



## The Consumption Activity Index: Improvements of Release Contents and Revisions of Compilation Methodology

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**The Consumption Activity Index:  
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Methodology\***

**Abstract**

In this paper, we explain improvements of the release contents and revisions of the compilation methodology of the Consumption Activity Index (CAI). Regarding improvements of the release contents, first, we will provide the CAI (adjusting travel balance) one month earlier than the current release schedule by using the immigration statistics. Second, the levels and contributions of the real CAI components (durable goods, non-durable goods, and services) will be released on a monthly basis. Regarding the revisions of the compilation methodology, first, we will change the weight of life insurance expenditure. Second, we will use a new data source for electricity consumption as existing data source is no longer available. These revisions have enabled us to improve the overall performance of the CAI by further increasing its correlation with consumption trends in the *Annual Report on National Accounts* (ARNA), while maintaining its small short-term fluctuations and high correlations with various confidence indicators.

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## ***1. Introduction***

Nakamura et al. (2016) proposed the Consumption Activity Index (CAI), which is a highly precise and comprehensive measure of private consumption released in a timely fashion, and accompanies only small statistical fluctuations. Following the initial release of the CAI in May 2016, we have posted monthly indicators of the CAI to the Bank of Japan's website. As described in Nakamura et al. (2016), with the CAI being an "open-source" indicator, we elicit opinions and requests from users and update the CAI accordingly on an ongoing basis. We have received various suggestions and comments since our first release in May. Taking such feedback into account, we provide here in this paper a detailed picture of the improvements in the release contents and revisions to the compilation methodology of the CAI.

In section 2, we describe improvements made to the release contents. In section 3, we explain revisions to the compilation methodology. In section 4, we highlight future challenges for further enhancement of the CAI based on opinions and requests from users. Section 5 concludes.

## ***2. Improvements of Release Contents of the CAI***

First, we will provide the CAI (adjusting travel balance) one month earlier than the current release schedule by using immigration data. Second, the levels and contributions of the real CAI components (durable goods, non-durable goods, and services) will be released on a monthly basis. We explain the details below.

### **(1) Earlier release of the CAI (adjusting travel balance)**

The CAI (adjusting travel balance) is a consumption indicator that excludes consumption of foreign visitors and is useful for evaluating consumption trends of the Japanese people.<sup>1</sup> Since the original CAI (adjusting travel balance) is compiled using data from the balance of payments statistics, the release timing had lagged behind by about one month from the CAI which includes foreign visitors' consumption.

In order to release the CAI (adjusting travel balance) at an earlier timing, we will estimate the travel balance by using the immigration statistics (Japan National

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<sup>1</sup> This also includes consumption of foreigners who live in Japan.

Tourism Organization [JNTO]), which is the underlying source data of travel balance in the balance of payments statistics. We will release the CAI (adjusting travel balance) and the non-adjusted CAI, which includes inbound tourism consumption concurrently. More specifically, we estimate the travel balance by using the immigration statistics based on the assumption that the per capita consumption amount is constant from that of the previous month (Chart 1 [1]). Since the estimated travel balance and the actual data are almost identical, monthly revisions are supposed to be small (Chart 1 [2]). The estimated CAI (adjusting travel balance) using the immigration statistics is very similar to the actual CAI (adjusting travel balance) based on the balance of payments data. The mean absolute error (MAE) of the difference between these two indicators (seasonally adjusted, month-on-month percentage changes) is 0.05 percentage points (Chart 2).

By estimating travel balance with the immigration statistics, we can shift forward the release date of the CAI (adjusting travel balance) by one month. Monthly revisions will be subtle, and hence we will be able to judge economic conditions in a timely manner.

## **(2) Monthly release of CAI components**

In line with the publication of the CAI paper in May 2016, we described movements of the CAI using contributions from the three components -- durable goods, non-durable goods, and services. After the first release of the CAI, we have received many requests from users asking for the publication of these components data together with the CAI. We will publish the levels of these components and their contributions in terms of quarter-on-quarter and month-on-month changes as shown in Chart 3.

### ***3. Revisions of the CAI compilation methodology***

#### **(1) Changes in the weight of life insurance expenditure**

Revisions of source statistics have been reflected in the monthly CAI on an ongoing basis. The largest source statistics revision that took place during the 6-month window following the first CAI release was to life insurance published in *Indices of Tertiary Industry Activity* (ITA; Ministry of Economy, Trade, and Industry [METI]). The Bank of Japan's Research and Statistics Department estimates the latest figures of life insurance expenditure since the official data of the ITA are not available at the time when the CAI

is released.<sup>2</sup> The official life insurance data of the ITA are published in the following month, although ITA data are also extrapolated by METI.<sup>3</sup> The actual data of life insurance are published by the Life Insurance Association two months after the first estimation and are reflected in the ITA (Chart 4 [1]).

Revisions to the actual figures should be minimal if an alternative estimation is conducted -- like that of travel balance already mentioned in the previous section -- using other data which are closely correlated with the actual data. Regarding life insurance expenditures, since reliable data for estimation do not exist, we therefore extrapolate its developments from past patterns. Such estimation is deemed appropriate and the size of revisions should be small if movements in the indicator are smooth. March and April data were prone to large revisions due to unusual patterns seen in life insurance data this year. The life insurance premium was to be raised in April and front-loaded sales of life insurance happened followed by a subsequent decline in sales (Chart 4 [2]).

In response, the CAI also underwent large revisions (Chart 4 [3]). Two reasons stand out for this: (1) revisions to life insurance data were significant and (2) it is possible that the weight of life insurance expenditure in the CAI turns out to be somewhat larger than the actual picture. When compiling the CAI, we use the *Family Income and Expenditure Survey* (FIES) as a main source statistics for its weighting. A variety of goods and services are integrated into three categories: durable goods, non-durable goods, and services. These three categories are then integrated into one single category using weights of the *System of National Accounts* (SNA) (Chart 5). Since expenditure data of life insurance in the FIES are not available, we use telecommunication expenditure data of the FIES and weights from the Input-Output Table to estimate the weight of life insurance expenditure to be used at the elementary level of integration (Chart 6 [1]). However, this methodology could overestimate the weight of life insurance expenditure compared with that in the SNA (Chart 6 [2]). Therefore, we alter the weight of life insurance expenditure so that its weight in the CAI -- about 8 percent of consumption expenditure -- coincides with that in the Input-Output Table.<sup>4</sup>

Next, we show how the change in the weight of life insurance expenditure affects the performance of the CAI. As was the case for the original CAI, we check the performance of the CAI from the following three approaches: (i) cross-comparison with

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<sup>2</sup> We use a simple estimation methodology: the three-month average of year-on-year changes.

<sup>3</sup> METI uses the ARIMA model for estimation.

<sup>4</sup> As a result, the weights of other services increased.

the *Annual Report on National Accounts* (ARNA), (ii) the size of monthly and quarterly fluctuations, and (iii) cross-comparison with confidence indicators. Regarding cross-comparison with the ARNA, Chart 7 (1) shows that the CAI based on the new life insurance expenditure weight performed much better than the original CAI. Next, Chart 7 (2) shows that the sizes of monthly and quarterly fluctuations of the CAI including the new life insurance expenditure weight are comparable with the original CAI. Finally, Chart 7 (3) reveals that the correlations of the new CAI with confidence indicators are similar to those of the original CAI.

Based on the above assessments, we believe that the performance of the CAI will be improved by changing the weight of life insurance expenditure. Therefore, we will use the new life insurance expenditure weight from the next publication.<sup>5</sup>

## **(2) Changes in source statistics of electricity consumption**

The sales amount of meter-rate lighting A or B, common types of contract for households, published by the Agency for Natural Resources and Energy was originally used as source statistics for electricity consumption in the CAI. The source statistics are no longer available due to changes in the Agency's publication format in accordance with the liberalization of retail electricity sales. As a replacement for this, we use electricity sales for all-type lighting contracts including not only households, but also small retail stores and others published by the Agency. The old and new source statistics show similar movements in both monthly and quarterly frequencies (Chart 8 [1]). Regarding cross-comparisons with the ARNA and confidence indicators, the CAI using the new electricity data source is comparable with that of the CAI based on old data (Chart 8 [2] and [3]).

## **(3) Overall performance of the new CAI**

We will check to see how the overall performance of the new CAI has changed with the inclusion of the new life insurance expenditure weight and new source data for electricity consumption. First, a cross-comparison with the ARNA in Chart 9 (1) shows that the performance of the new CAI is better than the old CAI. Next, the sizes of monthly and quarterly fluctuations of the new CAI are similar to those of the old CAI (Chart 9 [2]). Finally, cross-comparisons with confidence indicators depict that the performance of the new CAI is almost the same as that of the old CAI (Chart 9 [3]). Based on the above findings, it may well be said that the performance of the new CAI is

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<sup>5</sup> The new weights of all components will be published in the "Research Data" section at the Bank of Japan's website.

better than that of the old CAI.

