Hitotsubashi Workshop
on Economic Measurement
October 25, 2023

Age, Income, Region Specific CPI and Consumption Inequality

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Motivation

- Consumption Inequality has been regarded as one of the most important measures of economic welfare. (**Attansio and Pistaferri**, 2016, *J. Econ. Perspectives*)
- When measuring the inequality, many researchers use the official CPI that is usually treated as the common deflator among families.
- In reality, consumption baskets differ to a great extent among families, depending on their age, income, and region.

The choice of price indices has a significant impact on the inequality of real values.

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.

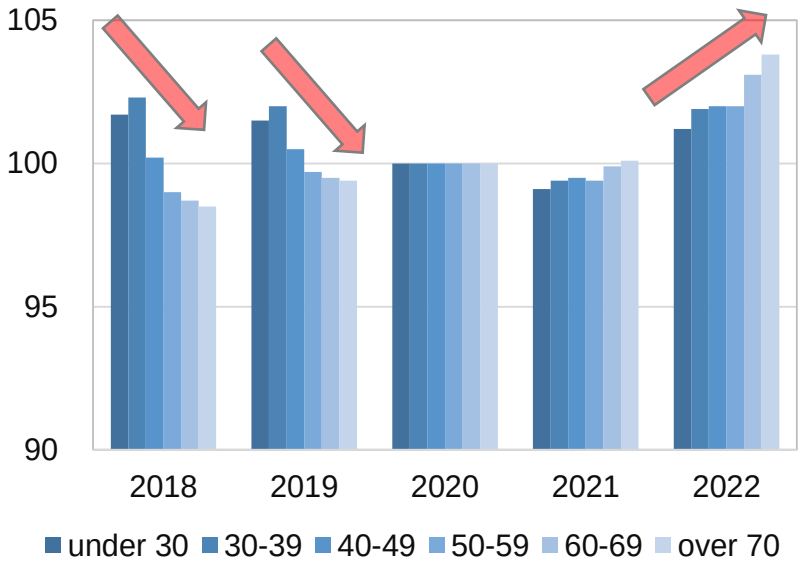
Moretti (2013, *Applied Econ*.)

Estimating CPI taking into account differences in housing prices by city

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

From the official CPI (Laspeyres, All items excl. imputed rent)

