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Reevaluating Household Real Consumption through Attribute-Specific Price Indices and Actual Consumption

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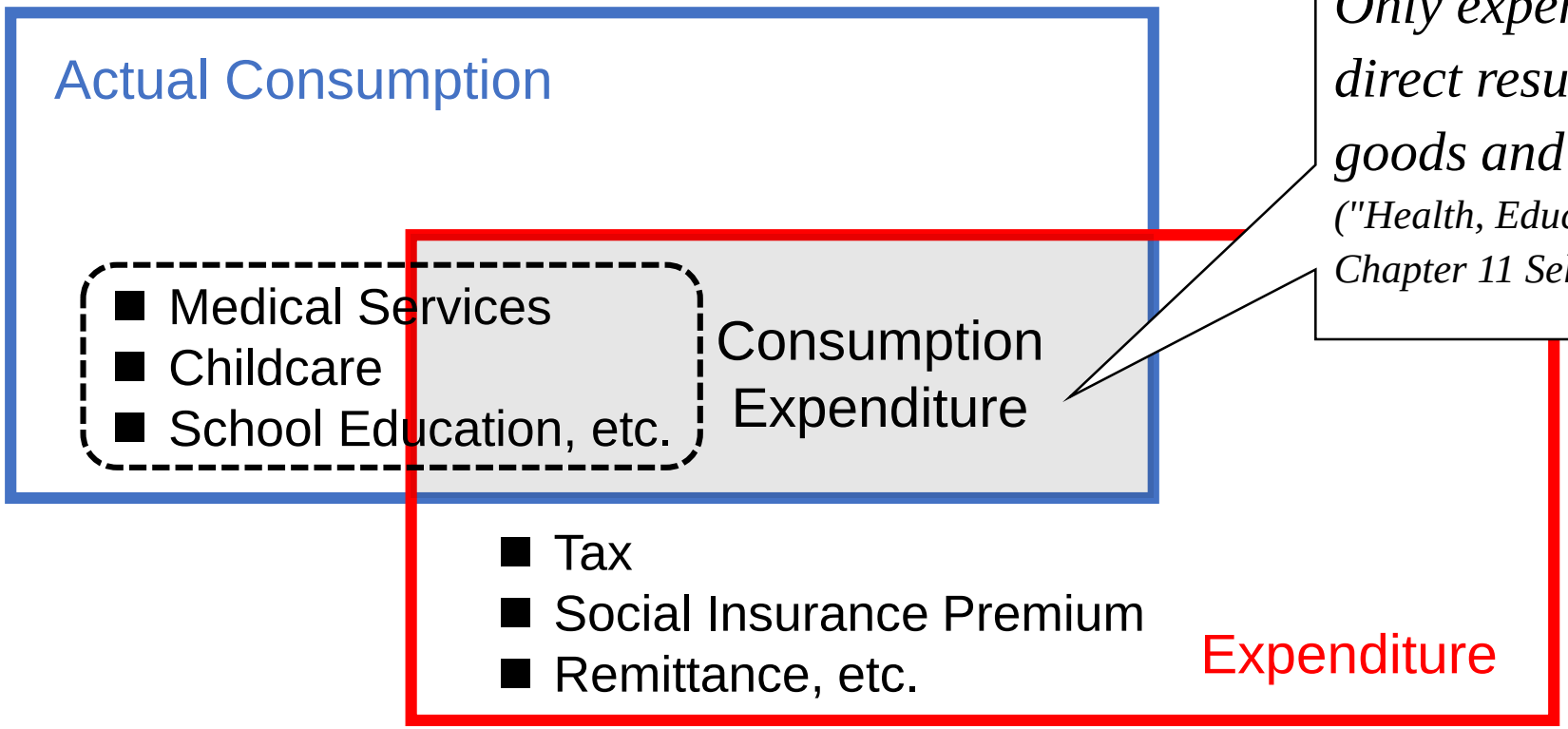
Focus of This Study



Only expenditure by households that is a direct result of purchase of individual goods and services is the scope of CPI.
("Health, Education, and Social Protection Services," Chapter 11 Selected Special Cases, p274.)

When evaluating household welfare:

(1) It is necessary to clearly define the deflator and the coverage of consumption.

(2) The conventional method, which relies on expenditure records from household surveys and official CPI, faces significant problems.

Outline

1. Starting Point of This Study:

Household Final Consumption Expenditure and Actual Consumption in SNA

Real Consumption Expenditure Calculated from Official Statistics

2. A Household Attribute-Specific Price Index: *Inflation inequality*

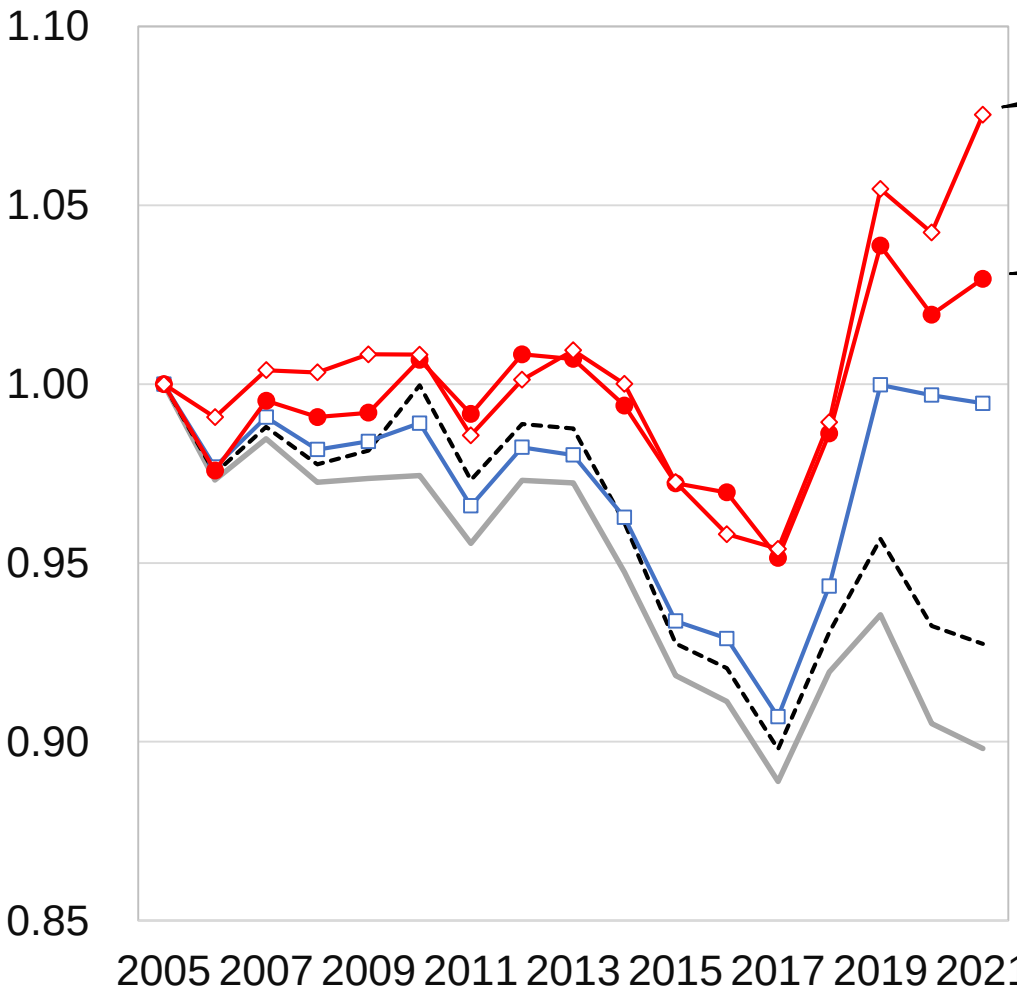
Description of the Data Used, Various Price Indices, Attribute-Specific Törnqvist Index

3. Incorporating Medical Services into a Quantity Index:

Long-Term Trends, Transition in Out-of-Pocket Share, Estimation of Real Actual Consumption