#### ***4. Future Challenges for Further Enhancement***

Based on comments and suggestions from users, we explain here the issues that were considered for further enhancement, but are rather subject to future challenges.

##### **(1) E-books**

Sales of e-books are increasing with more people using smartphones. Annual data on e-book sales (“eBook Marketing Report” by Impress Research Institute) show that the market scale of e-books has increased dramatically in the past few years (Chart 10). The problem, however, is that neither monthly nor quarterly data are available. We will include e-books data to the CAI should monthly or quarterly data become available in the future.

##### **(2) Charges for online content**

Some online content, such as online games, cloud services, and smartphone applications, are free of charge up to a certain amount, but charged for uses beyond that range. The CAI Plus includes digital content delivery services -- which include online delivery of music and video contents, streaming services, and content delivery services -- and they are more or less recognized conceptually in the statistics. However, the latest coverage of the source statistics is unclear and sales of online content provided by foreign entities are not captured in these source statistics. These sales data are not available and therefore the CAI does not include such data. We hope for enhancement of source data to be made to online content delivery services in the future.

#### ***5. Conclusion***

In this paper, we explained improvements of the release contents and revisions of the compilation methodology of the CAI. Regarding the release contents, first, by using the immigration statistics, we will provide the CAI (adjusting travel balance) one month earlier than the current release schedule. Second, the levels and contributions of the real CAI components (durable goods, non-durable goods, and services) will be released on a monthly basis. Regarding the revisions of the compilation methodology, first, we

change the weight of life insurance expenditure. Second, we use a new data source for electricity consumption as existing data source is no longer available. These revisions have enabled us to improve the overall performance of the CAI by further increasing its correlation with consumption trends in the ARNA, while maintaining its small short-term fluctuations and high correlations with various confidence indicators.

As a result of these improvements, more CAI-related indicators will be available at an earlier timing and revisions of the first release are expected to remain small, which in turn will bring more benefits and conveniences to users for those assessing economic conditions.

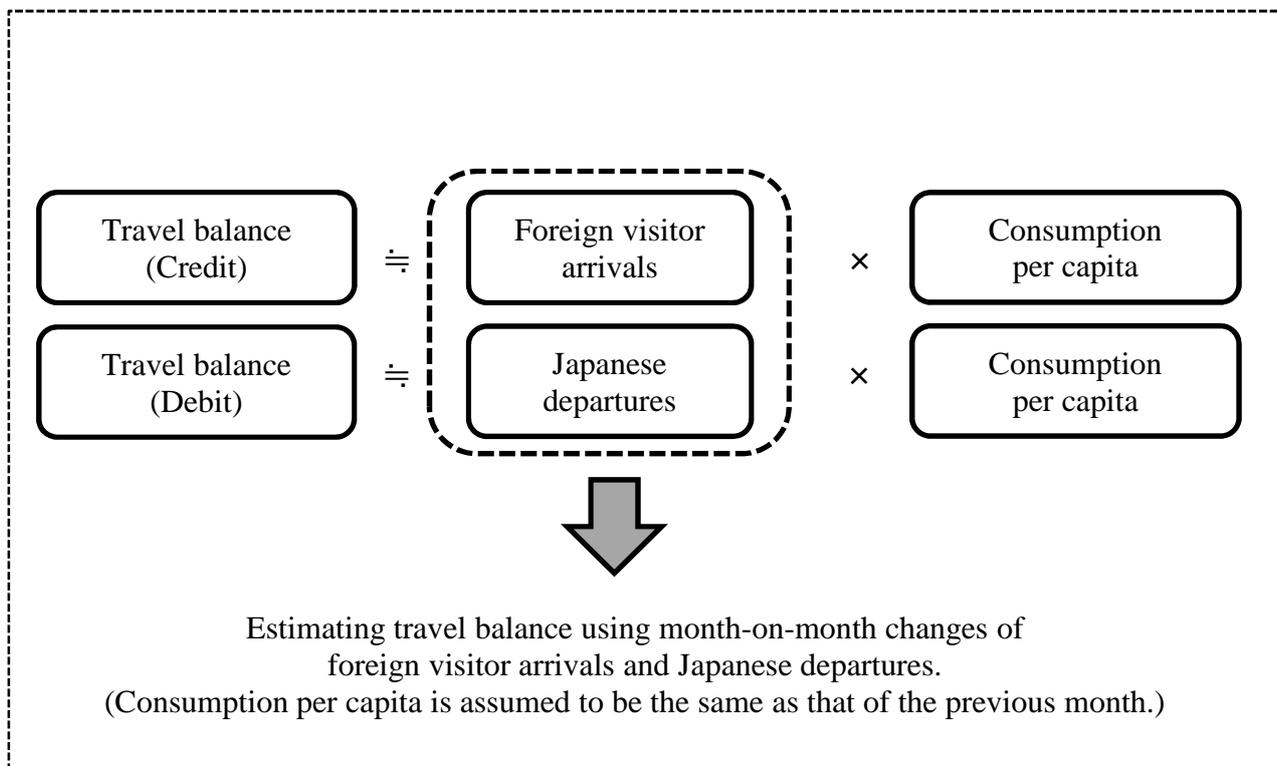
We know, however, that there is still room left for more items to be captured and in doing so the CAI will become a more accurate consumption indicator. We will continue on with our project to further improve the CAI as an “open source” economic indicator by eliciting opinions from users regarding source statistics and its compilation methodology.

## Reference:

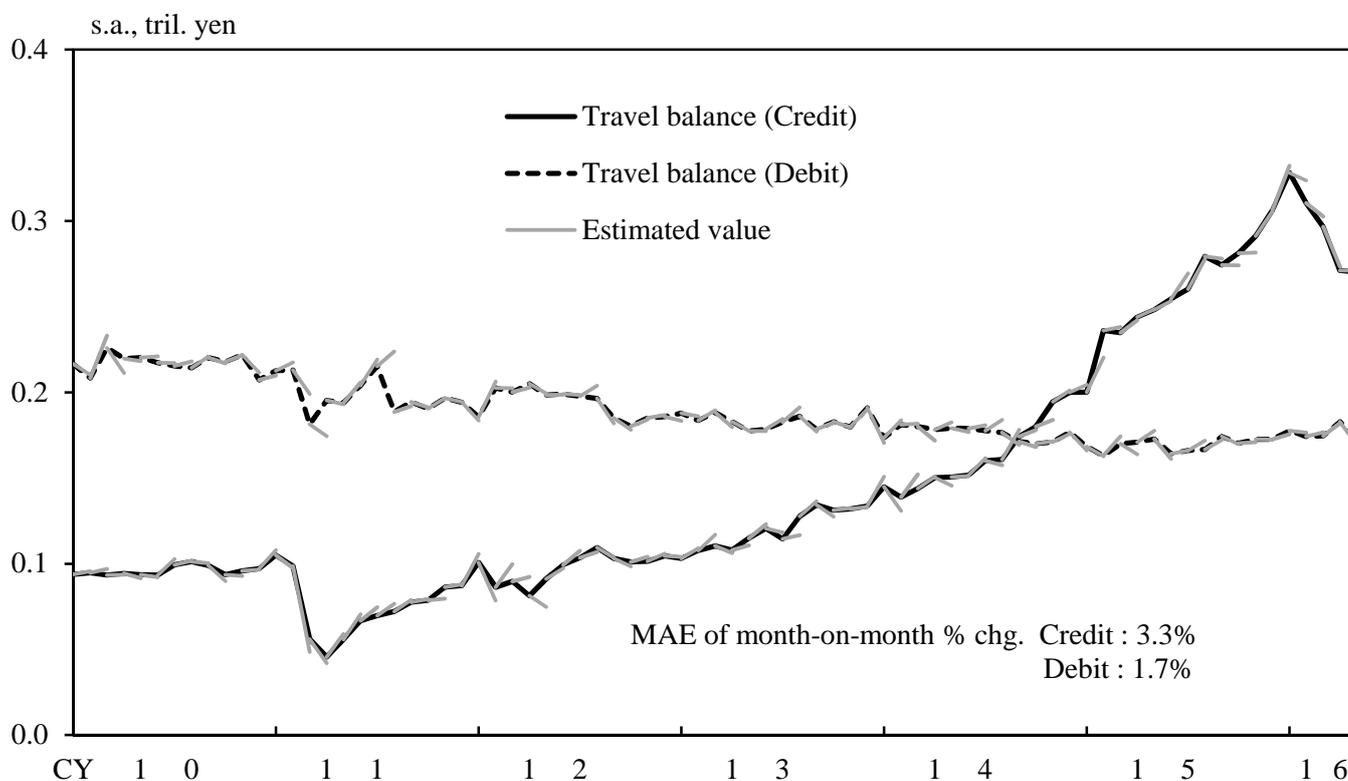
Koji Nakamura, Hiroshi Kawata, Masaki Tanaka, and Lisa Uemae, 2016, “The Consumption Activity Index,” Bank of Japan Research Paper  
[http://www.boj.or.jp/en/research/brp/ron\\_2016/ron160502a.htm/](http://www.boj.or.jp/en/research/brp/ron_2016/ron160502a.htm/)