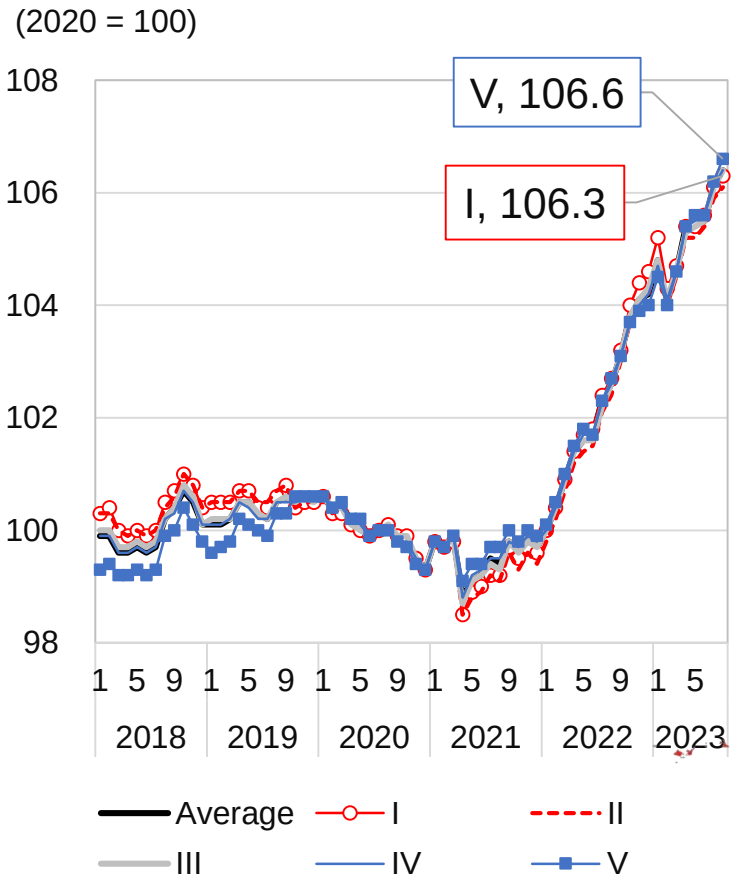
By Age



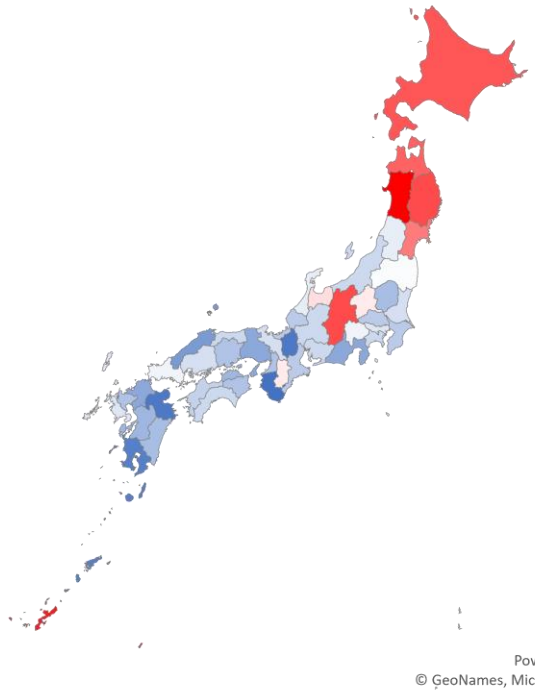
Note: Only the annual average value is available

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

By Income



By Region (August 2023)

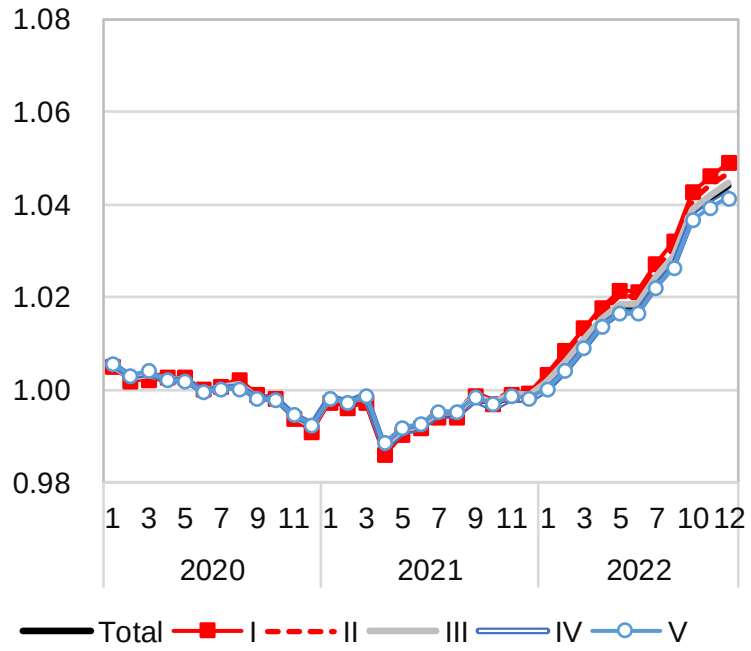


Is it necessary to consider price indices that take into account not just one but two or more attributes simultaneously?

