetric distribution, the rate of change of the CPI has dropped for the decade.



III Characteristics of Recent Perceived Inflation

This chapter outlines the characteristics of perceived inflation, based on data from opinion polls, and comparing the CPI in 2006 and 2007.

Perceived inflation is higher than measured inflation in Japan as well as most other countries. Criticism that recent change of the CPI is lower than the feeling of the people surged up in late 2007 when prices of goods and services related to raw materials, including oils, rose in the world market.

Annual change of the monthly CPI, excluding fresh food, reaches 1.0 percent in February 2008 for the first time since March 1998. Nowadays there is growing awareness that consumer prices are rising. On

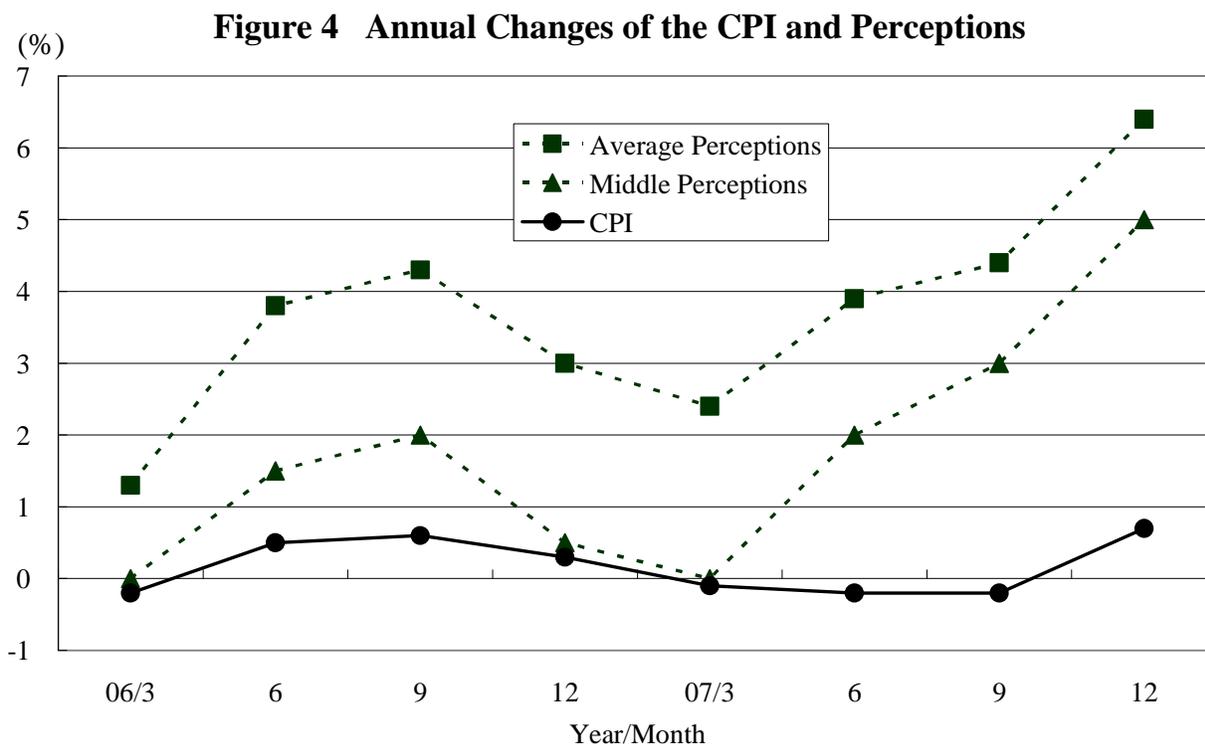
⁷ For example, lemons increased 31.6 percent, oranges 31.2 percent, sea bream 17.2 percent; cameras decreased 30.6 percent, laptop computers 26.7 percent and flat screen TVs 21.6 percent from the previous year in 2007.

the background of the discussion of inflation in Japan, consumers begin to consider the price rises as a sign of continuing inflation, led by price hikes in materials linked to global socioeconomic structure, as opposed to tentative phenomena caused by bad weather or natural disasters. Although people in Japan have taken a lesson from economic malaise caused by deflation, they are not in favor of recent price rises as a blight signal of escaping from deflation. Instead, they rather dread the arrival of accelerated inflation in the near future, while no inflation-linked pay rises are expected for the time being.

The Bank of Japan monitors the perception of individuals regarding the price changes over the previous year on a quarterly basis in the Opinion Survey on the General Public's Views and Behavior⁸. According to the result, the average perceived inflation reached 6.4 percent, while the medium value of perceived inflation reached 5.0 percent in the survey in December 2007.

⁸ The object of the Opinion poll on the General Public's Views and Behavior is approximately 4,000 randomly sampled individuals aged 20 years or more.