## Estimation of Travel Balance

### (1) Estimation Method of Travel Balance



### (2) Performance of Estimation

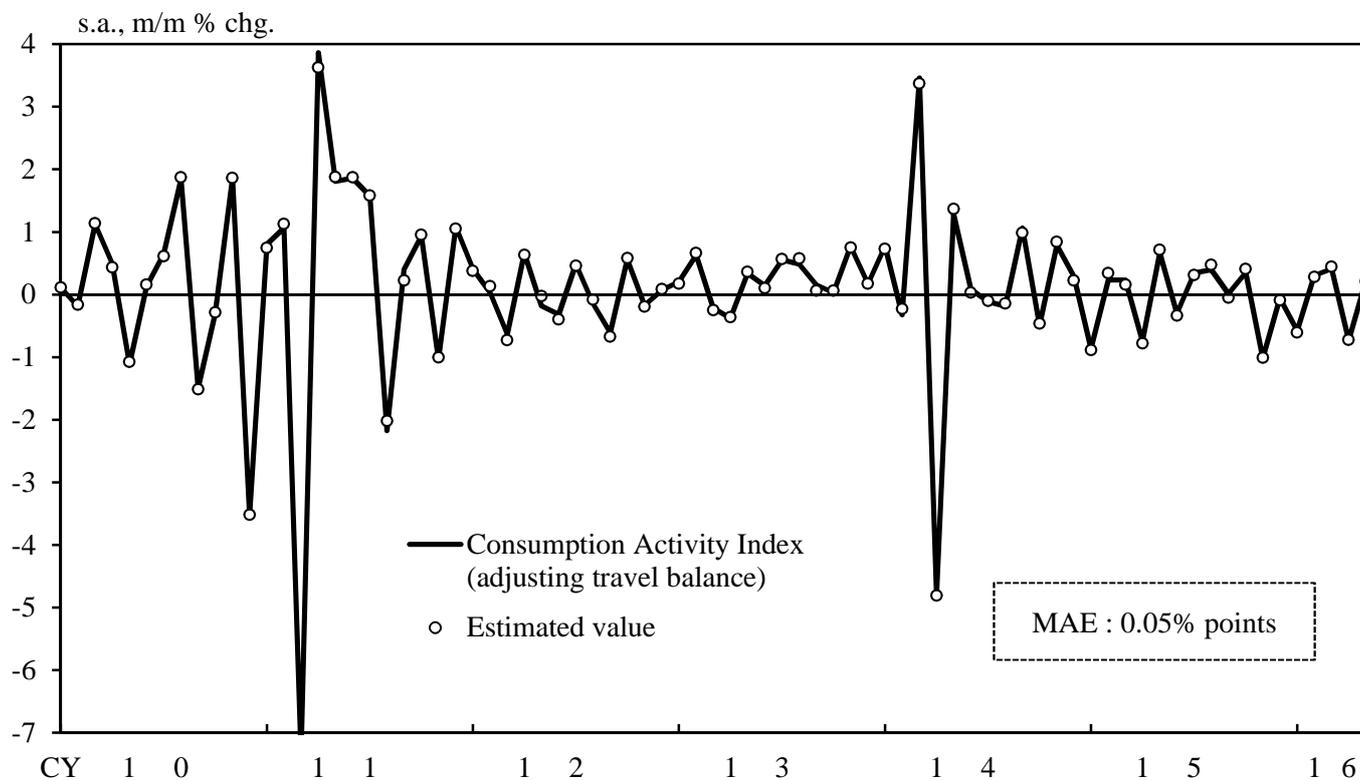


Notes: 1. To evaluate the performance of the estimation accurately, real-time data of travel balance are used.  
2. Sample period of MAE (Mean Absolute Error) is January 2010-May 2016.

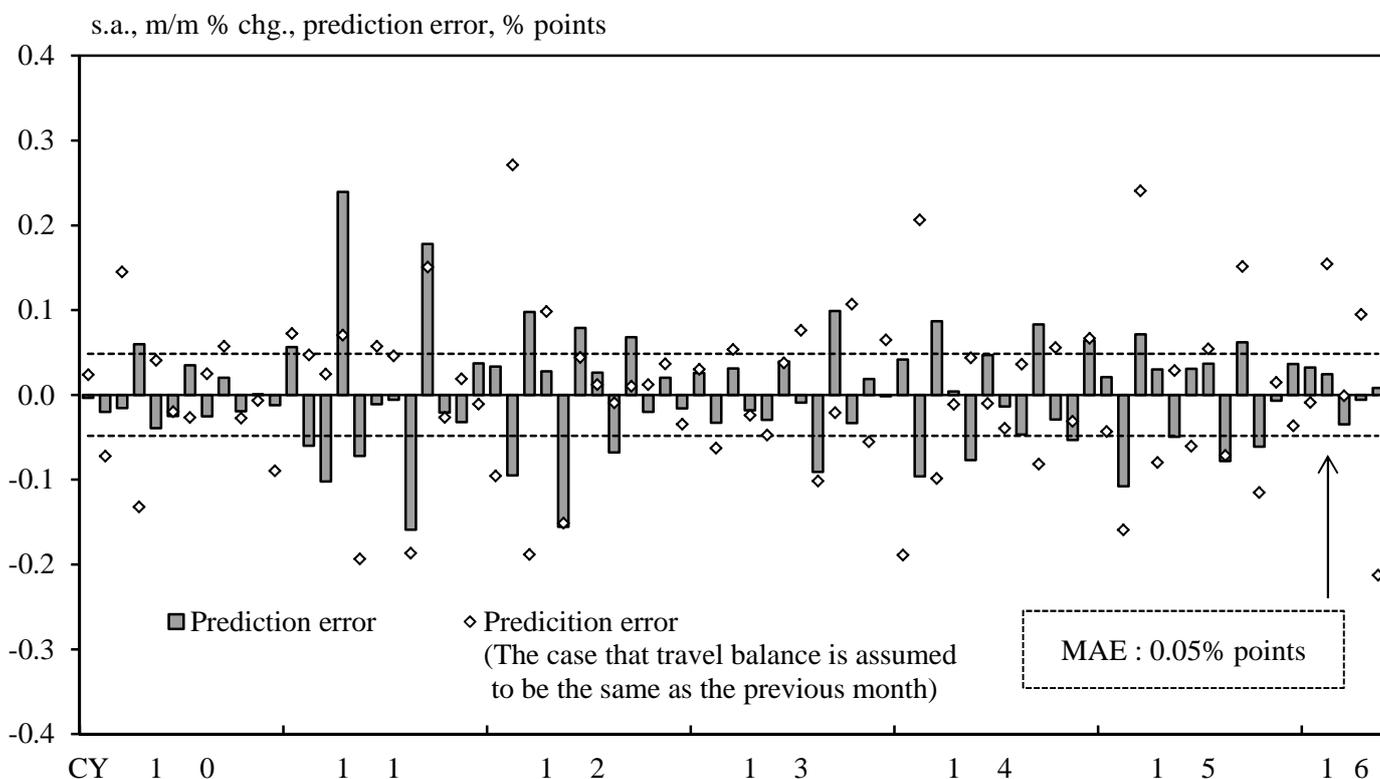
Sources: Japan National Tourism Organization (JNTO); Ministry of Finance and Bank of Japan.

## Estimation of Consumption Activity Index (adjusting travel balance)

(1) Estimated Value of Consumption Activity Index (adjusting travel balance)