Abe and Inakura (2023),
Young index by income-bracket (I, II, III, IV, V) in each prefecture

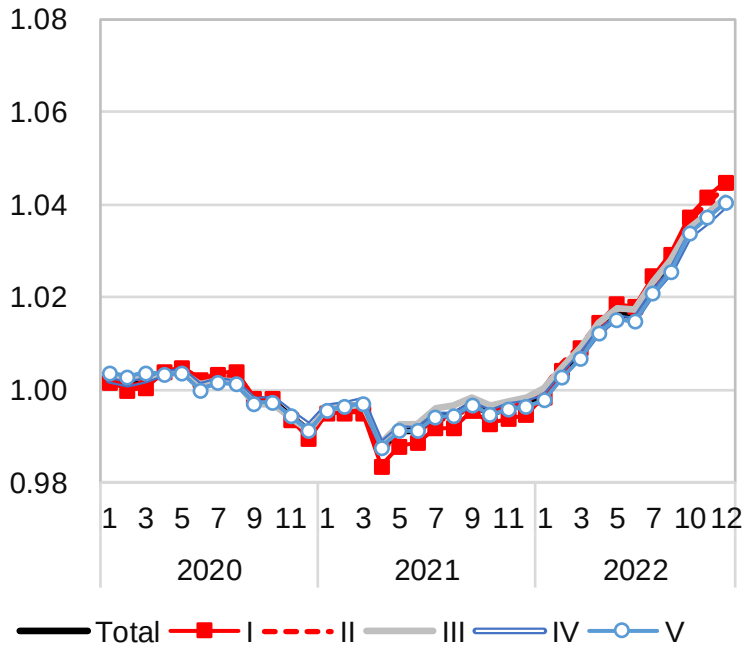
(Dec 2022) I-V= 0.008

Japan



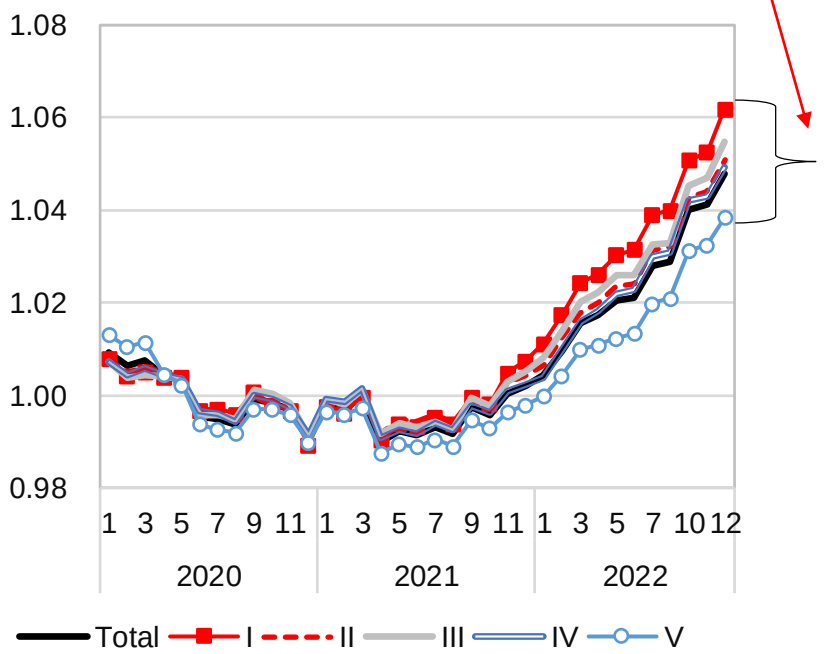
(Dec 2022) I-V= 0.004

Tokyo



(Dec 2022) I-V= 0.023

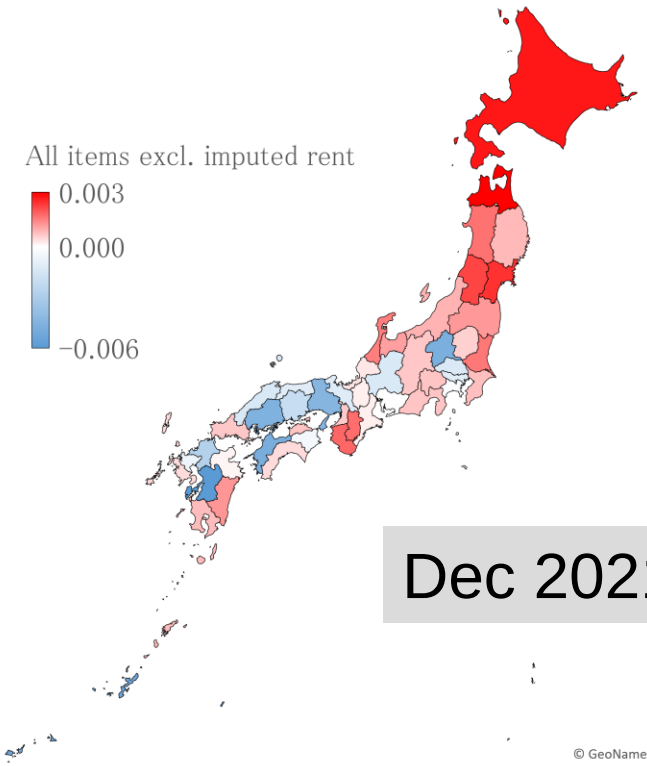
Miyagi



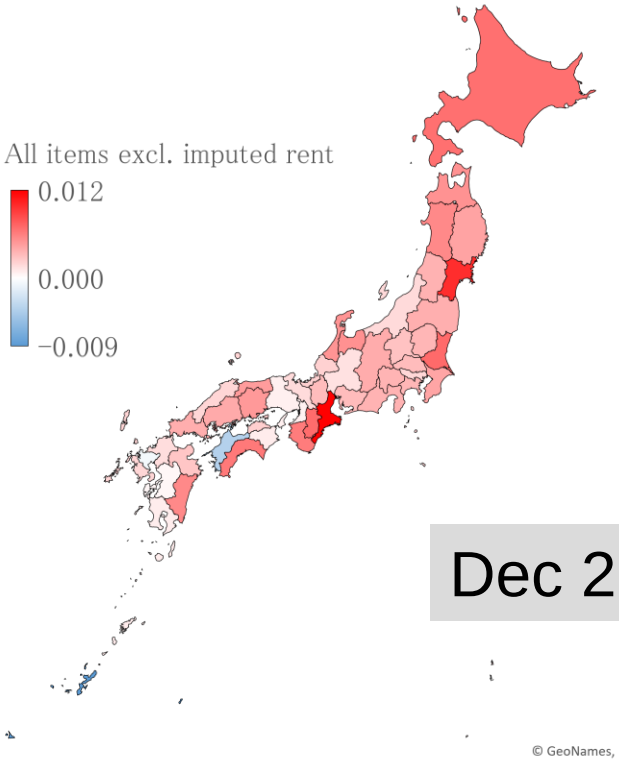
Data source: Estimates by Abe and Inakura (2023) from the Ministry of Internal Affairs and Communications' "National Family Income and Expenditure Survey (2019)", "Household Survey," and '"Consumer Price Index."

cont. I – V（All items excl. imputed rent）

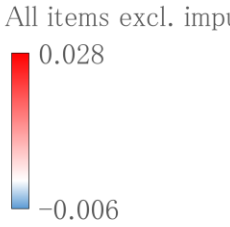
Dec 2020



Dec 2021



Dec 2022



Data source: Estimates by Abe and Inakura (2023) from the Ministry of Internal Affairs and Communications' "National Family Income and Expenditure Survey (2019)", "Household Survey," and '"Consumer Price Index."

The Purpose of Our Study

In considering inflation inequality,

it's essential to account for household-specific expenditures and purchase prices.

Scanner data (e.g., **Kaplan & Schulhofer-Wohl**, 2017, *J. Mon. Econ.*) and

credit card payment histories (e.g., **Cavallo**, 2020, *NBER WP*) provide valuable information for this purpose.

However, these data sources have limitations:

- ✓ Limited to specific product categories (e.g., groceries and daily necessities).
- ✓ Questionable representativeness of respondents.
- ✓ Low coverage of expenditure data.