Comparing changes over the previous year between the CPI and the averaged perceived inflation, the difference has been expanding since June 2007. In particular the difference in December 2007, when the change over the previous year of the monthly CPI reached the highest value since August 2006, was about six percentage points. The averaged level of perceived inflation has risen with feeling that inflation is quite high by small number of people, so the middle value of perceived inflation had been lower than the averaged. However, even the middle value of perceived inflation rose, to around four percentage points more than measured inflation, to around the level of averaged perceived inflation in December 2007. (Figure 4)



Many people seem to regard recent inflation as larger than measured inflation, and the primary consideration should be to analyze and explain the reasons in order to facilitate better understanding toward the CPI.

IV Effects of Quality Adjustments

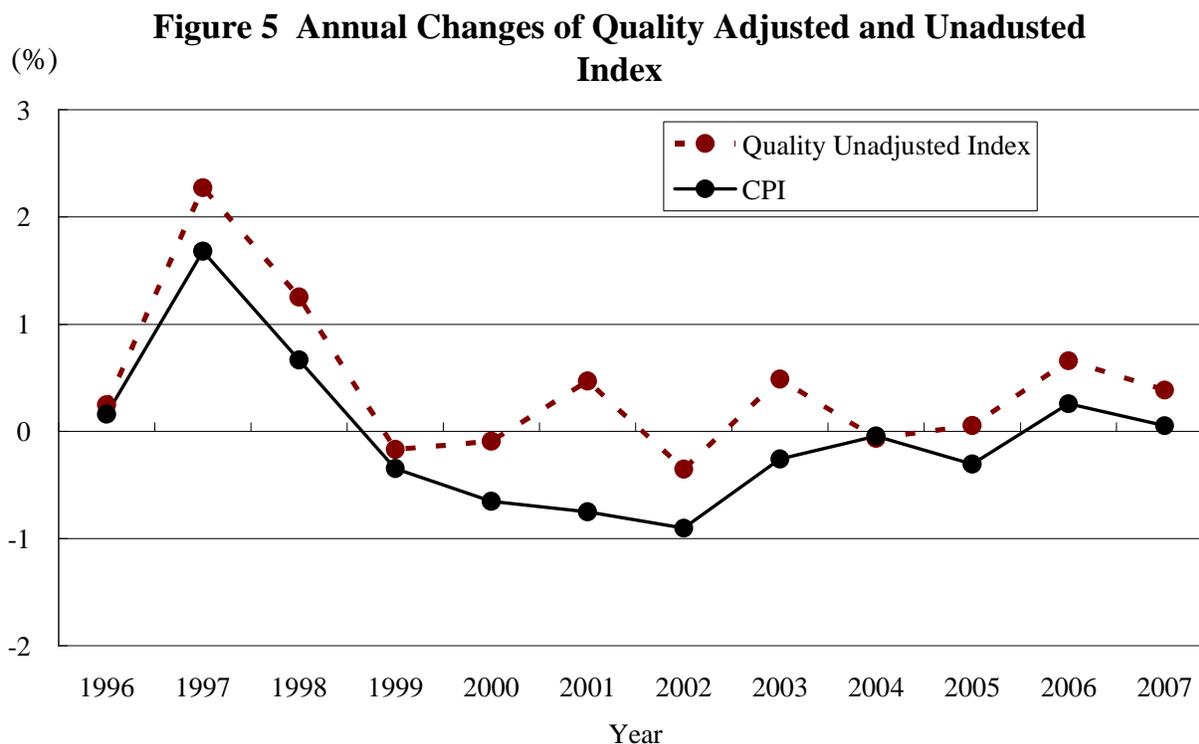
This chapter reviews the effects of quality adjustments on the gap of measured and perceived inflation.

Quality adjustment for the CPI is an essential element for accurate measurement for price changes, but quality changes are apt to be neglected in perception of price changes. For this reason, quality adjustment is one critical factor for the gap between perceived and measured inflation. Many people tend to perceive

price movements without considering the quality of goods and services. The quality adjustments in this paper refer to adjustments of qualities which are apt to be neglected in mind when observing goods or services: the overlapping method, the option cost, the Hedonic indices, imputation and trimming of exceptional data, or whatever. Quantity adjustments are, however, excluded because changes in quantity, such as in size and weight, can be so easily perceived through the superficial observations of goods or services that they can also reflect perceived inflation.

In principle, quality adjustments are carried out when a specification is changed in accordance with a change in the representation of specifications; when an outlet where a price is collected is changed; or when a good or service is changed within a specification, according to a change in the market or consumption taste during compilation of the CPI.

Figure 5 presents the annual changes of the actual CPI and those of a hypothetical index without quality adjustments. Annual change without quality adjustments has been higher than or equal to the CPI. This fact gives an explanation to the criticisms that the CPI understates the inflation: while the criticisms are based on the perceptions that do not take account of quality changes. The CPI measures the price changes with the adjustment for quality change taken into account.