(2) Prediction Error of Estimated Value

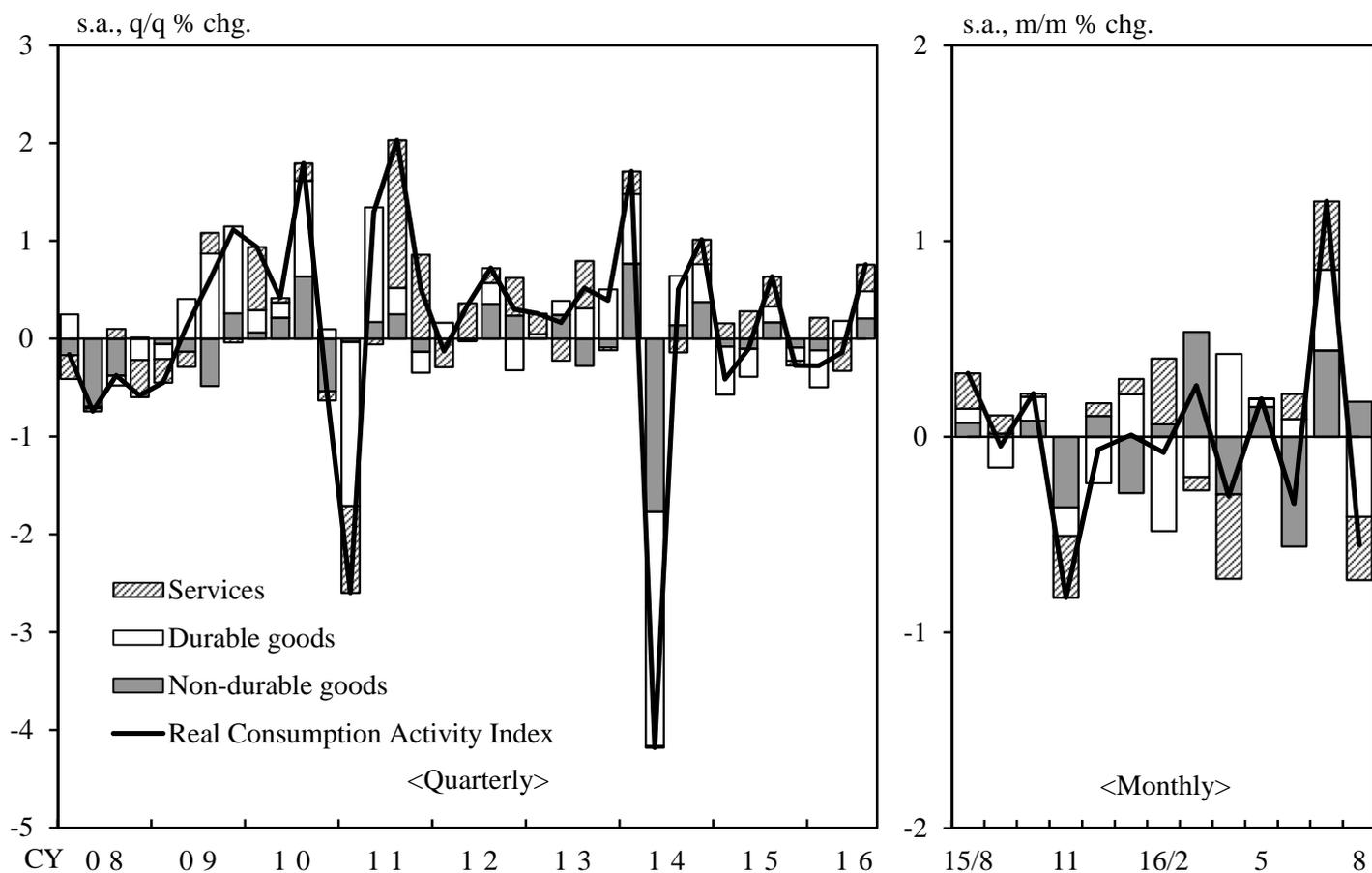


Notes: 1. To evaluate the performance of the estimation accurately, real-time data of travel balance are used.

2. Sample period of MAE (Mean Absolute Error) is January 2010-May 2016.

Sources: Cabinet Office; Bank of Japan; Ministry of Economy, Trade and Industry; Ministry of Internal Affairs and Communications, etc.

### Real Consumption Activity Index: Contributions by Type

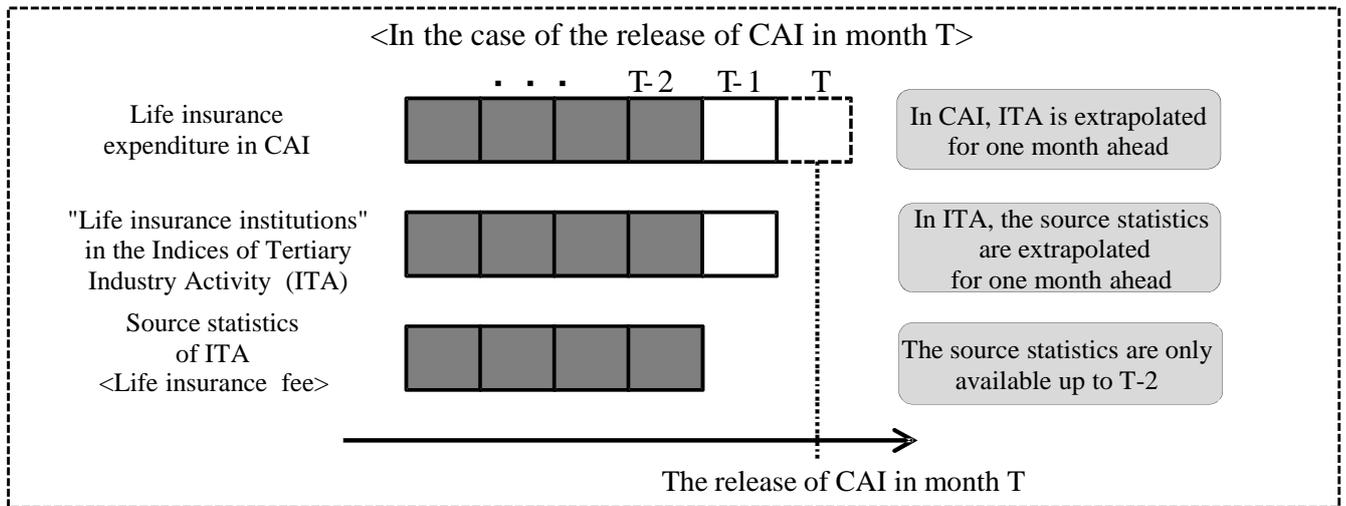


Note: Figures for 2016/Q3 are July-August averages.

Sources: Cabinet Office; Bank of Japan; Ministry of Economy, Trade and Industry; Ministry of Internal Affairs and Communications, etc.

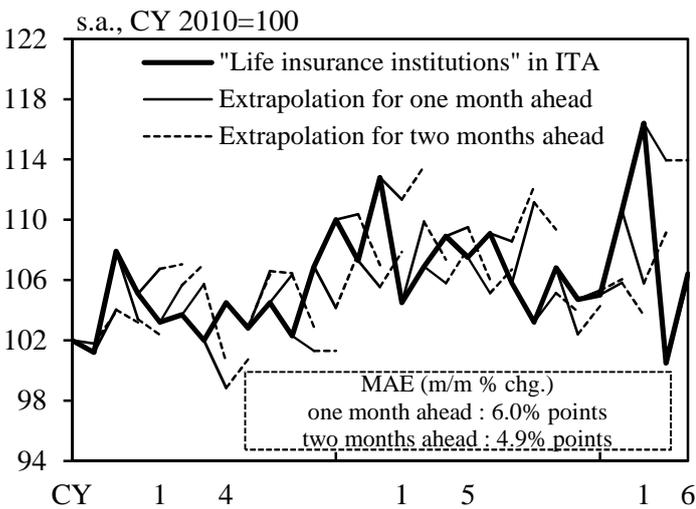
## Extrapolation of Life Insurance Expenditure