Our research utilizes microdata from official statistics:

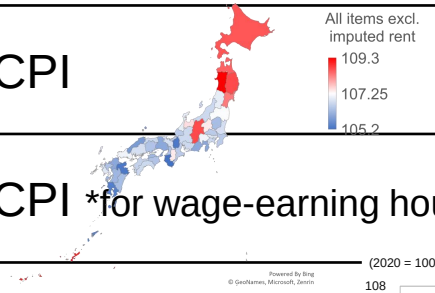
- ✓ Covering all consumption categories, including services.
- ✓ Targeting a representative sample of households (approximately 8,000 households monthly).
- ✓ Utilizing high-precision household-specific expenditure data by diary basis.

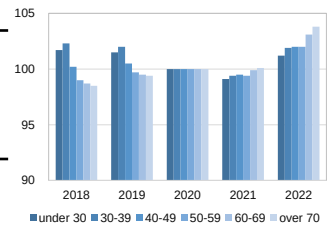
Our purpose is to clarify how the choice of price indices impacts the measurement of inequality in real consumption expenditure.

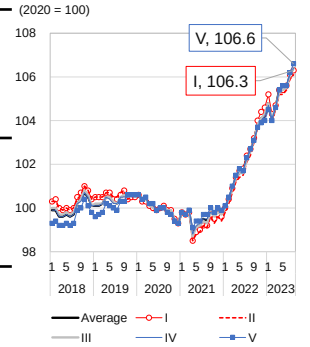
How many indices do we attempt to calculate?

Slide for Laspeyres, Paasche, Fisher

No.	Age (6 category)	Income (5)	Region (8)	# of Price Indexes	note
000	0	0	0	1	<- corresponds to the 'national average' of the official CPI Note: we are calculating Fisher, not Laspeyres.
001	0	0	1	8	<- published in the official CPI
010	0	1	0	5	<- published in the official CPI *for wage-earning households only
011	0	1	1	40	
100	1	0	0	6	<- published in the official CPI
101	1	0	1	48	
110	1	1	0	30	
111	1	1	1	240	(= 6*5*8)







Household characteristics used for index calculation

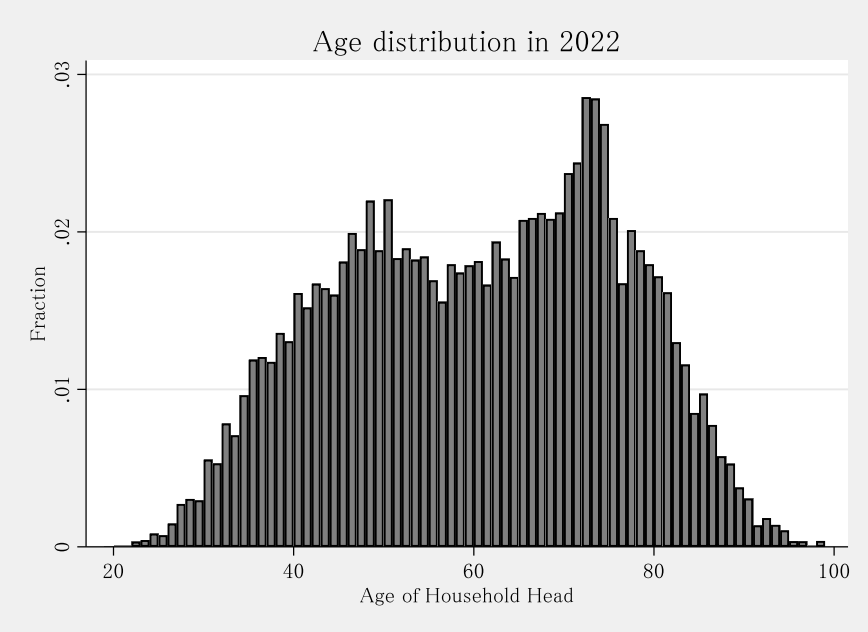
Age (of the head of household)
under 40
40-49
50-59
60-69
70-79
over 80