It should be noted that the quality unadjusted index refers to Tokyo ward area⁹ only¹⁰, while the CPI

⁹ The ward area of Tokyo refers to the 23 wards located in the central area of Tokyo, ranging from 6.6 percent of the midnight population and 8.9 percent of the daytime population.

refers to the whole country. The reason for limiting the area to the ward areas of Tokyo is that it is difficult to compute national average prices because of regional variations of specifications. Therefore, the difference between the annual changes in the quality unadjusted index and the CPI includes trivial effects arising from differences in the geographical coverage of data, not to mention the main effects of quality adjustments.¹¹

The annual change for ham represents the effects of quality adjustments among items. The specification for ham¹² was changed on March 2007 from standard to premium, owing to an upgrade in people's preference for better quality. If consumers do not recognize the difference of quality, they feel that the price for ham increased 16.3 percent in 2007 from the previous year, despite the fact the measured inflation showed an increase of only 2.8 percent, calculated with quality adjusted prices. In other years there were little differences between perceived and measured inflation due to price changes in ham, because the specification was the same, and the effects of quality adjustments, caused by changing survey outlets or trimming values with extensive rises or falls of prices within the sphere of the specifications, were comparatively small.

The category of laptop computers exemplifies another typical case. Although the specification is specifically defined, it comprises a wide variety of devices with a range of performance, functions, applications or accessories. Price changes in laptop computers have been perceived as averaged price movement for all devices, within a range of about minus 20 to plus 10 percent every year, based on the annual change of prices obtained in the Retail Price Survey since 2000. This does, however, comprise up-to-date models of laptop computers at the current observed period. In the CPI, the price change for laptop computers measured with the adjustment by the Hedonic method have decreased in the range of minus 40 to minus 20 percent for the same period. The difference of the two indices shows how much quality of laptop computers have improved drastically, and it represents the gap of the perception and the CPI.

Generally speaking, a massive scale of price decline due to quality adjustments is observed for durable goods whose manufacturing technology has advanced rapidly. Thus, quality adjustments were not a main factor for the gap between perceived and measured inflation between 1960 and 1980.

V Effects by Frequency of Purchases

¹⁰ Weightings by item for the index without quality adjustments do not refer to the ward area of Tokyo but to the entire nationwide area.

¹¹ Some substitutive methods are adopted. Some items missing in the Retail Price Survey were substituted with analogous items in the survey. Further, the quality unadjusted indices were compiled with the same indices for the CPI for several service charges for which it is difficult to determine them.

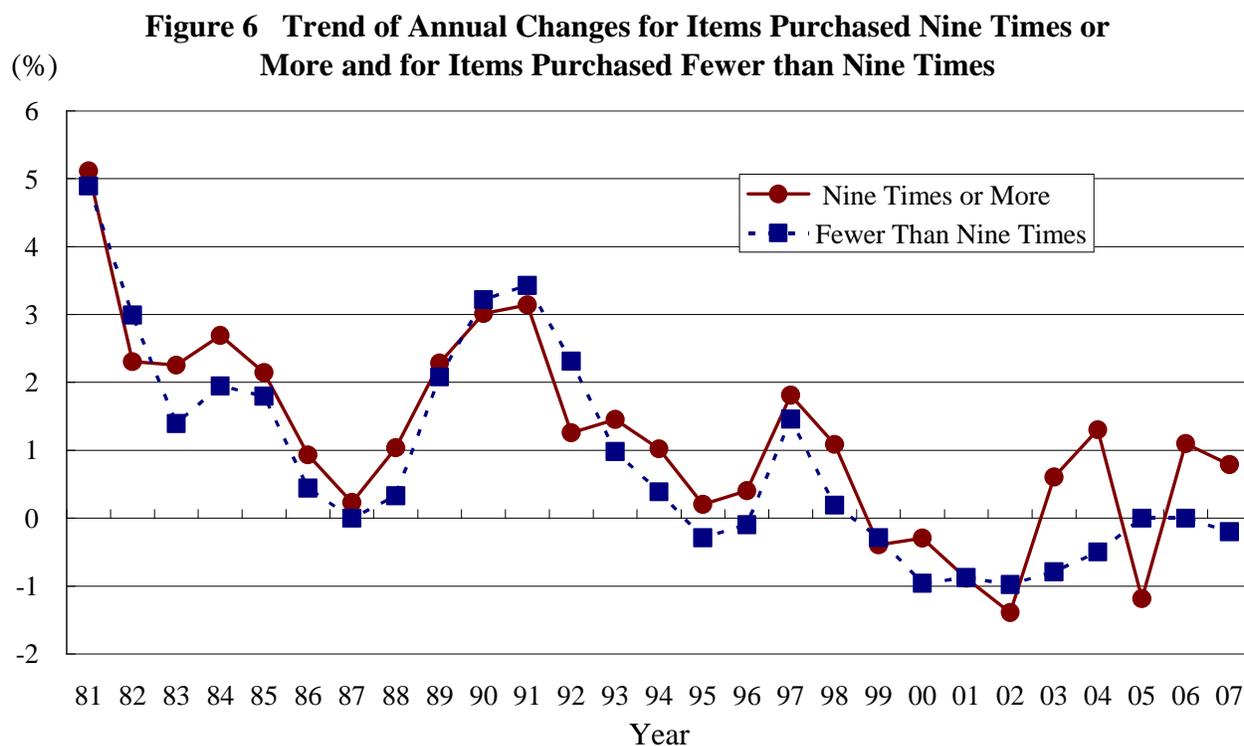
¹² The strict specification for ham is roast ham, goods by the Japanese Agricultural Standards (JAS), a premium from March 2007.