### (1) Extrapolation and Release Schedule of Life Insurance Expenditure

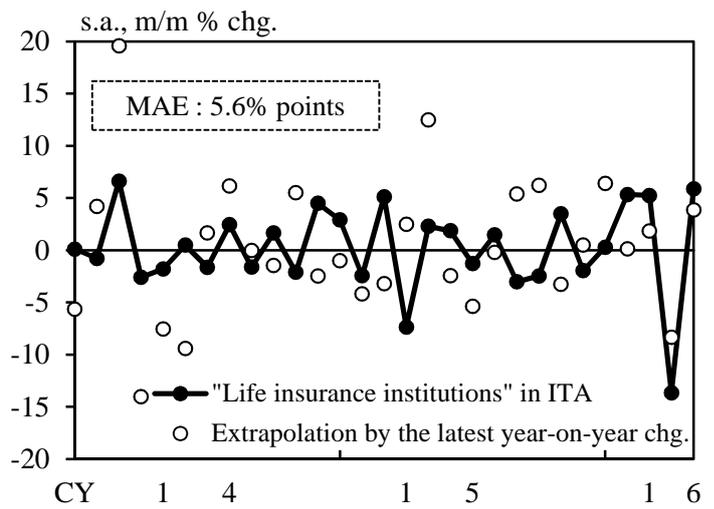


### (2) Extrapolation and Revision of Life Insurance

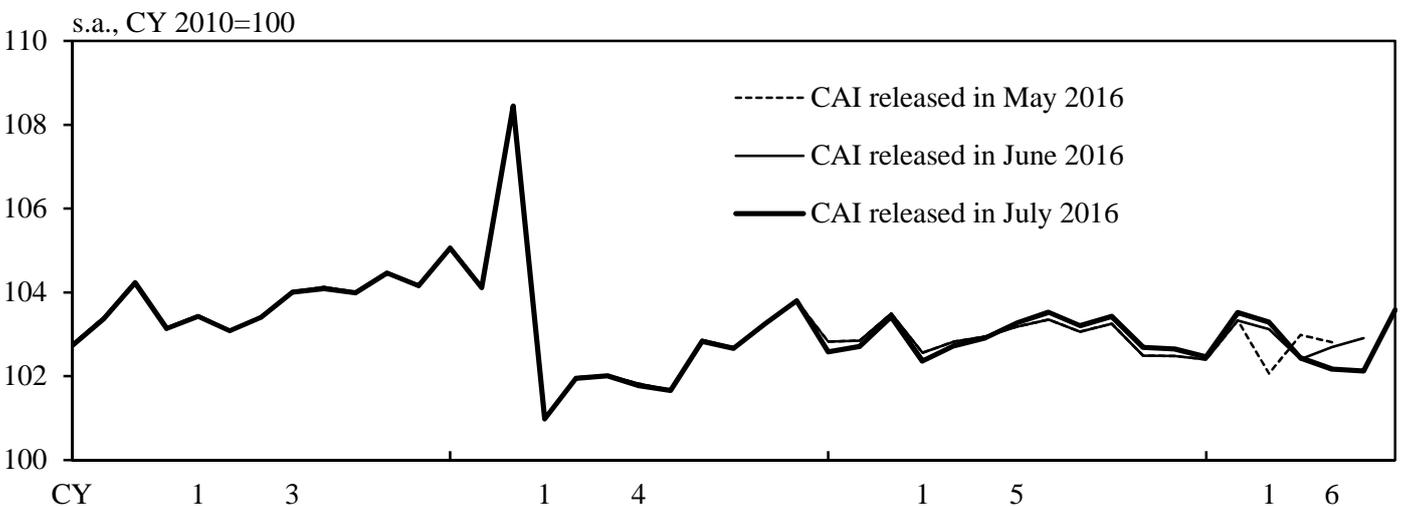
#### (a) Extrapolation and Revision in ITA



#### (b) Extrapolation and Revision in CAI

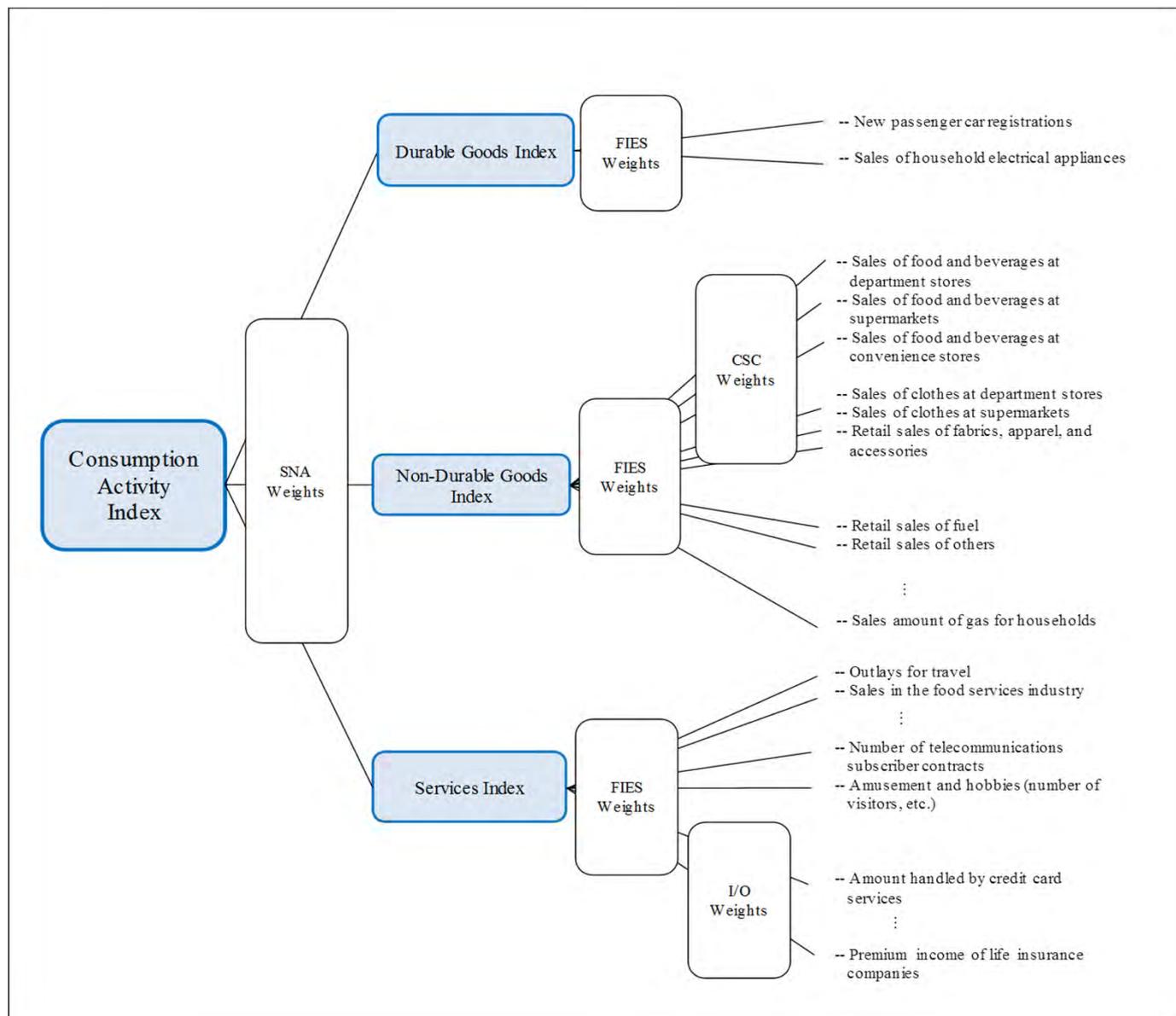


### (3) Revision of CAI



Notes: 1. Figures for the extrapolation in (2)(a) are estimated using ARIMA model.  
 2. Figures for the extrapolation in (2)(b) are estimated using the latest ITA, while omitting the effect of revision of ITA.  
 3. Sample period of MAE (Mean Absolute Error) is January 2010-May 2016.  
 Sources: Cabinet Office; Bank of Japan; Ministry of Economy, Trade and Industry; Ministry of Internal Affairs and Communications, etc.

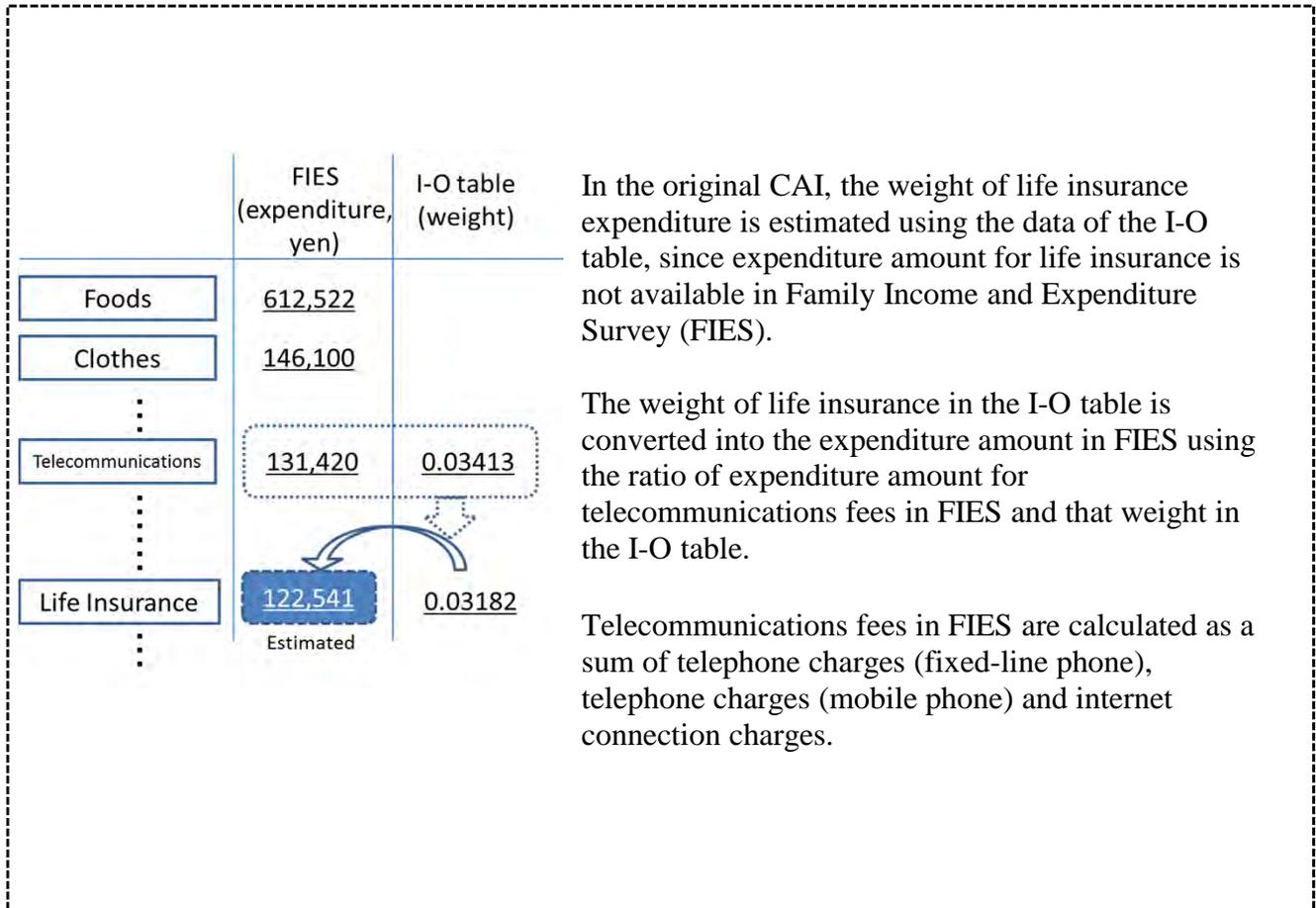
## Weights of Consumption Activity Index



- Notes: 1. System of National Accounts (SNA) weights are those of each consumption type in nominal domestic final consumption expenditure of households in the SNA.
2. FIES weights are those of each good/service in yearly total consumption expenditures in the Family Income and Expenditure Survey.
3. CSC weights are those of each good in yearly sales of each business category in the Current Survey of Commerce.
4. I/O weights are those of each service in the household consumption expenditure in the Input-Output Tables.
5. SNA weights, FIES weights, and CSC weights are those of CY 2010. I/O weights are those of CY 2011.
6. CSC weights are used for integrating some series classified as non-durable goods. I/O weights are used for integrating some series classified as services.