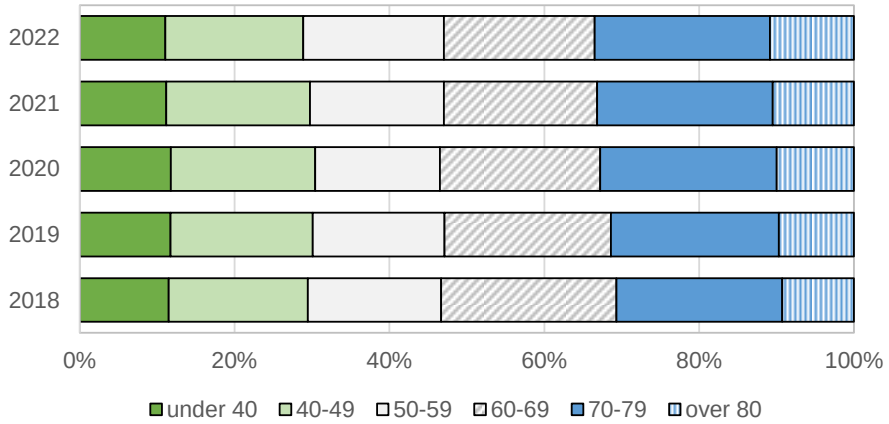
Household income
I
II
III
IV
V

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

Age distribution in Japan

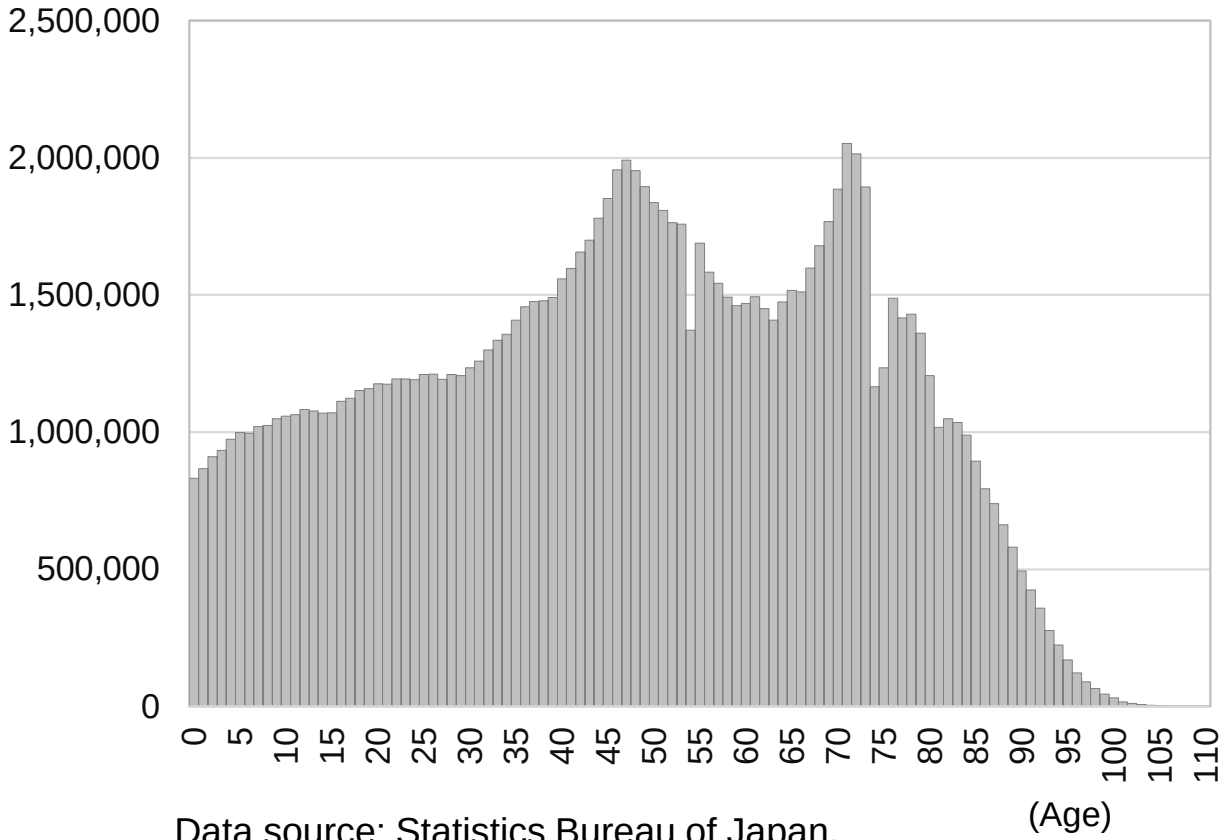