4. Household Real Consumption
through Attribute-Specific Price Indices and Actual Consumption

Highlight: Evaluation of Equivalent Real Consumption Using Five Methods



(5) Quantity Index Using Household Expenditure Data and Out-of-pocket Estimates

(4) Quantity Index with Estimates of National Medical Care Expenditure

(3) Deflated by Attribute-specific Törnqvist

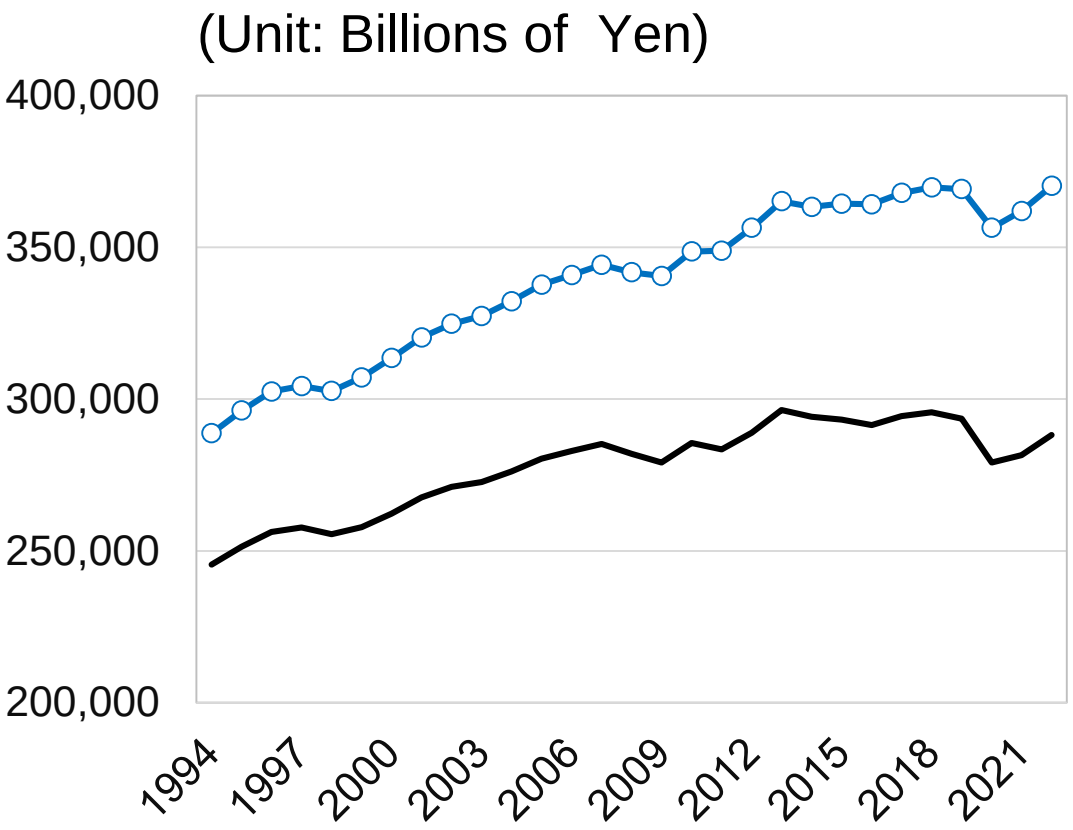
(2) Deflated by the Common Törnqvist

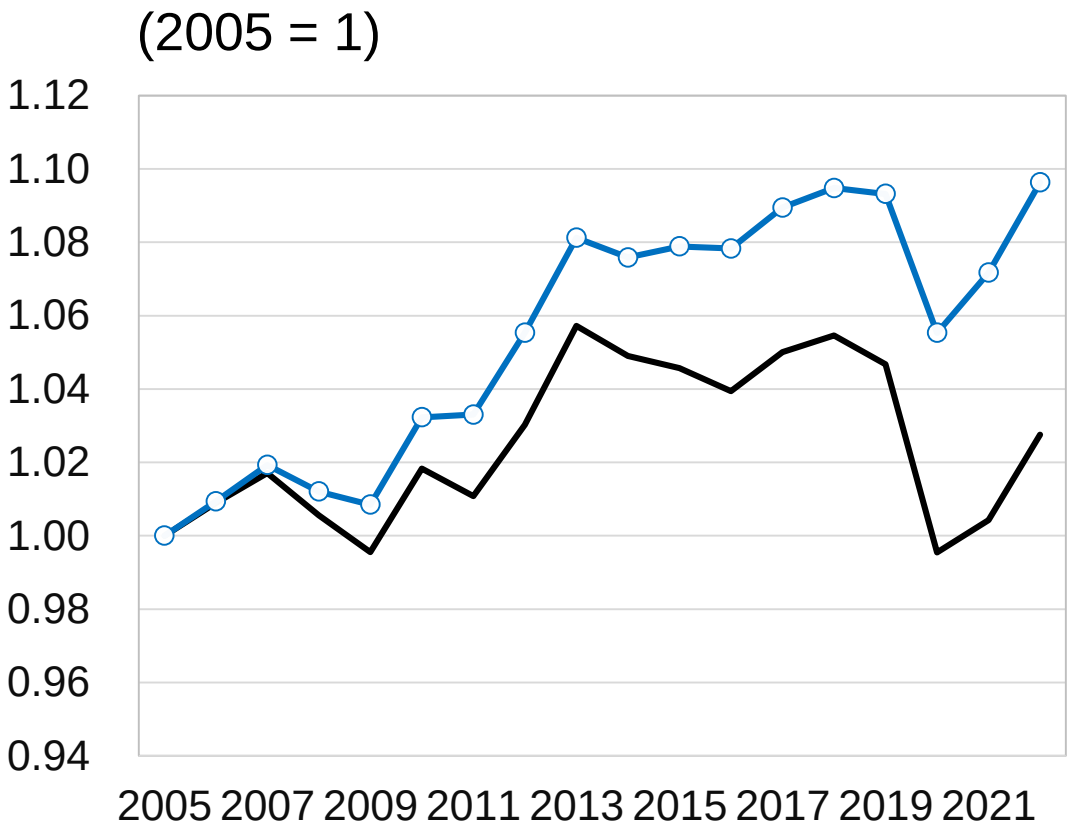
(1) Equivalent Household Expenditures Deflated by the Official CPI

Note: Households with Heads Under 40 Years Old

1. Starting Point of This Study

Household Final Consumption vs. Actual Consumption



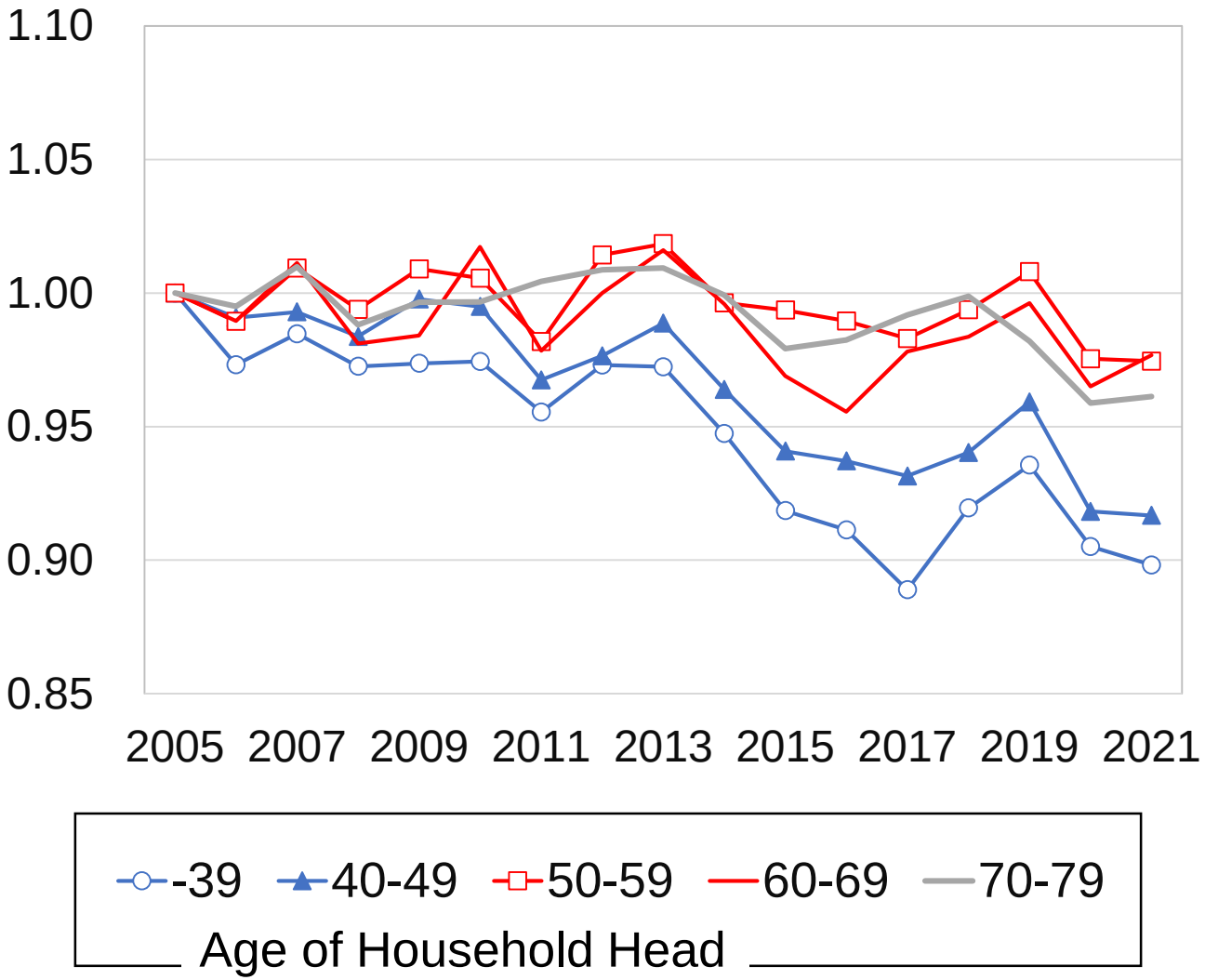


—Household final consumption expenditure

—○—Actual household final consumption

Data source: Compiled from "National Accounts," Cabinet Office, Government of Japan.
Note: Based on chained year 2015 prices.

Real Equivalent Consumption Expenditures by Age Category (2005 = 1)

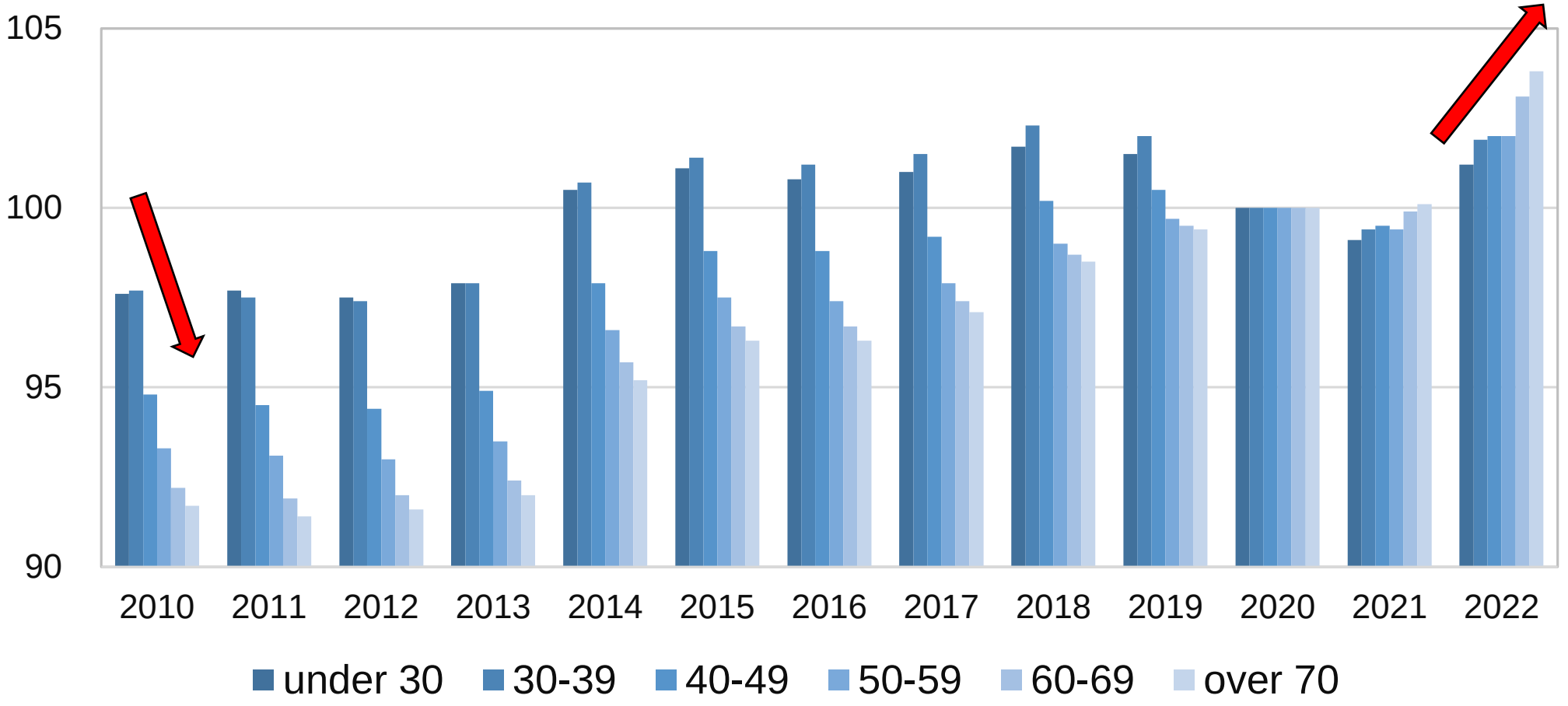


- Decline in Real Household Consumption Expenditure in Japan
- Notable Decreases Among Young and Middle-Aged Groups

  Vihriälä (2017), **Kitao & Yamada** (2023), **Murata & Hori (2023)**
- The Japanese government's cabinet meeting in 2019 resolved to enhance economic support for young people.

Note: Expenditures adjusted using the OECD-modified equivalence scale.
Data Source: Consumer Price Index and Family Income and Expenditure Survey conducted by the Ministry of Internal Affairs and Communications.

Official CPI by Age Category



Data source: Created from the Ministry of Internal Affairs and Communications' "Consumer Price Index"

2. A Household Attribute-Specific Price Index:

Inflation inequality

Jaravel (2019, *QJE*) , **Wimer & Collyer & Jaravel** (2019*, Policy Brief, Columbia Univ.)*

When using price indices by income-brackets, (compared to using the ordinal CPI)

an additional 3.2 million individuals fall below the poverty line.

Moretti (2013, *Applied Econ*.)