## Weight of Life Insurance Expenditure

### (1) Calculation of Weight of Life Insurance Expenditure in CAI

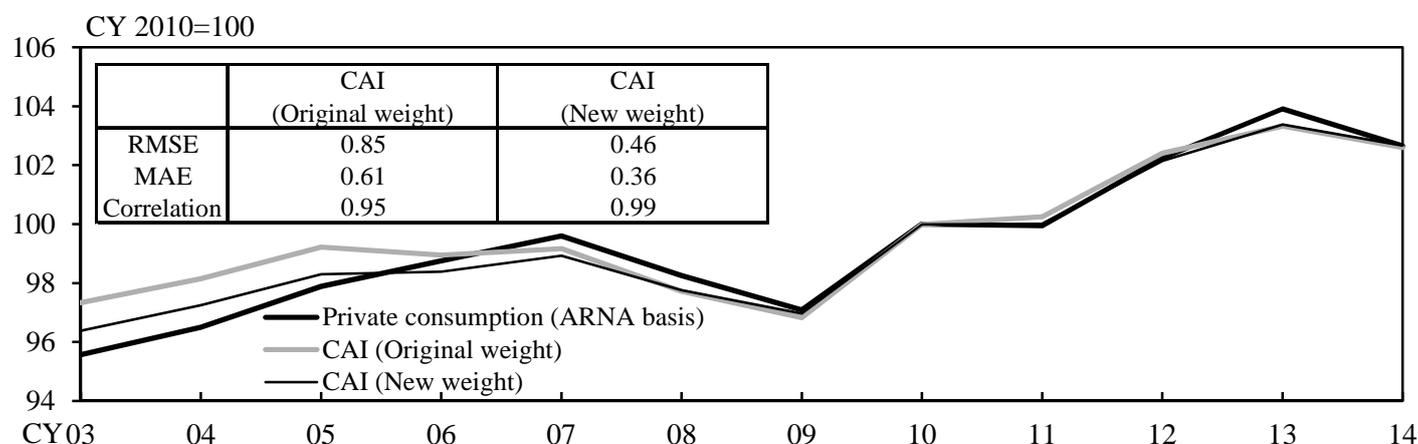


### (2) Weights of Life Insurance Expenditure in Service Category

	Weights of life insurance in service category
Consumption Activity Index <Original weight>	About 17%
Private Consumption in the I-O table (Excluding Imputed Rent)	About 8%
Consumption Activity Index <New weight>	About 8%

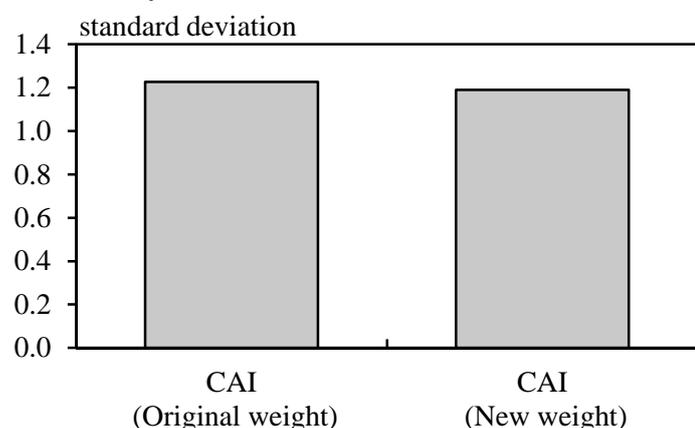
## Performance of CAI Before and After Changes in the Life Insurance Weight

### (1) Comparison with Private Consumption in Annual Report on National Accounts (ARNA)

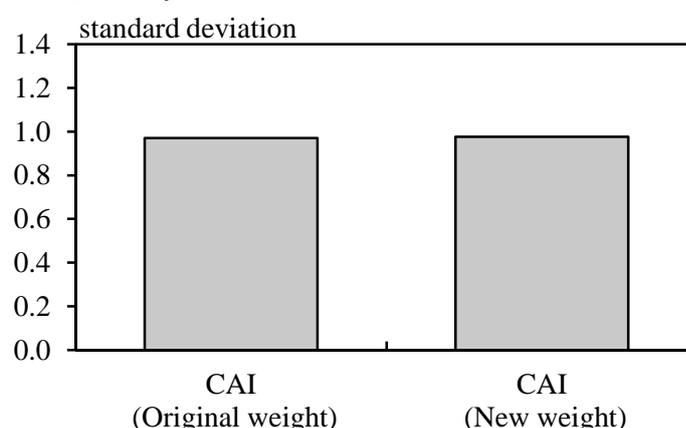


### (2) Size of Monthly and Quarterly Fluctuations

#### (a) Monthly Fluctuations

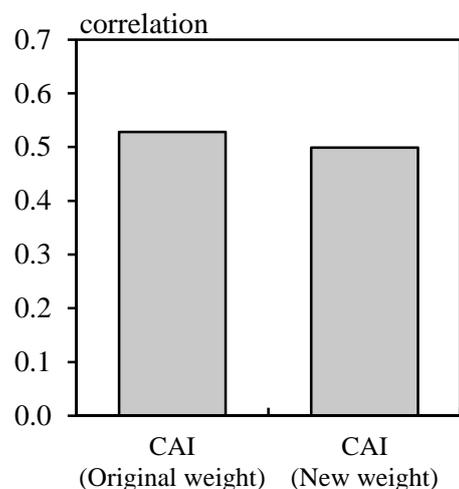


#### (b) Quarterly Fluctuations

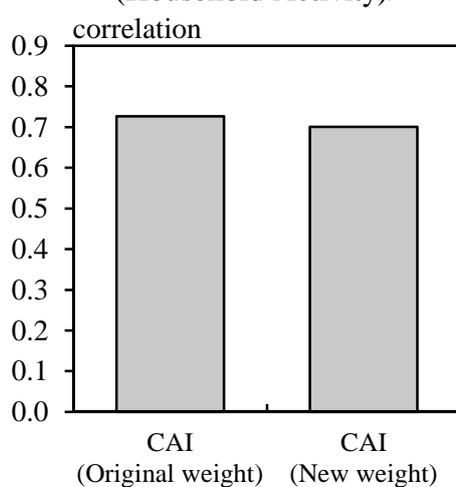


### (3) Correlation with Confidence Indicators

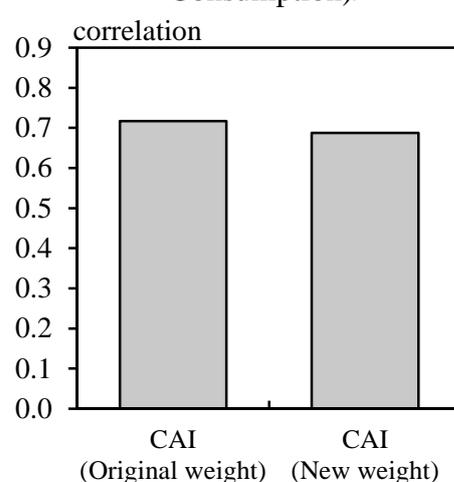
#### <Consumer Confidence Index>



#### <Economy Watchers Survey (Household Activity)>



#### <Tankan (Related to Private Consumption)>



Notes: 1. RMSE (Root Mean Squared Error), MAE, and correlation in (1) are calculated in relation to the private consumption in the ARNA (sample period: CY 2003-CY 2014).