This chapter provides the effects caused by frequency of purchases which influences consumer perception, since people are more sensitive to price changes of items which they frequently purchase, using indices based on the annual purchase frequency classes of the CPI.

Frequency of purchases is another critical factor where perceived inflation is higher than measured inflation because psychological impressions tend to be formed by the frequency of experiences to purchase goods or services at outlets or institutions. People are apt to feel that inflation depends on their own purchased goods or services. This means that goods or services frequently purchased have a more significant influence on perceived inflation than those for which there is less chance of purchase, although measured inflation depends not on the frequency of purchase but on the amount of consumption.

For the purpose of the empirical study, a special index has been built, which includes prices for only frequently purchased goods or services: items purchased nine times or more, per year on the average of all households i.e. non-durable goods or daily consumer purchases.

Comparing annual price changes for items purchased nine times or more with those purchased fewer than nine times a year¹³, they were similar until 2002, but the former tended to be higher than the latter except for 2005¹⁴ after 2002. (Figure 6)

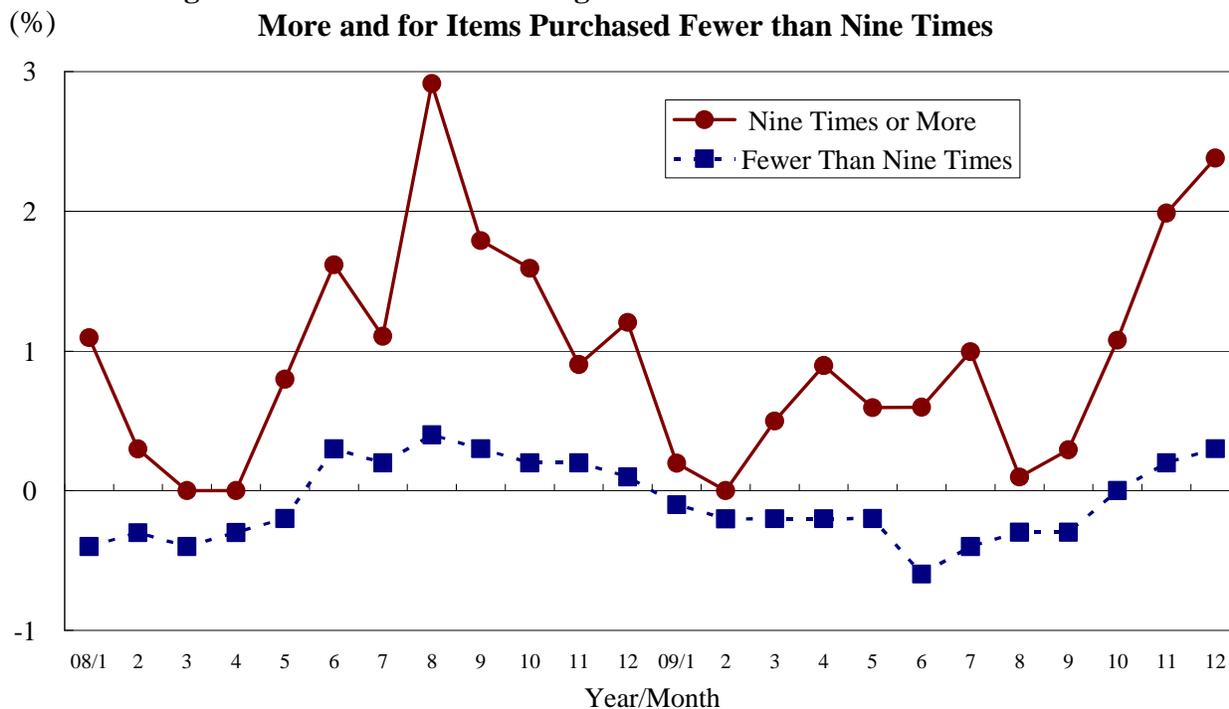


¹³ The composition of the items purchased nine times or more changes depending on the base years of the CPI. It is determined on the basis of the data from the Family Income and Expenditure Survey. The number of items purchased nine times or more decreased due to diversification of consumption from 133 on the 1995 year base, to 110 on the 2000 year base and 89 on the 2005 year base respectively, while those for all items have remained almost the same from 580 on the 1995 year base, to 596 on the 2000 year base and 584 on the 2005 year base.