Estimating CPI taking into account differences in housing prices by city

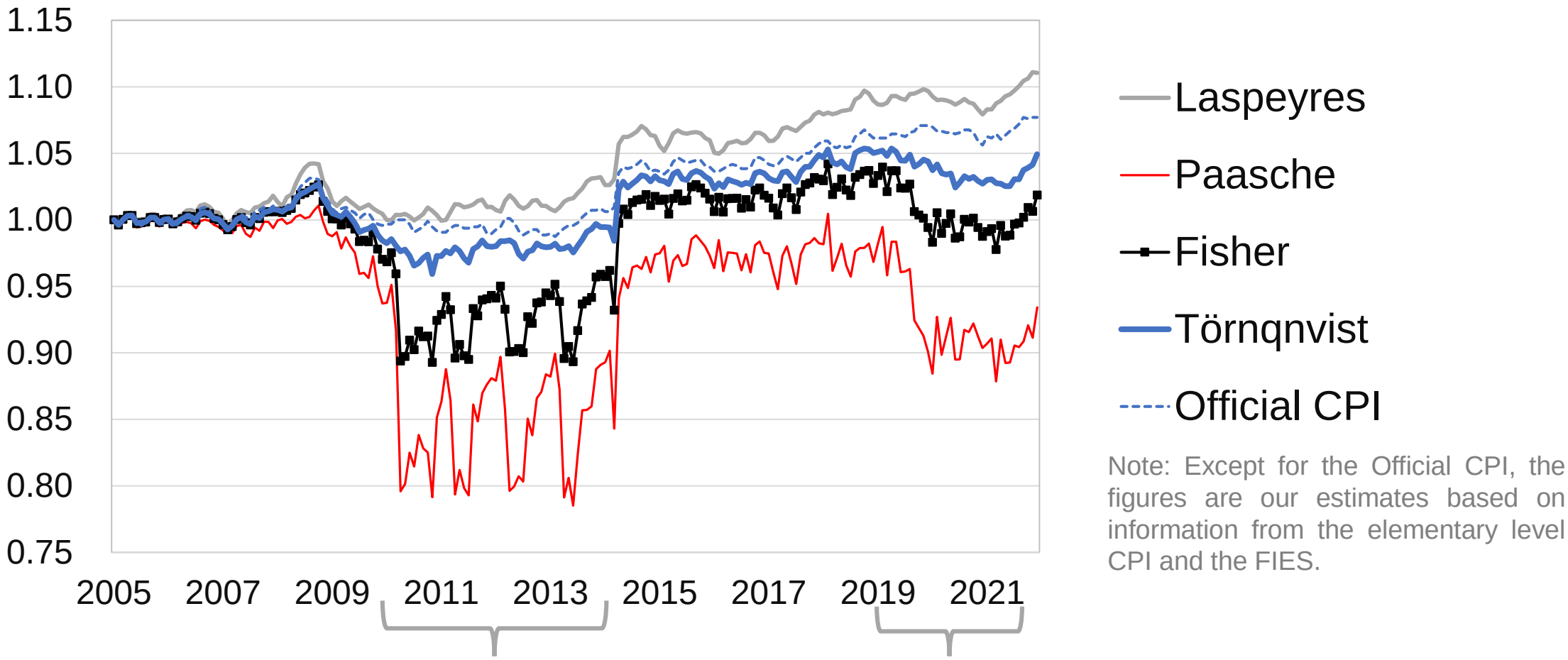
-> Nominal wage premium for college graduates (+20% in 2000) declined to +14%

Data

Variable	Data source	Note
Price	Consumer Price Index	✓ by item (# of items: 499) ✓ national average (prefecture-specific itemized CPI is not publicly available)
Expenditure	Family Income and Expenditure Survey (**FIES**)	✓ utilizing microdata (# of households / month: about 8,000) ✓ households with two or more members (single-member households is to be added) ✓ analysis period: 2005M1-2021M12

Prices are assumed to be the same for all households, with only expenditure weights differing.

Various Price Indices Common to Household Attributes



Note: Except for the Official CPI, the figures are our estimates based on information from the elementary level CPI and the FIES.

Note1: In July 2011, Japanese TV sets switched to digital broadcasting, and conventional TV sets could no longer receive the signals. Therefore, many households purchased new TV sets compatible with digital broadcasting around 2011.

Note2: In October 2019, free preschool and childcare were introduced for ages 3-5.

Household characteristics used for index calculation

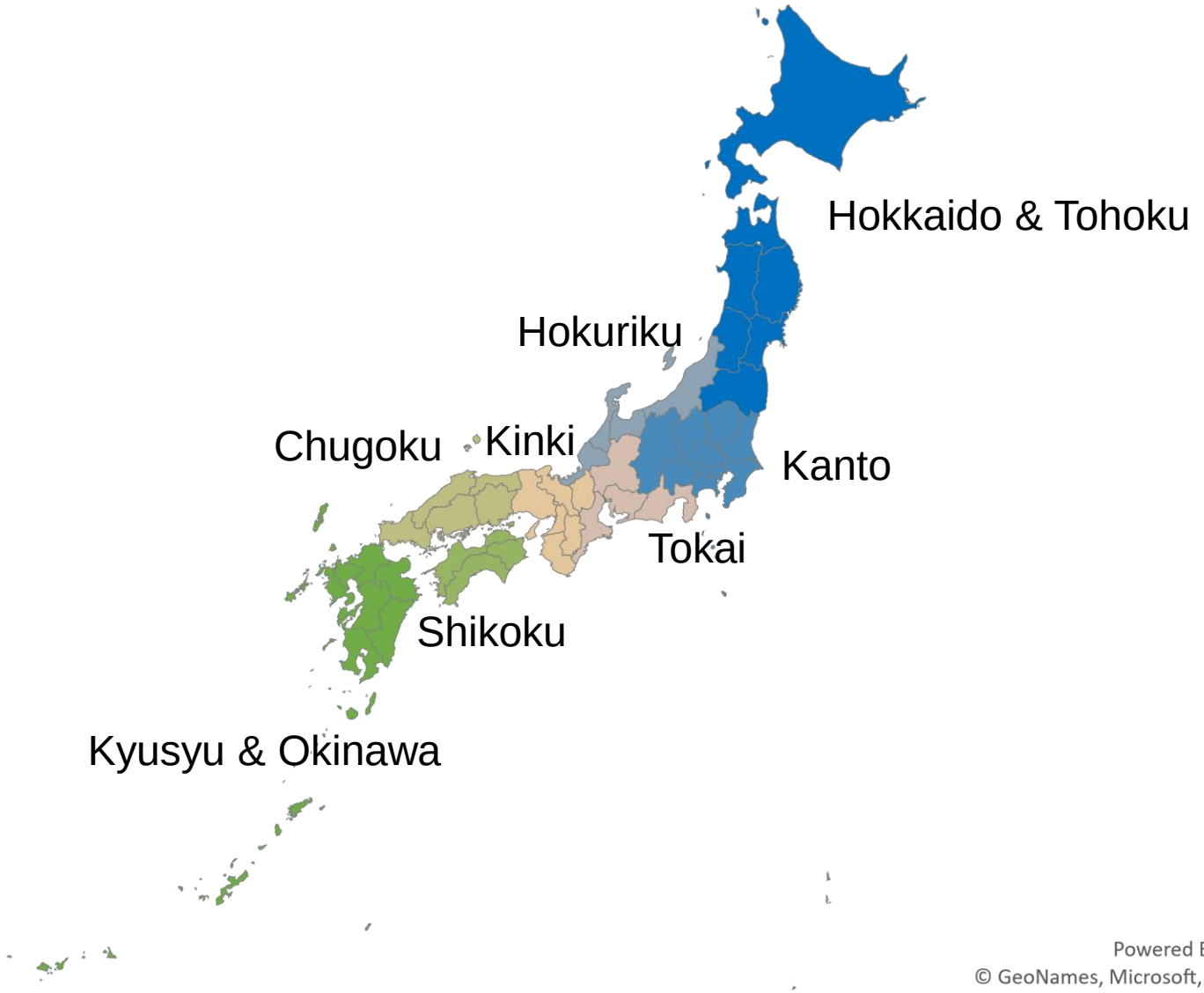
Age (of the head of household)
under 40
40-49
50-59
60-69
70-79

Household income
I
II
III
IV

Region
Hokkaido & Tohoku
Kanto
Hokuriku
Tokai
Kinki
Chugoku
Shikoku
Kyusyu & Okinawa

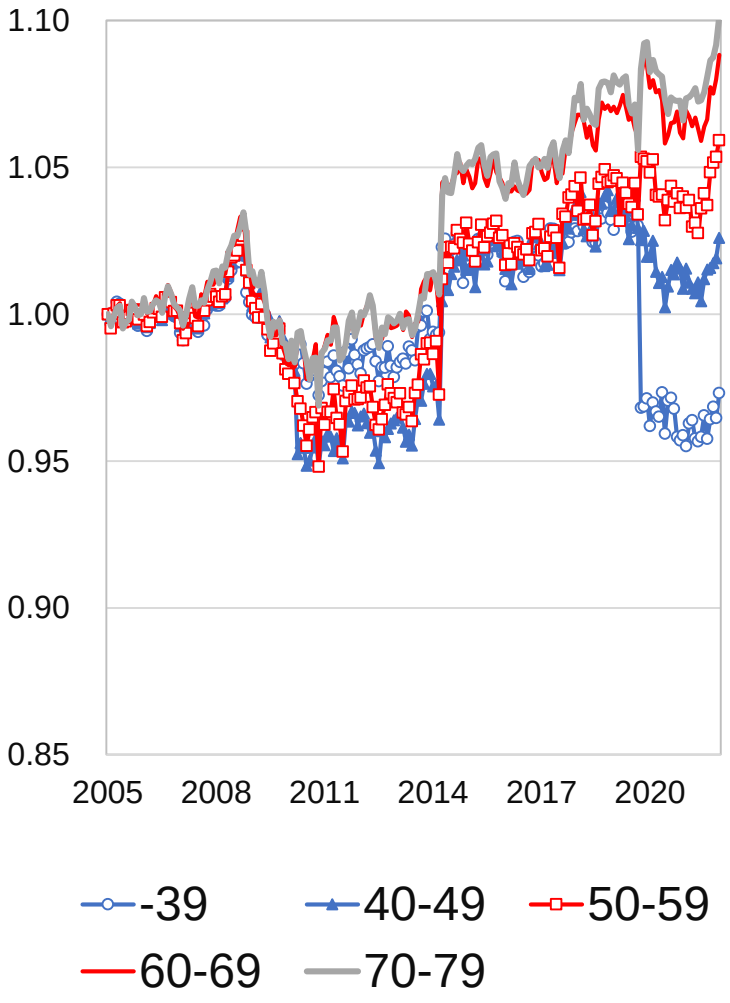
Eight regions

Region
Hokkaido & Tohoku
Kanto
Hokuriku
Tokai
Kinki
Chugoku
Shikoku
Kyusyu & Okinawa