2. Sample period in (2)(a) is February 2003-December 2015. Sample period in (2)(b) is 2003/Q2-2015/Q4.

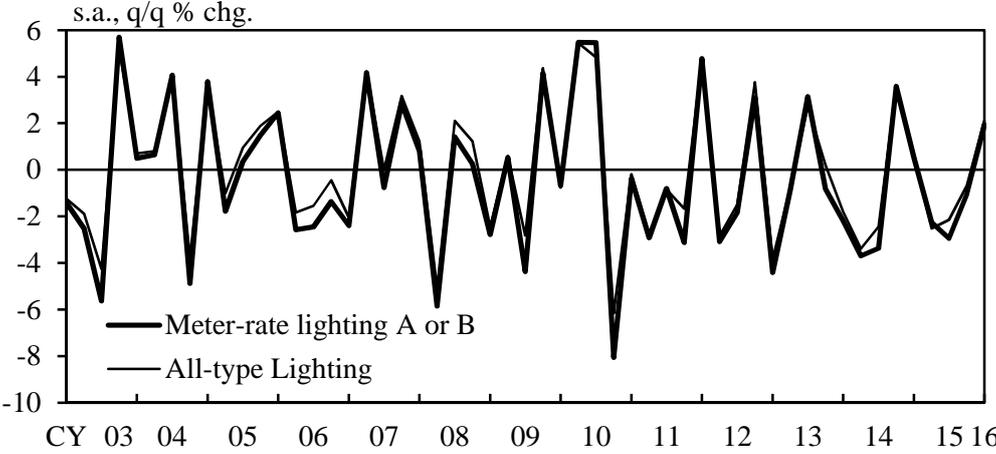
3. Sample period of correlations between the CAI and Consumer Confidence Index or Economy Watchers Survey in (3) is January 2003-December 2015. Sample period of correlations between the CAI and Tankan is 2004/Q1-2015/Q4.

Sources: Cabinet Office; Bank of Japan; Ministry of Economy, Trade and Industry; Ministry of Internal Affairs and Communications, etc.

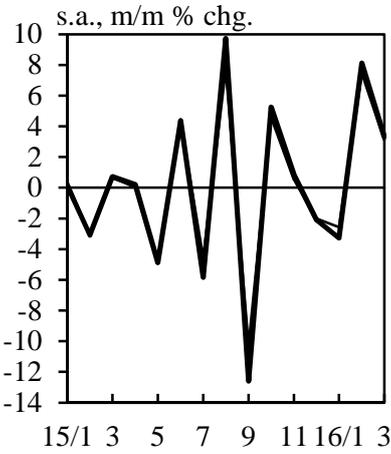
# Changes in Source Statistics of Electricity Consumption

(1) Comparison of All-type Lighting and Meter-rate Lighting A or B

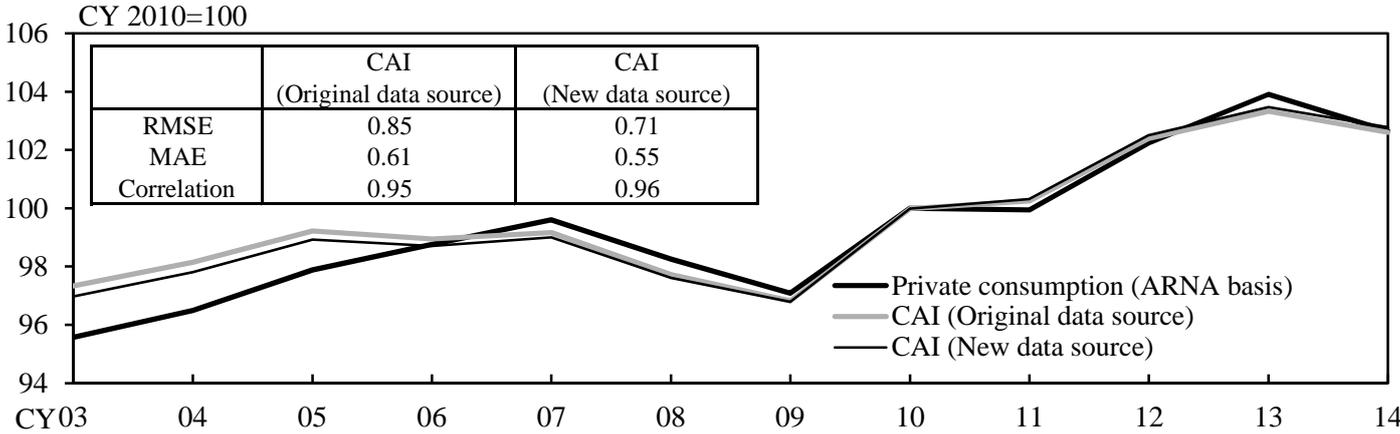
(a) Quarterly



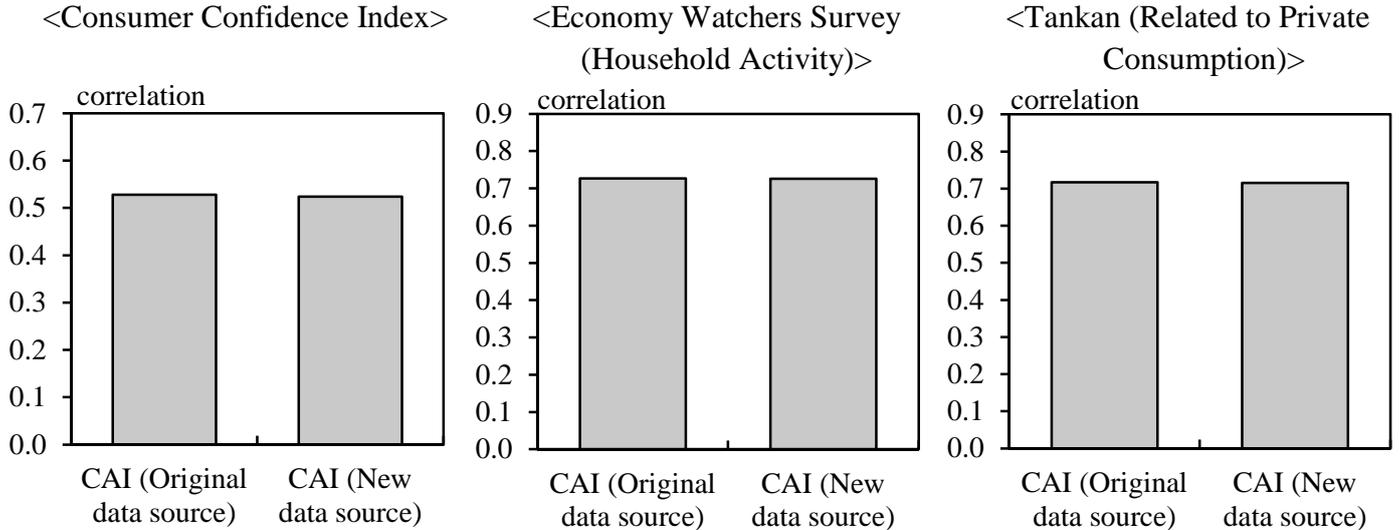
(b) Monthly



(2) Comparison with Private Consumption in ARNA



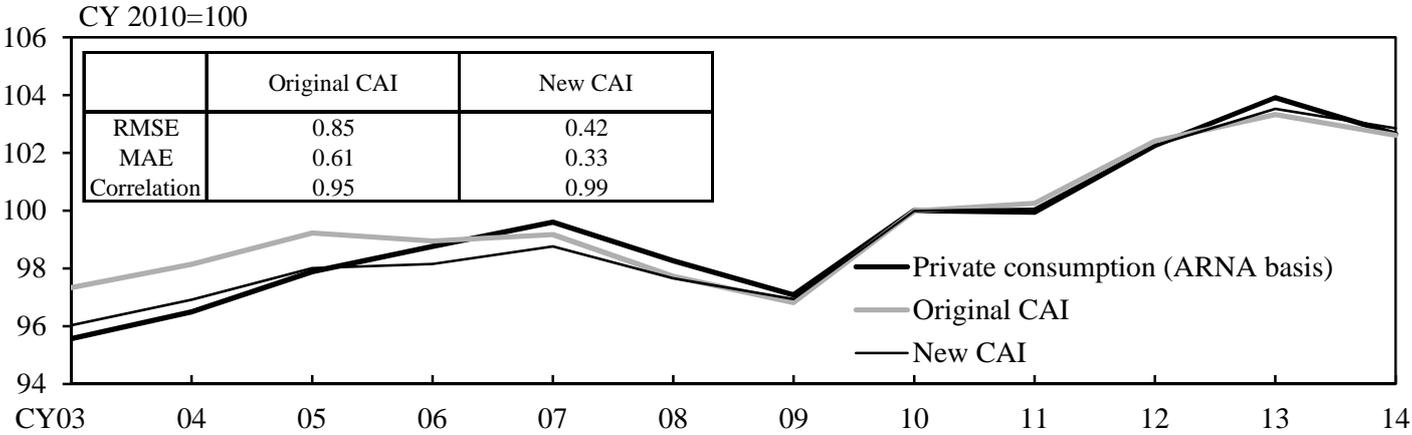
(3) Correlation with Confidence Indicators



Notes: 1. The Consumption Activity Index in this chart doesn't reflect the change in the weight of life insurance discussed before.  
 2. RMSE, MAE, and correlation in (2) are calculated in relation to the private consumption in the ARNA (sample period: CY 2003-CY 2014).  
 3. Sample period of correlations between the CAI and Consumer Confidence Index or Economy Watchers Survey in (3) is January 2003-December 2015. Sample period of correlations between the CAI and Tankan is 2004/Q1-2015/Q4.  
 Sources: Agency for Natural Resources and Energy; Cabinet Office; Bank of Japan; Ministry of Economy, Trade and Industry; Ministry of Internal Affairs and Communications, etc.