Family Income and Expenditure





Note: Limited to households with two or more members.

Census (2020)

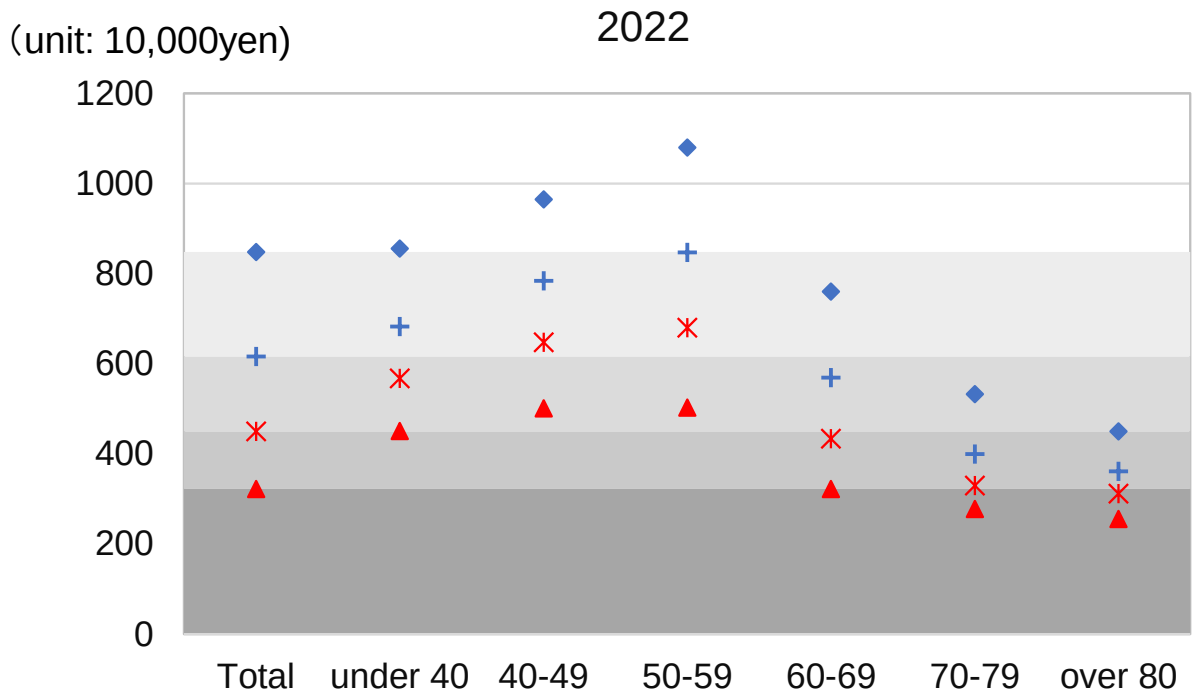


Data source: Statistics Bureau of Japan, 2020 Population Census.