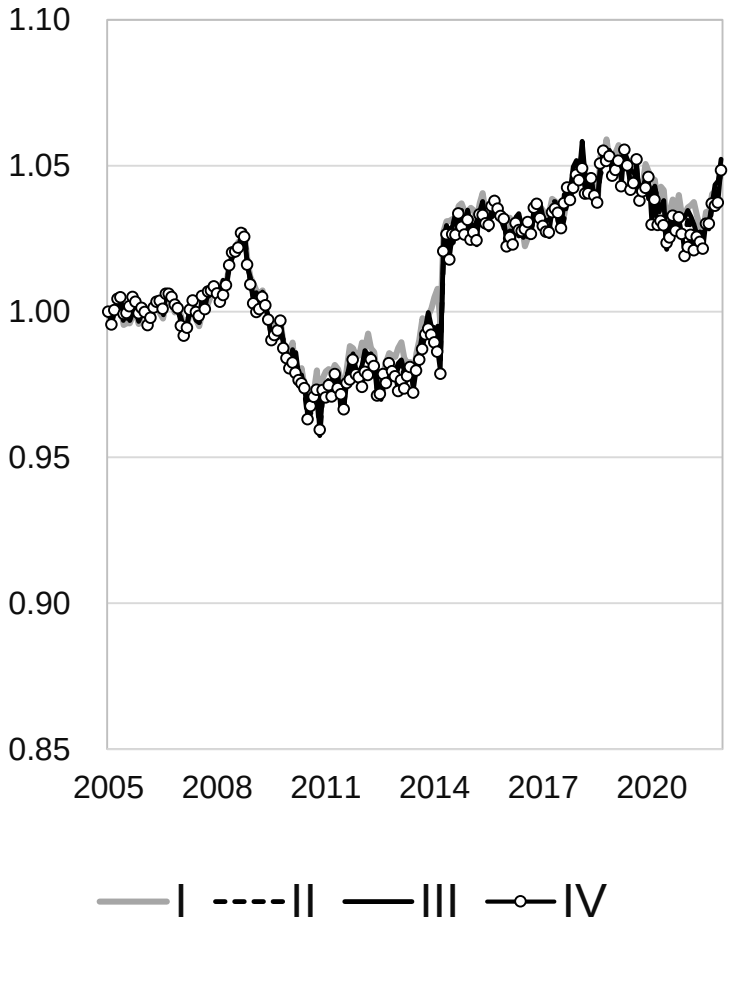


Törnqvist Index Considering Single Attribute

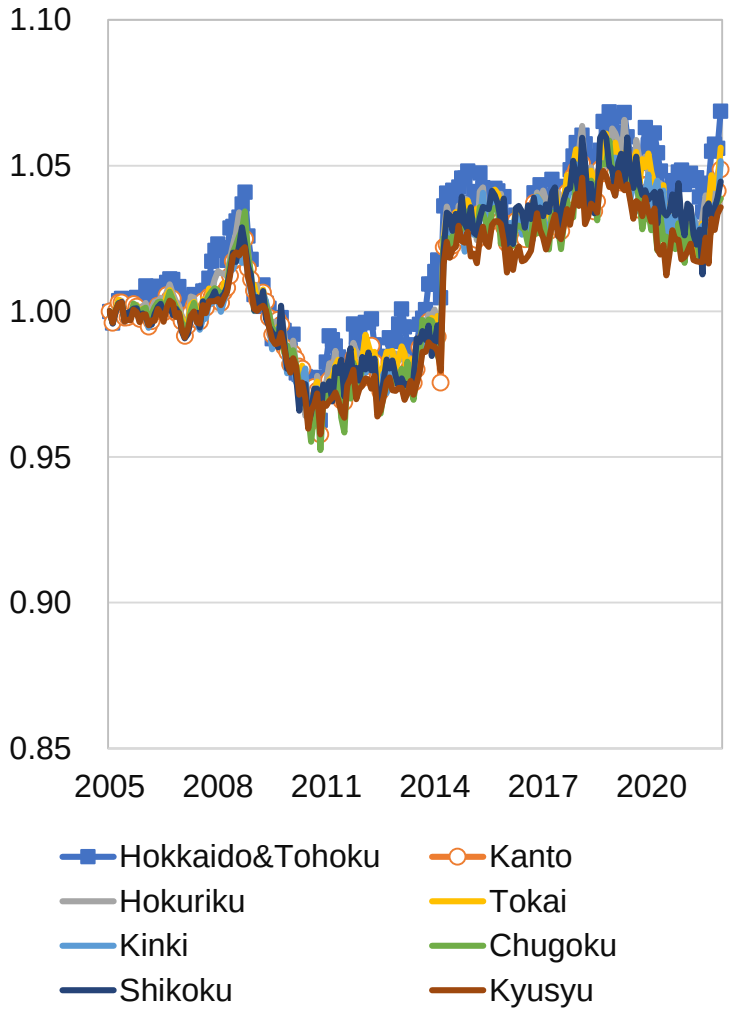
By Age Category



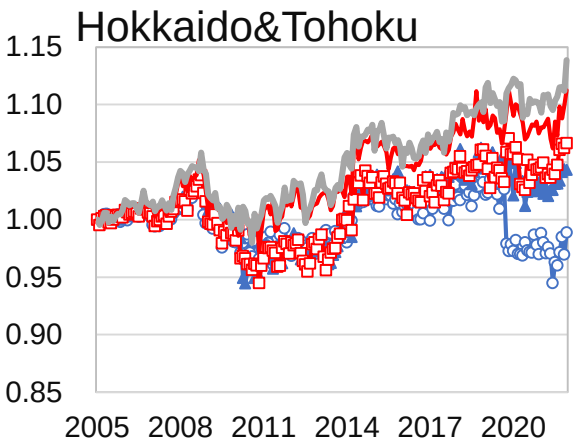
By Income Category

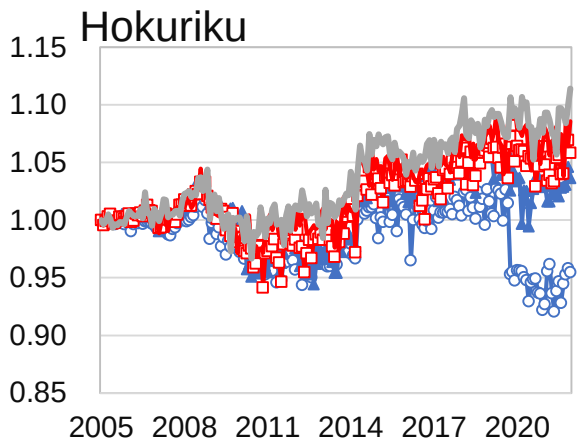


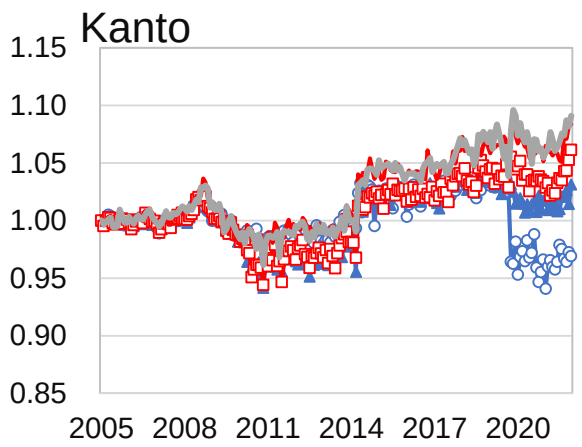
By Regional Block

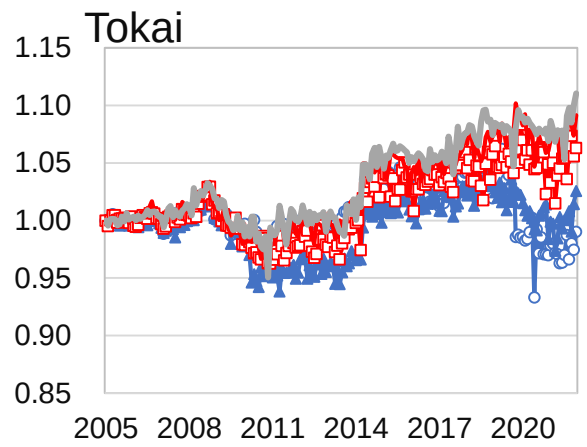


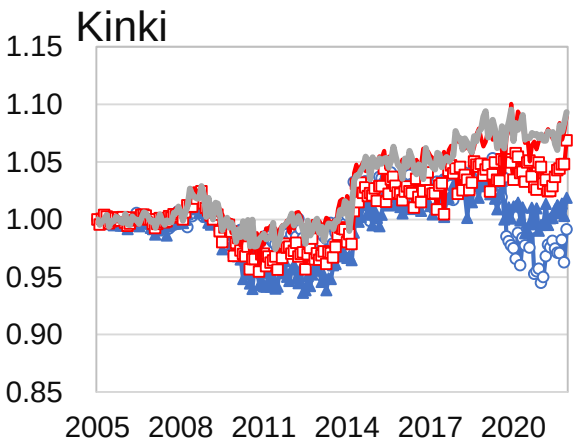
Törnqvist Index Considering Two Attributes: Regional Block and Age Category

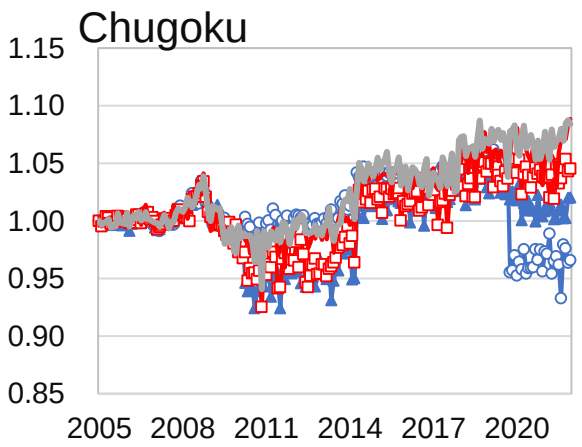


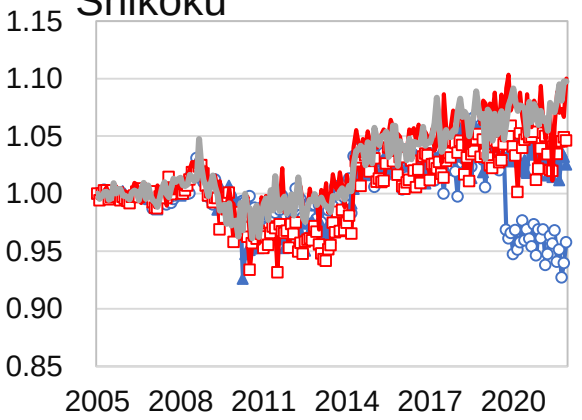


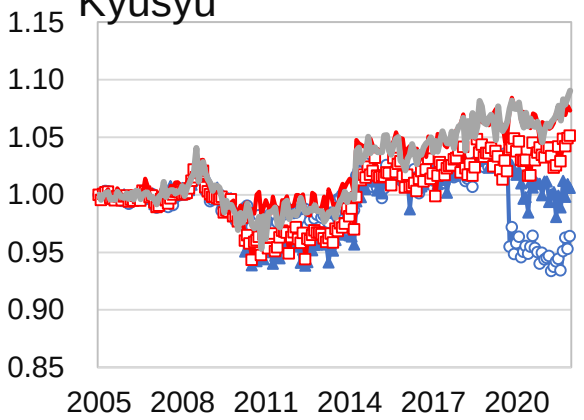








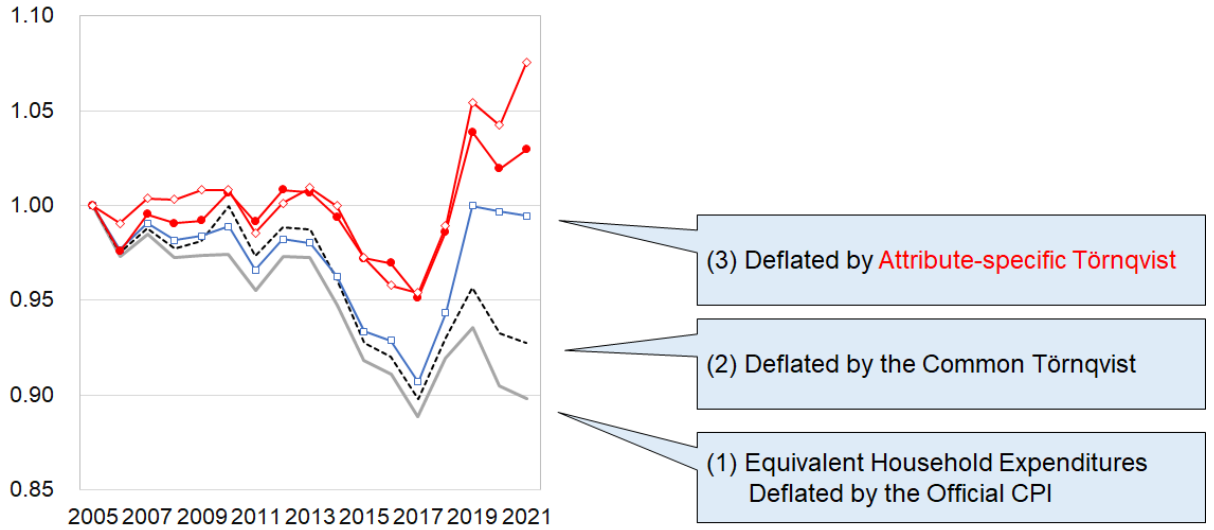




-39 40-49 50-59 60-69 70-79

Real Consumption Expenditure: Implicit Quantity Index (1), (2), (3)