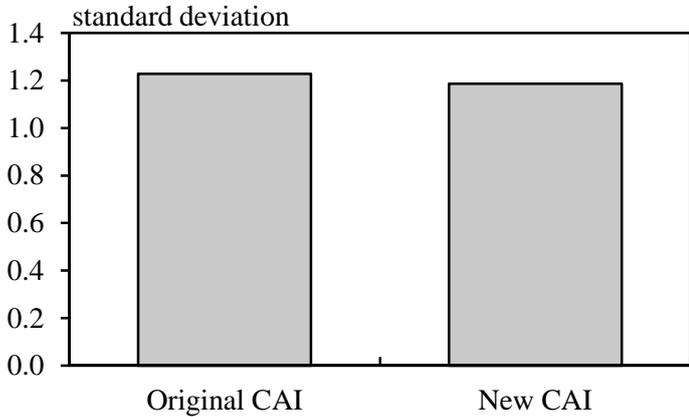
## Performance of the CAI Before and After Revisions

### (1) Comparison with Private Consumption in ARNA

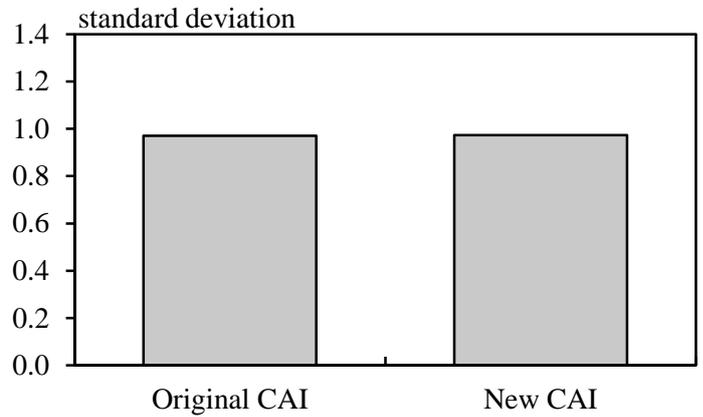


### (2) Size of Monthly and Quarterly Fluctuations

#### (a) Monthly Fluctuations

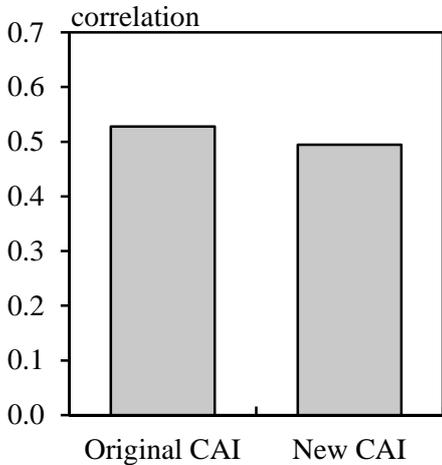


#### (b) Quarterly Fluctuations

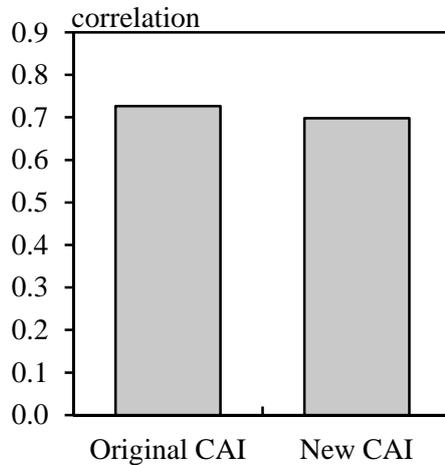


### (3) Correlation with Confidence Indicators

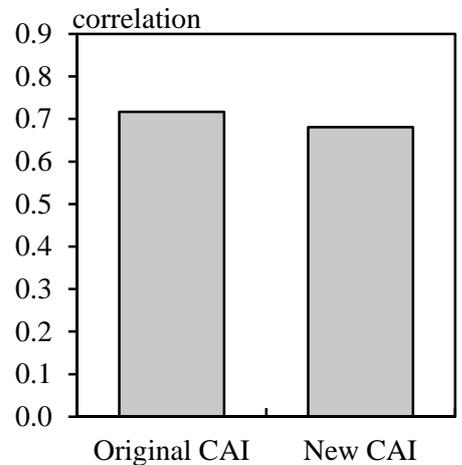
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#### <Economy Watchers Survey (Household Activity)>



#### <Tankan (Related to Private Consumption)>



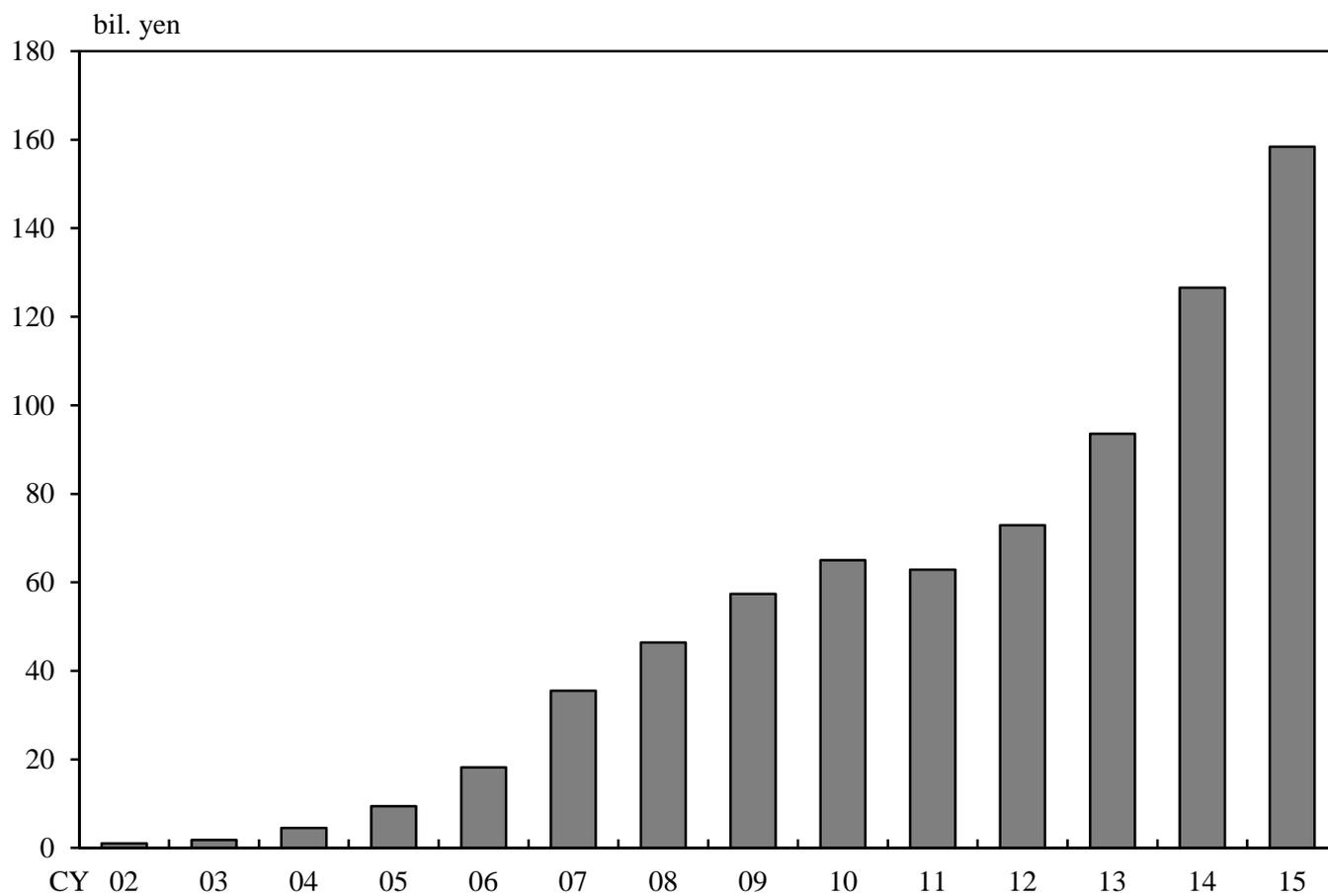
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Sources: Cabinet Office; Bank of Japan; Ministry of Economy, Trade and Industry; Ministry of Internal Affairs and Communications, etc.

## Market Scale of E-books



Source: Impress Research Institute "eBook Marketing Report" (in Japanese).