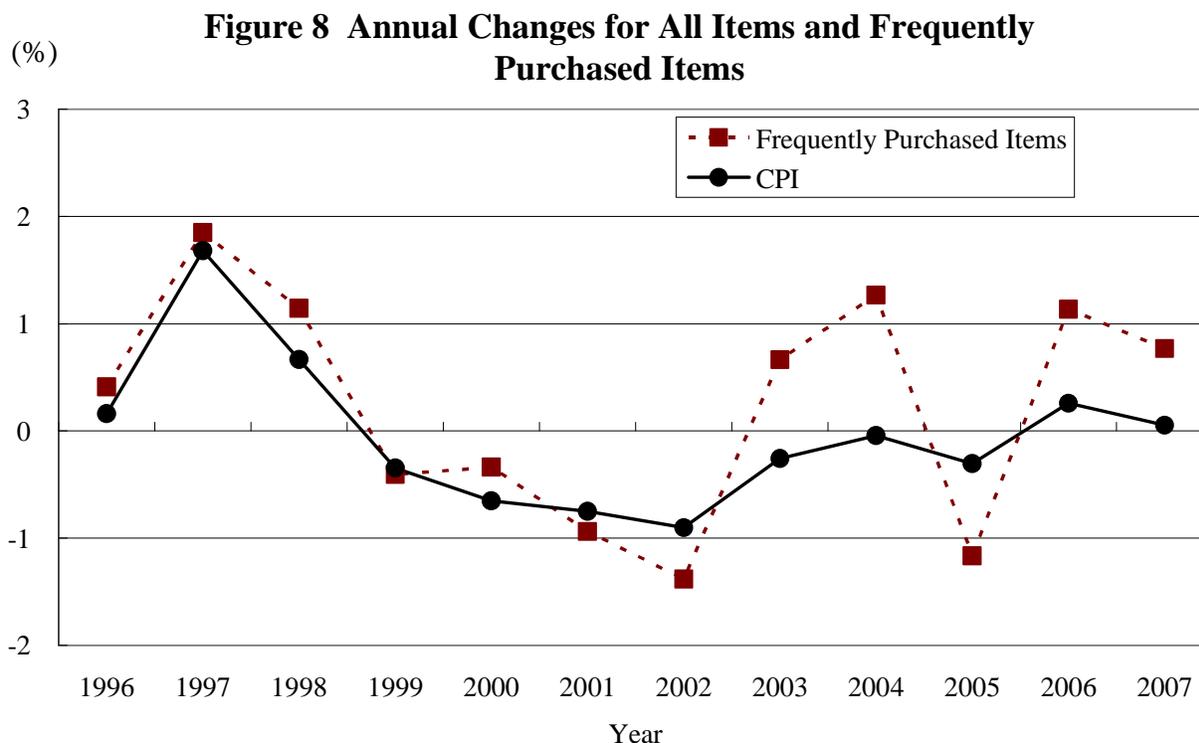
¹⁴ In 2005 prices for rice and fresh vegetables, which are purchased frequently, fell reversing the trend of rises in the preceding year caused by bad weather.

Since 2006, the former is consistently higher every month. Especially in August 2006 and December 2007, the difference exceeded two percentage points, which is comparatively large given the total CPI having remained around zero in the same period. (Figure 7) Nowadays there is a growing tendency for prices for frequently purchased goods and services to increase; while prices for those with less frequency, such as durable goods, hover around or below zero. Consequently, enlarged difference between these two indices provides one of reasons of the gap between perceived and measured inflation.

Figure 7 Recent Annual Changes for Items Purchased Nine Times or More and for Items Purchased Fewer than Nine Times



The annual change for the items purchased nine times or more per year was higher than the total CPI except for 2005 after 2002. The difference was nearly 1.0 percentage point, comparatively large, because the absolute value of the annual change of the CPI was small. (Figure 8) The high price increase of the frequently purchased items makes the perceived inflation rate higher than the actually measured inflation rate of the CPI, and the gap sometimes triggers criticisms that the CPI may be understating the inflation rate.



VI Total Effects of Quality Adjustments and Frequency of Purchases

This chapter outlines the total effects that quality changes and the frequency of purchases would give on the perceived inflation rate. Here, an experimental index is calculated using the quality unadjusted prices of frequently purchased items, and its movement is compared with the perceived inflation rate.

If the price data for the CPI are not adjusted for quality, and limited exclusively to frequently purchased items, the index based on such data becomes nearer to the perceived inflation rate. The following figures demonstrate the distribution of annual index changes without quality adjustments and for items purchased nine times or more in 1997 and in 2007. The shape of Figure 9 for 1997 resembles that in Figure 2, i.e. distribution of annual changes of item indices for all items in 1997.