$QI_{i,t}^{1} = \frac{E_{i,t}}{E_{i,s}} \Big/ \frac{P_t^{CPI}}{P_s^{CPI}}$	(1)
$QI_{i,t}^{2} = \frac{E_{i,t}}{E_{i,s}} \Big/ \frac{P_t^{Tor}}{P_s^{Tor}}$	(2)
$QI_{i,t}^{3} = \frac{E_{i,t}}{E_{i,s}} \Big/ \frac{P_{i,t}^{Tor}}{P_{i,s}^{Tor}}$	(3)



Price Indices: Published Data and Our Estimates

P_t^{CPI}	Official CPI excluding owner-occupied imputed rent
P_t^{Tor}	The Törnqvist index excluding owner-occupied imputed rent at time t, which is common across households.
$P_{i,t}^{Tor}$	The Törnqvist index of household i at time t, excluding owner-occupied imputed rent.

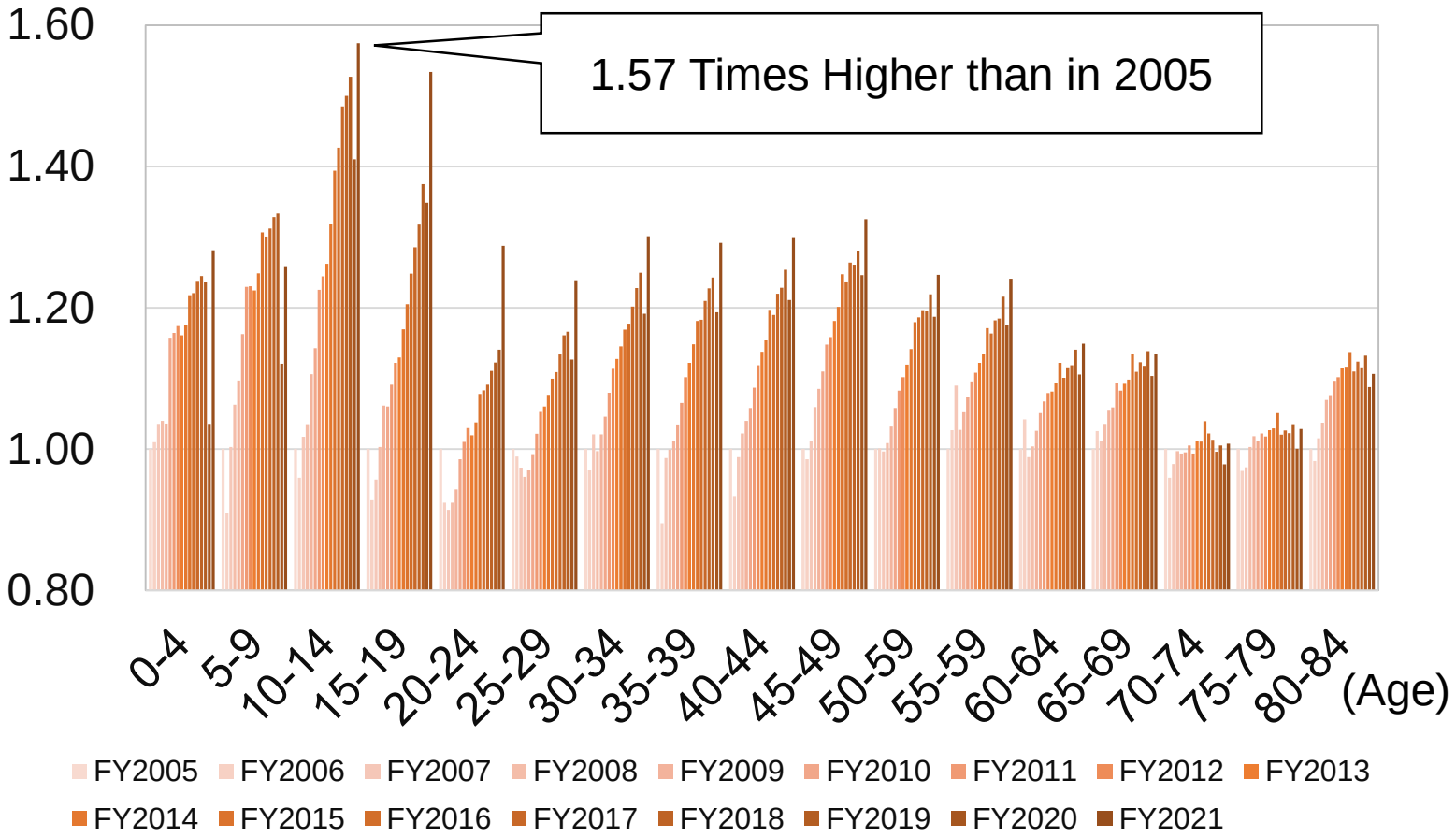
Expenditure in FIES

$E_{i,t}$	Equivalent nominal expenditure of household i at time t, excluding owner-occupied imputed rents.

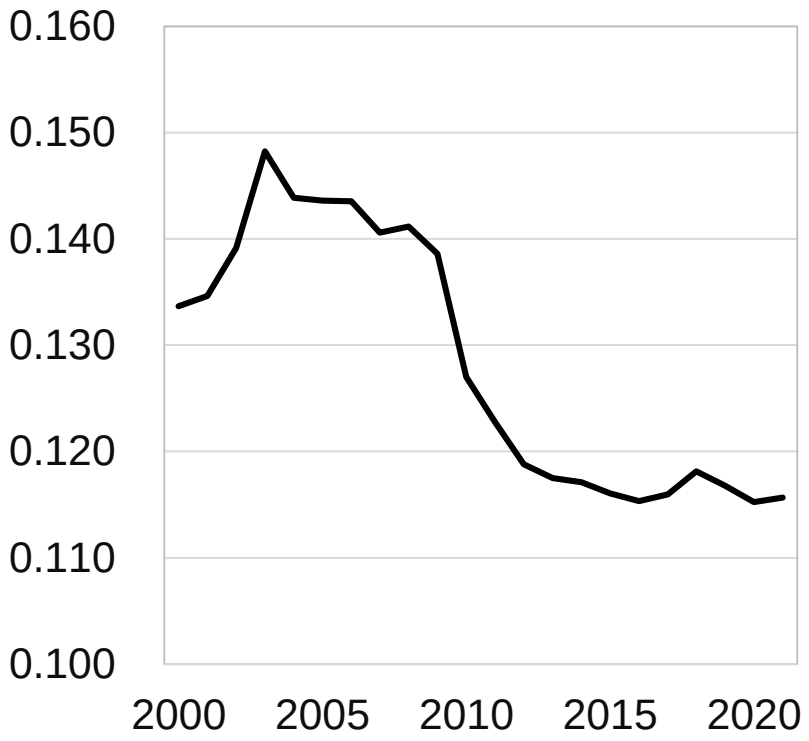
3. Incorporating Medical Services into a Quantity Index

Medical Service Consumption in Japan

National Health Care Expenditures by Age Category (Per Capita, Nominal Values, Year 2005=1)



Share of Medical Expenses Borne by Patients



Data source: Ministry of Health, Labour and Welfare, “Estimates of National Medical Care Expenditure”.

Two Quantity Indices for Medical Services

$$QI_{i,t}^{M} = \left(\frac{C_{i,t}^{M}}{C_{i,s}^{M}}\right) \Big/ \left(\frac{P_t^{SNA,M}}{P_s^{SNA,M}}\right) \quad (4)$$

$$QI_{i,t}^{M'} = \left(\frac{E_{i,t}^{M}}{E_{i,s}^{M}}\right) \Big/ \left(\frac{P_t^{SNA,M}\ \overline{s_{i,t}^{M}}}{P_s^{SNA,M}\ \overline{s_{i,s}^{M}}}\right) \quad (5)$$

$\overline{s_{i,t}^{M}}$: Estimated Self-Payment Ratios by Household Attributes. For details, refer to the paper.

Under 40: **0.566** in 2021 (2005 = 1)

70-79: **0.963** in 2021

Price Indices: Published Data

$P_t^{SNA,M}$	GDP deflator for Health and Social Services published in SNA

Actual Medical Consumption: Estimated from National Medical Care Expenditure and FIES Microdata

$C_{i,t}^{M}$	Nominal Equivalent Actual Medical Consumption

Expenditure in FIES

$E_{i,t}^{M}$	Equivalent medical and health care nominal expenditure of household i at time t.

Aggregate Quantity Index: Cobb-Douglas Type Composite Index

$$QI_{i,t}^{4} = \left[QI_{i,t}^{M}\right]^{\alpha}\left[QI_{i,t}^{O}\right]^{(1-\alpha)}, \quad \text{where } QI_{i,t}^{M} = \left(\frac{C_{i,t}^{M}}{C_{i,s}^{M}}\right)\Big/\left(\frac{P_{t}^{SNA,M}}{P_{s}^{SNA,M}}\right). \qquad (4)'$$

$$QI_{i,t}^{5} = \left[QI_{i,t}^{M'}\right]^{\alpha}\left[QI_{i,t}^{O}\right]^{(1-\alpha)}, \quad \text{where } QI_{i,t}^{M'} = \left(\frac{E_{i,t}^{M}}{E_{i,s}^{M}}\right)\Big/\left(\frac{P_{t}^{SNA,M}\,\overline{s_{i,t}^{M}}}{P_{s}^{SNA,M}\,\overline{s_{i,s}^{M}}}\right). \qquad (5)'$$

α: Represents the weights of actual medical consumption and real non-medical consumption in the quantity index calculation.

α = 0.132, derived using SNA data.

For more details, please refer to the paper.

Price Indices: Published Data and Our Estimates

$P_{i,t}^{Tor,O}$	The Törnqvist index of household i at time t, excluding imputed rents, medical, and health care.

Expenditure in FIES

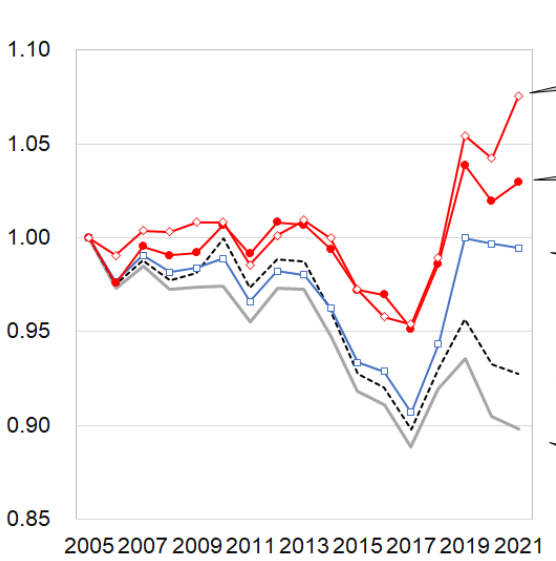
$E_{i,t}^{O}$	Equivalent nominal expenditure of household *i* at time *t*, excluding imputed rents, medical, and health care.

$$QI_{i,t}^{O} = \frac{E_{i,t}^{O}}{E_{i,s}^{O}}\Big/\frac{P_{i,t}^{Tor}}{P_{i,s}^{Tor}}$$

4. Household Real Consumption through Attribute-Specific Price Indices and Actual Consumption

Evaluation of Equivalent Real Consumption Using Five Methods

$QI_{i,t}^{1} = \frac{E_{i,t}}{E_{i,s}} \Big/ \frac{P_t^{CPI}}{P_s^{CPI}}$	(1)
$QI_{i,t}^{2} = \frac{E_{i,t}}{E_{i,s}} \Big/ \frac{P_t^{Tor}}{P_s^{Tor}}$	(2)
$QI_{i,t}^{3} = \frac{E_{i,t}}{E_{i,s}} \Big/ \frac{P_{i,t}^{Tor}}{P_{i,s}^{Tor}}$	(3)
$QI_{i,t}^{4} = \left[QI_{i,t}^{M}\right]^{\alpha}\left[QI_{i,t}^{O}\right]^{(1-\alpha)}$	(4)'
$QI_{i,t}^{5} = \left[QI_{i,t}^{M'}\right]^{\alpha}\left[QI_{i,t}^{O}\right]^{(1-\alpha)}$	(5)'



(5) Quantity Index Using Household Expenditure Data and Out-of-pocket Estimates

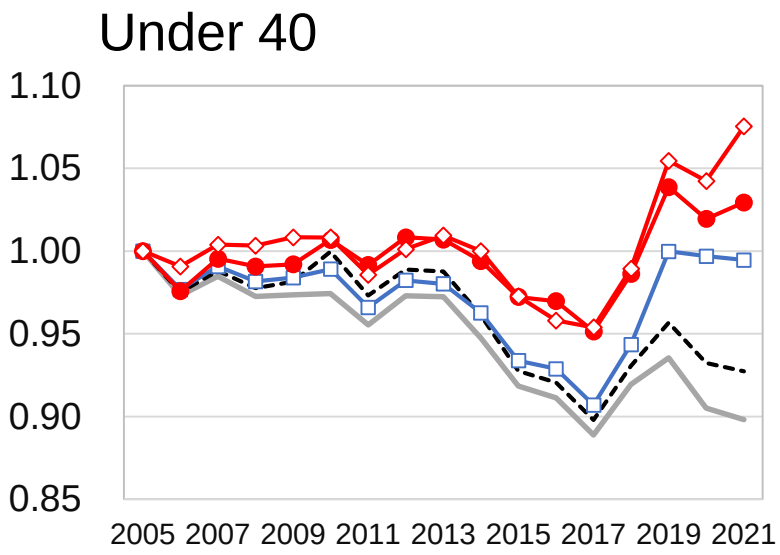
(4) Quantity Index with Estimates of National Medical Care Expenditure

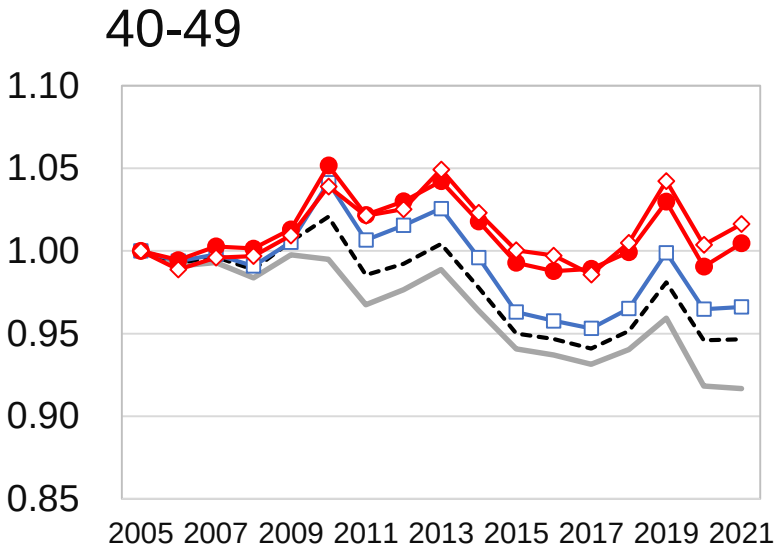
(3) Deflated by Attribute-specific Törnqvist

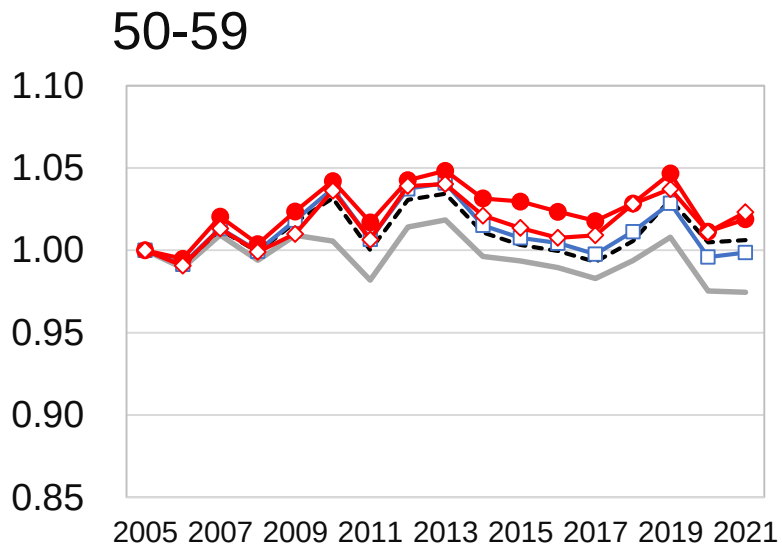
(2) Deflated by the Common Törnqvist

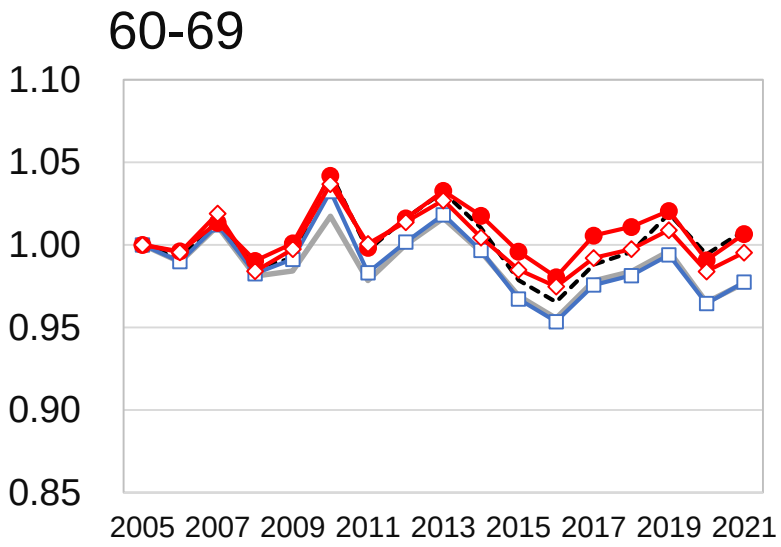
(1) Equivalent Household Expenditures Deflated by the Official CPI

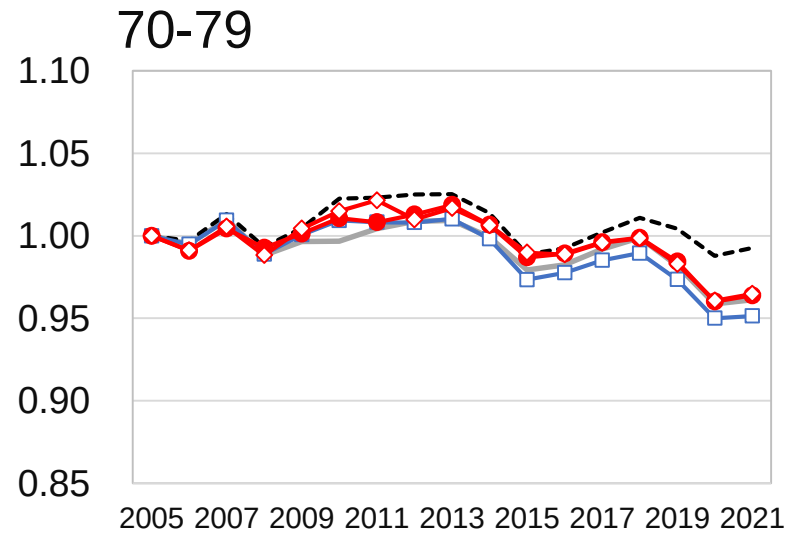
Real Consumption Trends: by Age Category × Aggregation Method