Figure 9 Distribution of Annual Changes for Frequently Purchased Items without Quality Adjustments in 1997

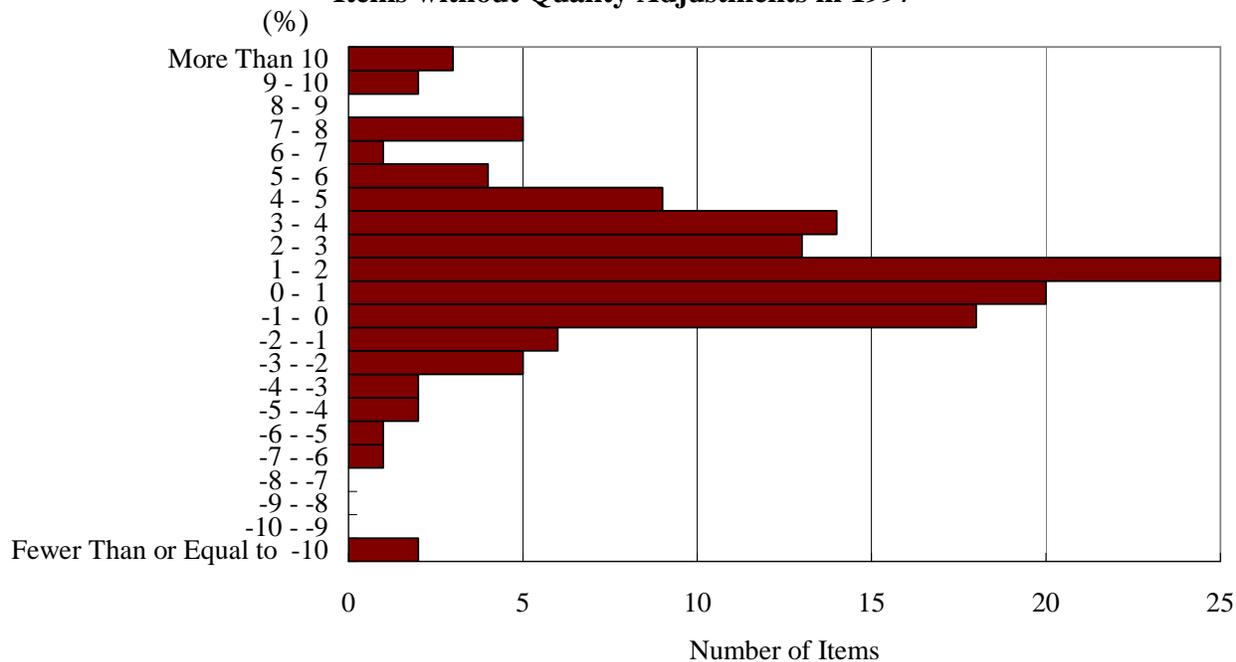


Figure 10 shows the distribution of annual changes for frequently purchased items without quality adjustments in 2007. In Figure 10, the categories around zero percent were lower, but the category of more than 10 percent was almost the same, compared to that for the CPI in Figure 3.

Figure 10 Distribution of Annual Changes for Frequently Purchased Items without Quality Adjustments in 2007