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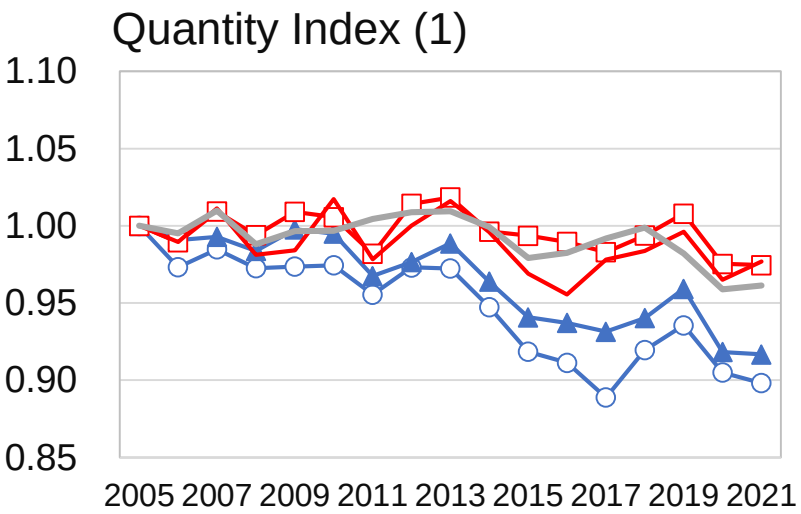
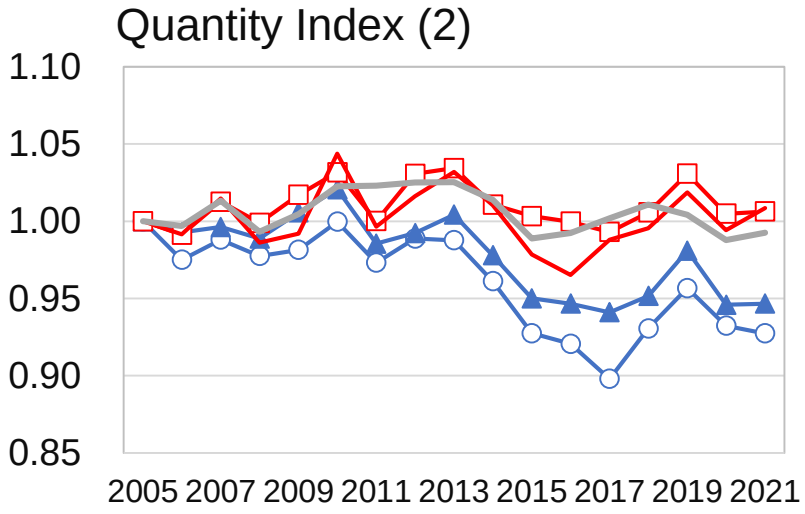
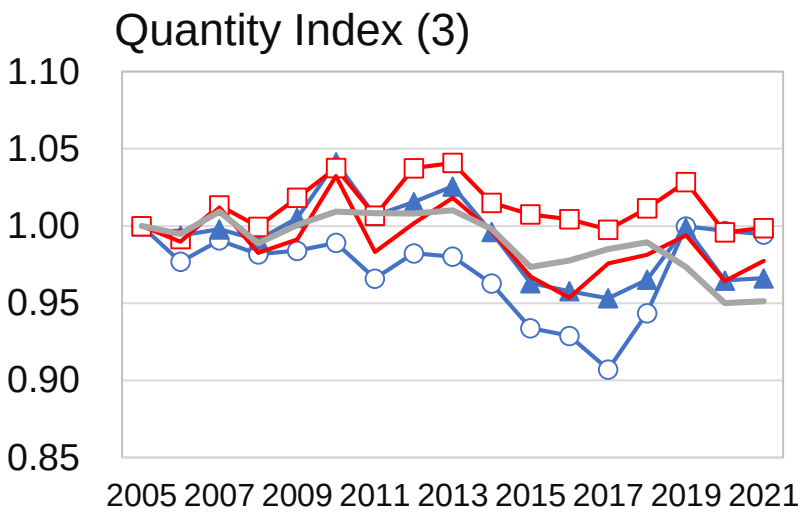
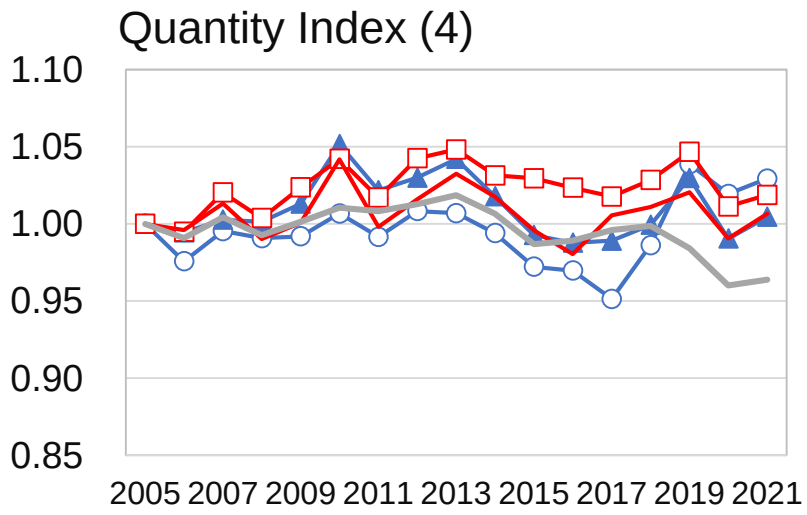
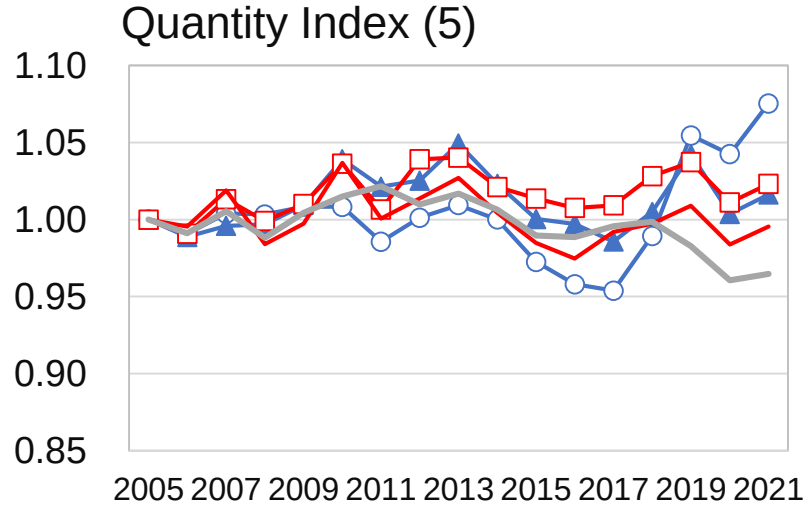
Real Consumption Trends: by Aggregation Method × Age Category











(1) Equivalent Household Expenditures Deflated by the Official CPI
(2) Deflated by the Common Törnqvist

(3) Deflated by Attribute-specific Törnqvist

(4) Quantity Index with Estimates of National Medical Care Expenditure
(5) Quantity Index Using Household Expenditure Data and Out-of-pocket Estimates

-39 40-49 50-59 60-69 70-79

Conclusion

The Törnqvist index by household attributes:

- Declined significantly for younger households after October 2019, when free childcare costs for infants began.
- When there are policy changes targeted at specific groups, using a price index common to all household attributes will lead to an overestimate (or underestimate) of the real expenditures of that particular group.

To measure economic welfare:

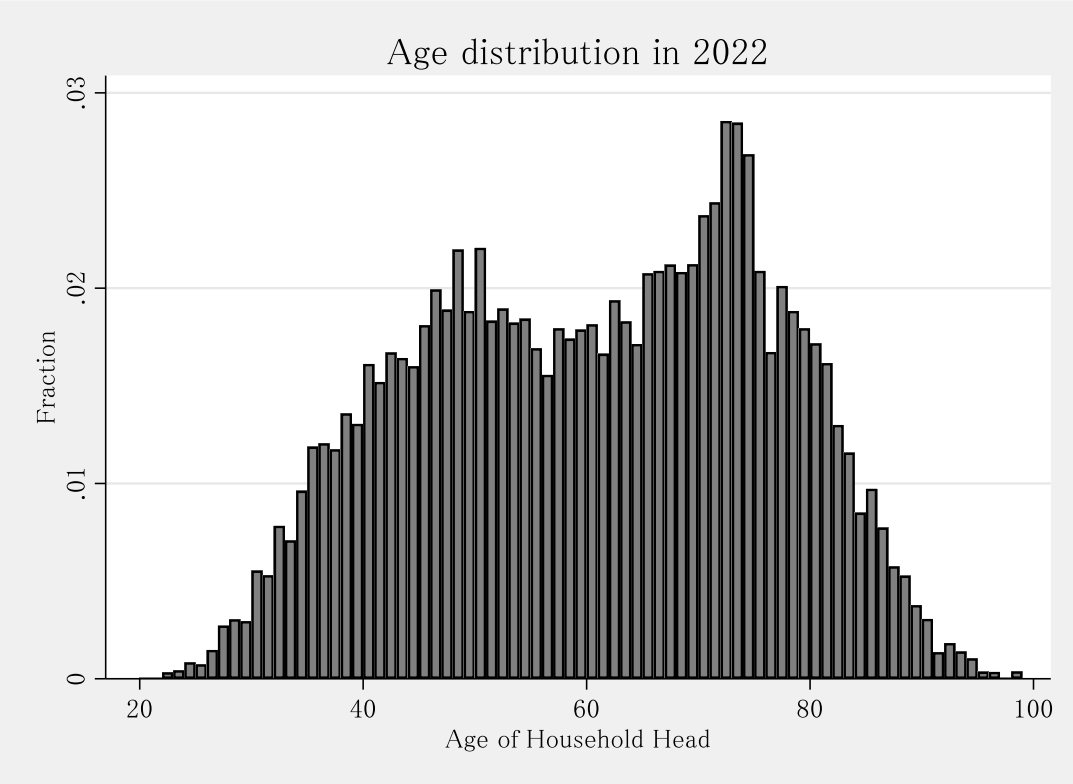
- Estimating household consumption of medical care based solely on out-of-pocket costs is likely to introduce significant measurement errors.

For consumption that has **statistically disappeared** from household expenditures due to policy changes, one method is to use external data to independently estimate the aggregate quantity indices for items where spending and consumption do not align.

Appendix

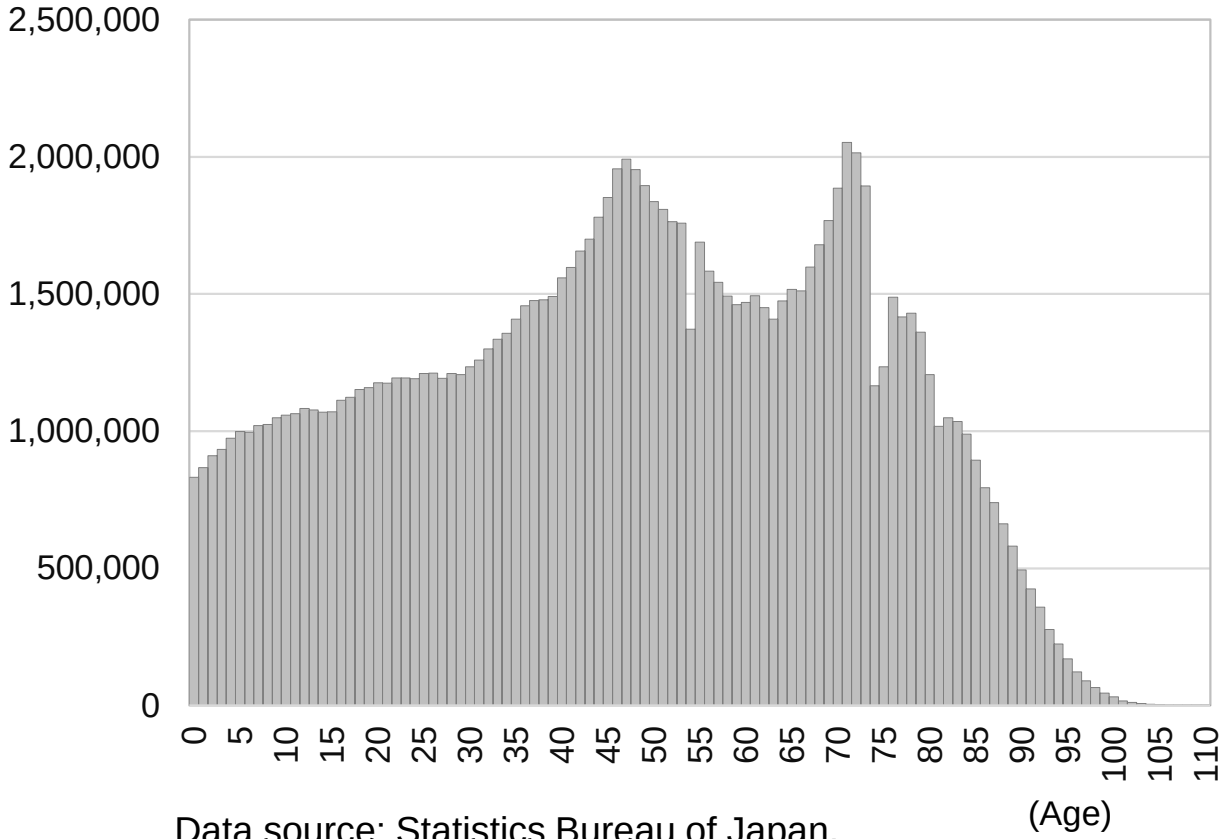
Age Distribution in Japan

Family Income and Expenditure



Note: Limited to households with two or more members.

Census (2020)



Data source: Statistics Bureau of Japan, 2020 Population Census.