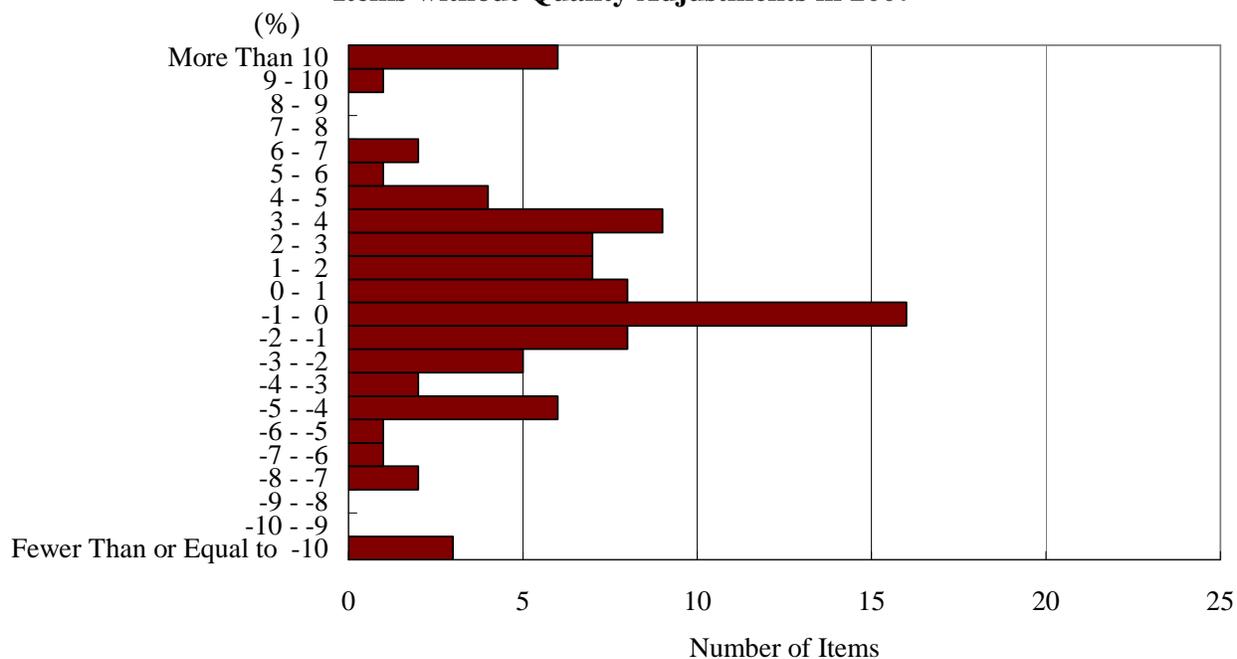
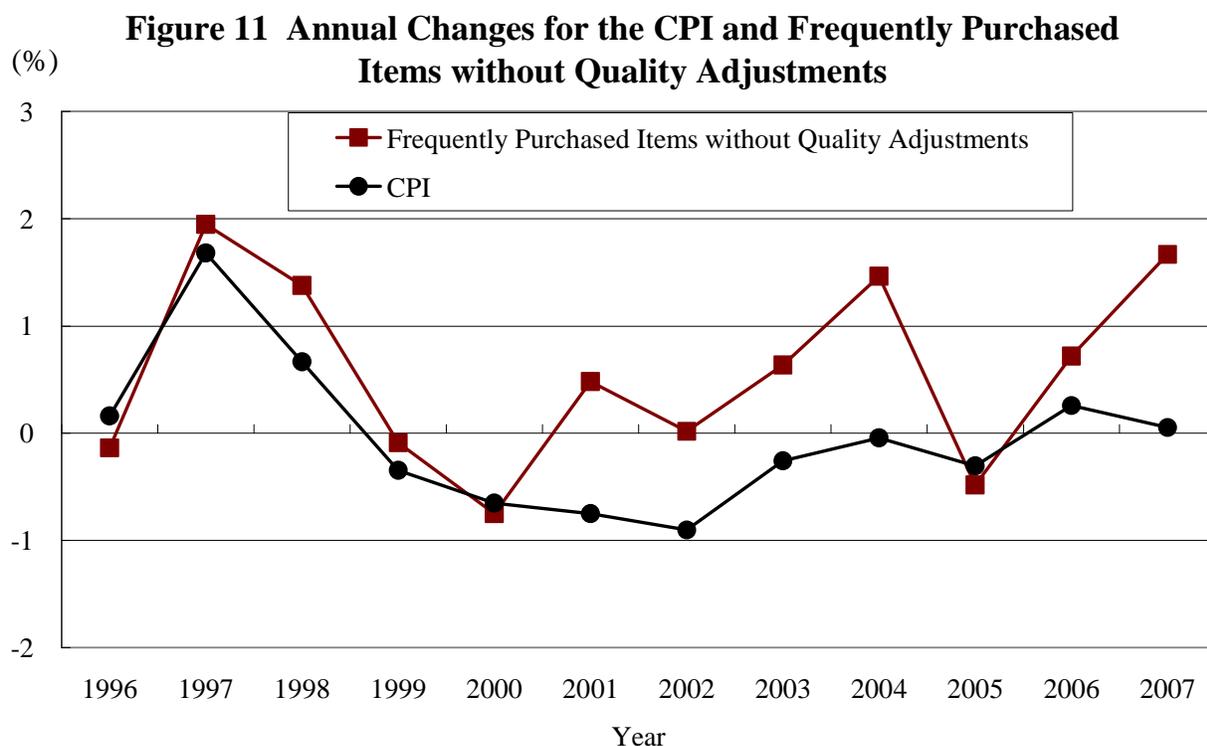