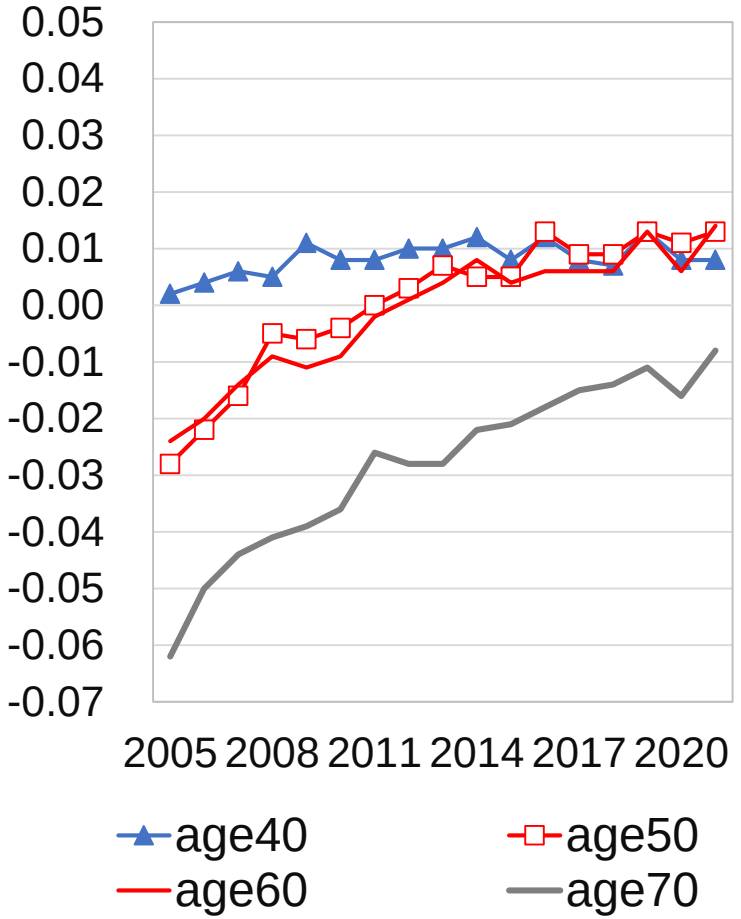
Numerical Example Illustrating the Method for Estimating the Proportion of Out-of-Pocket Medical Expenses

Column 1	Column 2	Column 3	Column 4	Column 5
Family ID	Expenditure on Medical Services as Recorded in FIES (Unit: 1,000 Yen/Month) $E_{i,t}^{M}$	Age of Each Household Member	Monthly Medical Expenses for the Relevant Age Group, Estimated from the National Medical Care Expenditures $C_{i,t}^{M}$	**Self-payment ratio** $s_{i,t}^{M}$
1	3	0	20	3/(20+10+10+10) = 0.06
		5	10	
		30	10	
		40 (HH head)	10	
2	0	0	20	0/((20+10+10+10)) = 0
		5	10	
		30	10	
		40 (HH head)	10	
3	13	75	60	13/(60+70) = 0.1
		80 (HH head)	70	

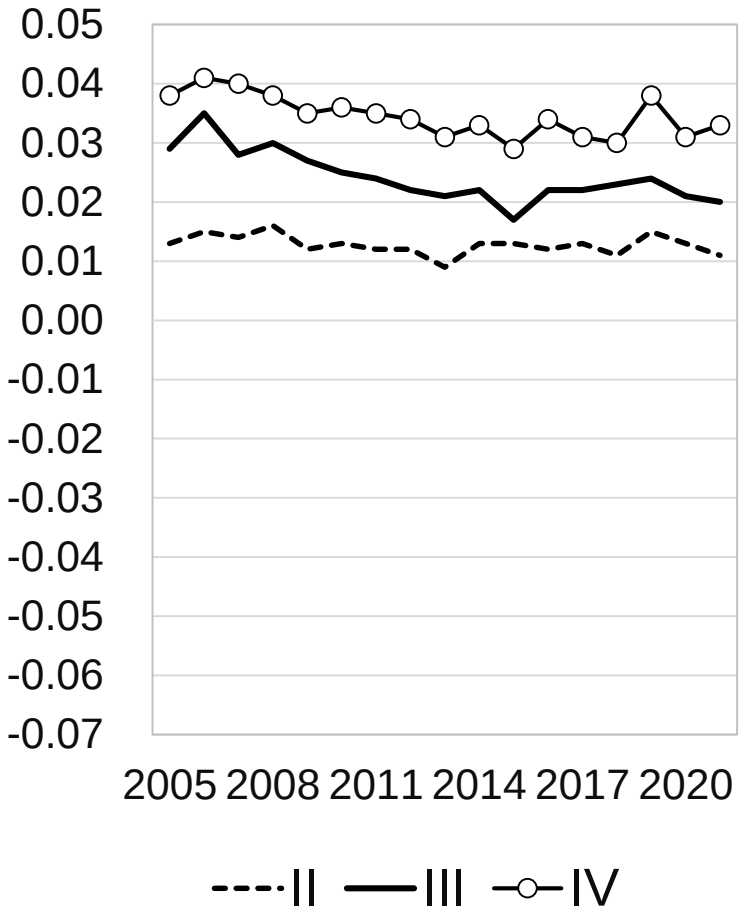
Coefficient Estimates

Dependent Variable: Proportion of Out-of-Pocket Medical Expenses

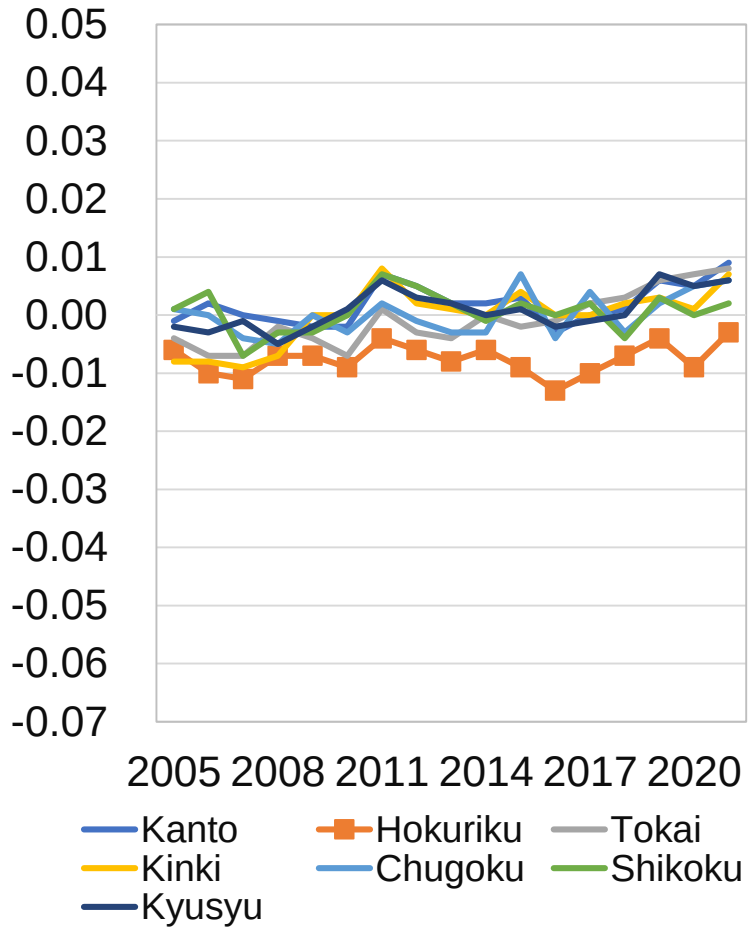
Age Categories (Base Category：Under 40)



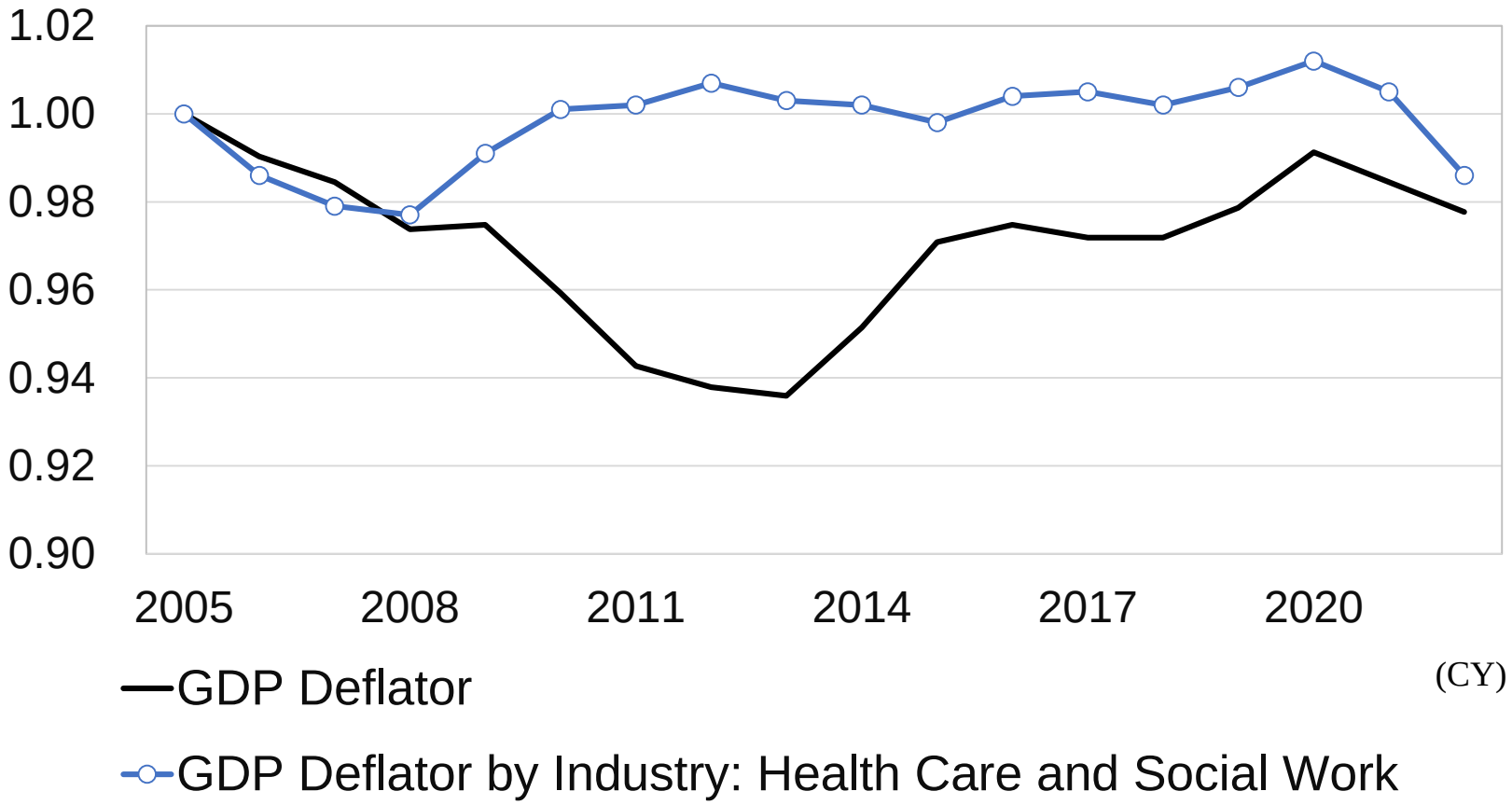
Annual Income Categories (BC： I)



Regional Blocks (BC: Hokkaido & Tohoku)



GDP Deflator



Data source: Compiled from "National Accounts," Cabinet Office, Government of Japan.