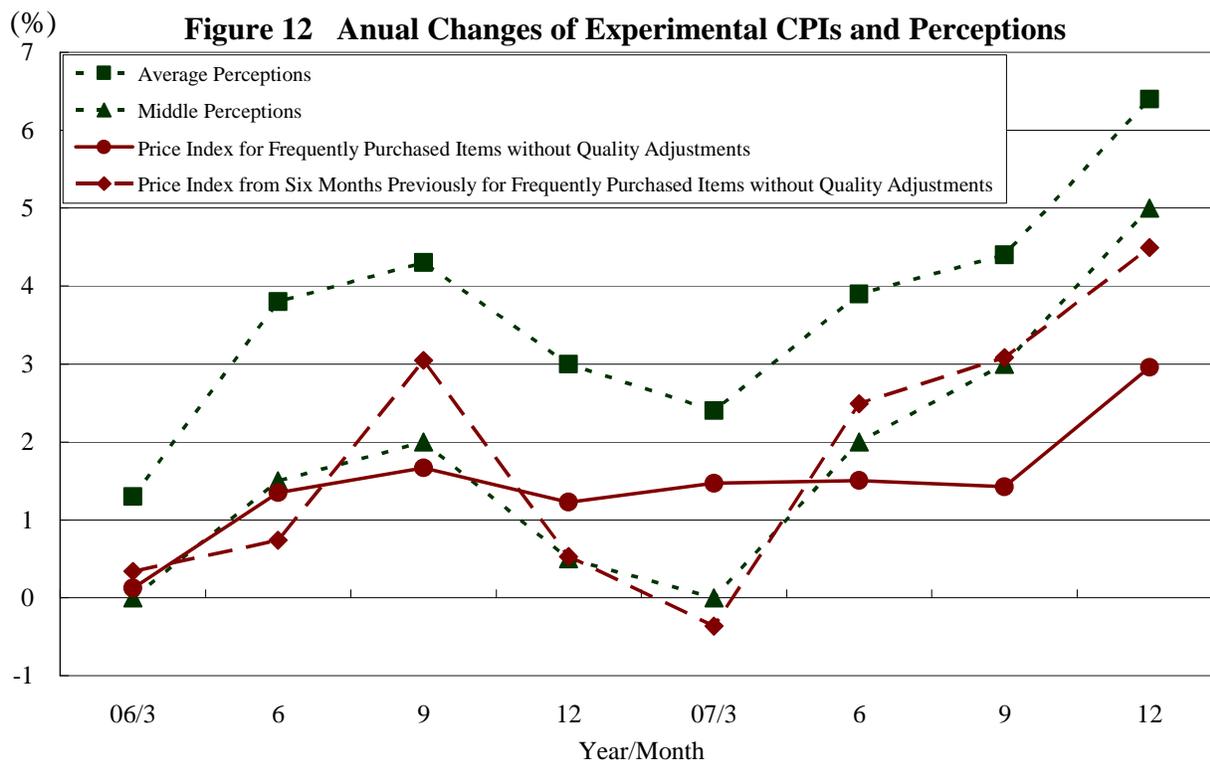
Figure 11 shows annual changes of the index for frequently purchased items without quality adjustments compared against the annual changes of the CPI. Before 2000, both changes indicated almost similar tendencies, but except for 2005 after 2000 they differed, whereby the annual change of the index for frequently purchased items without quality adjustments was higher than or equal to that of the CPI, especially in 2007, where it reached 1.7 percent, much higher than 0.0 percent for the CPI. Compared to in 2006, effects with quality adjustments and frequency on the gap were amplified in 2007, sparking discussions concerning the gap between the perceived and measured inflation.

On the other hand, the annual change in frequently purchased items without quality adjustments was still lower than that based on the opinion poll which showed an increase exceeding two percent on every quarter in 2007.



These two series can be divided into changes by month. Figure 12 shows changes over the previous year of an experimental index, that is, for frequently purchased items without quality adjustments of the CPI, compared with those of the data of the Opinion Survey on the General Public's Views and Behavior on March, June, September and December in 2006 and 2007. Changes over the previous year of the experimental index move approximately with the medium value of perceived inflation by the opinion poll to some extent. In short, changes of the CPI resemble perceived inflation more closely if they are compiled by neglecting quality adjustments and infrequently purchased items.

Nevertheless, they do not match exactly on an overall basis. If the changes were substituted so as to reflect recent changes, for instance, with annual changes calculated based on changes from six months previously, excluding items for fresh vegetables¹⁵, they would resemble the data more closely, particularly medium values, based on the Opinion Survey. Consumers' perception of the price increase is more likely to be affected by the shorter-term price changes, such as recent six months.



Consumers' perception of inflation is likely to be affected not only by the prices of goods and services they purchase but also reporting in the news media. The latter effect is quite difficult to measure quantitatively. It should also be added that the observation period of the Opinion Survey ranges nearly one month from around the middle of the previous month to the current month; the observation day of the CPI, on Wednesday, Thursday or Friday in a week including the twelfth day of the current month in

¹⁵ Fresh vegetables have so strong seasonality that prices for them are missing for some months and cannot be compared among months.

VII Conclusion

The above empirical analyses regarding the gap between perceived and measured inflation lead us to the following conclusions.

The gap in perception inflation from measured inflation is mainly caused by three factors; quality adjustments, purchasing frequency and price changes of the nearest time period, all of which can be evaluated quantitatively to some extent and pictured by recompiling data used for the CPI.

As far as needs of users of more detailed information on the CPI have increased, it is beneficial to provide an experimental index occasionally to show the perceived inflation formed from components of the CPI, with explanations regarding the index and surroundings, to facilitate user better understanding of the latter, and, moreover, to enhance the usefulness, accountability and credibility of the official CPI.

Further detailed empirical analyses to evaluate effects by quality adjustments as shown in this paper are necessary, using exactly the same coverage of data, with the same regional weights over the entire nationwide area, with the same imputation methodologies used to compensate for the lack of specifications in local area as for compilation of the CPI.

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¹⁶ Prices for fresh foods were observed three times on Wednesday, Thursday or Friday in weeks including the fifth, twelfth and twenty-second days of the month for the CPI.