Calculation method for income quintiles

Income quintiles are calculated within age categories by year,

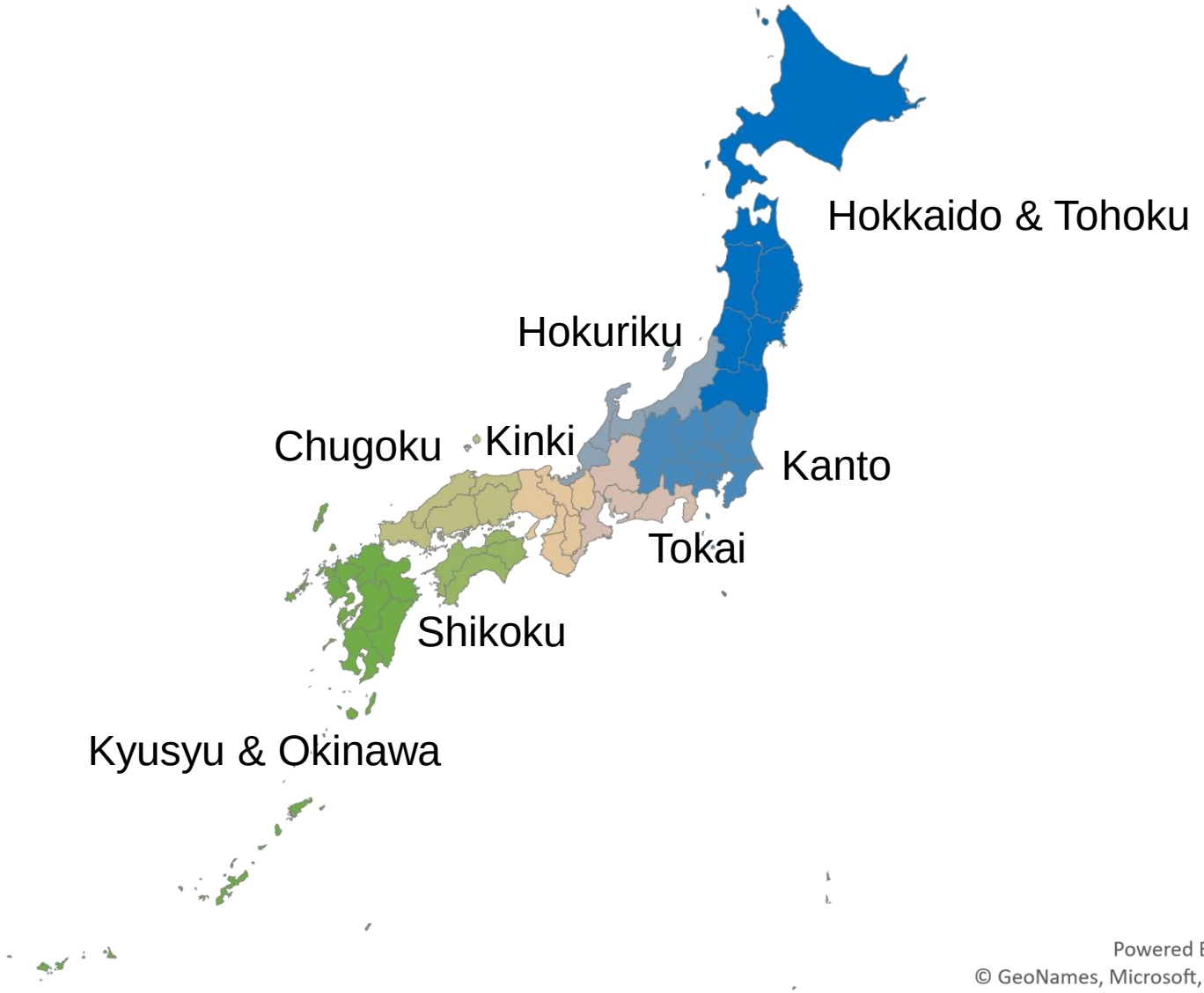
not pooled across all households.



Data source: Estimates from microdata of Family Income and Expenditure
(households with two or more members)

Eight regions

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



Data

Variable	Data source	Note
Price	Consumer Price Index	✓ by item (# of items: 581) ✓ national average (prefecture-specific itemized CPI is not publicly available)
Expenditure	Family Income and Expenditure	✓ utilizing microdata (# of households / month: about 8,000) ✓ households with two or more members (single-member households is to be added) ✓ analysis period: 2018M1-2022M12 (to be extended)

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

Method

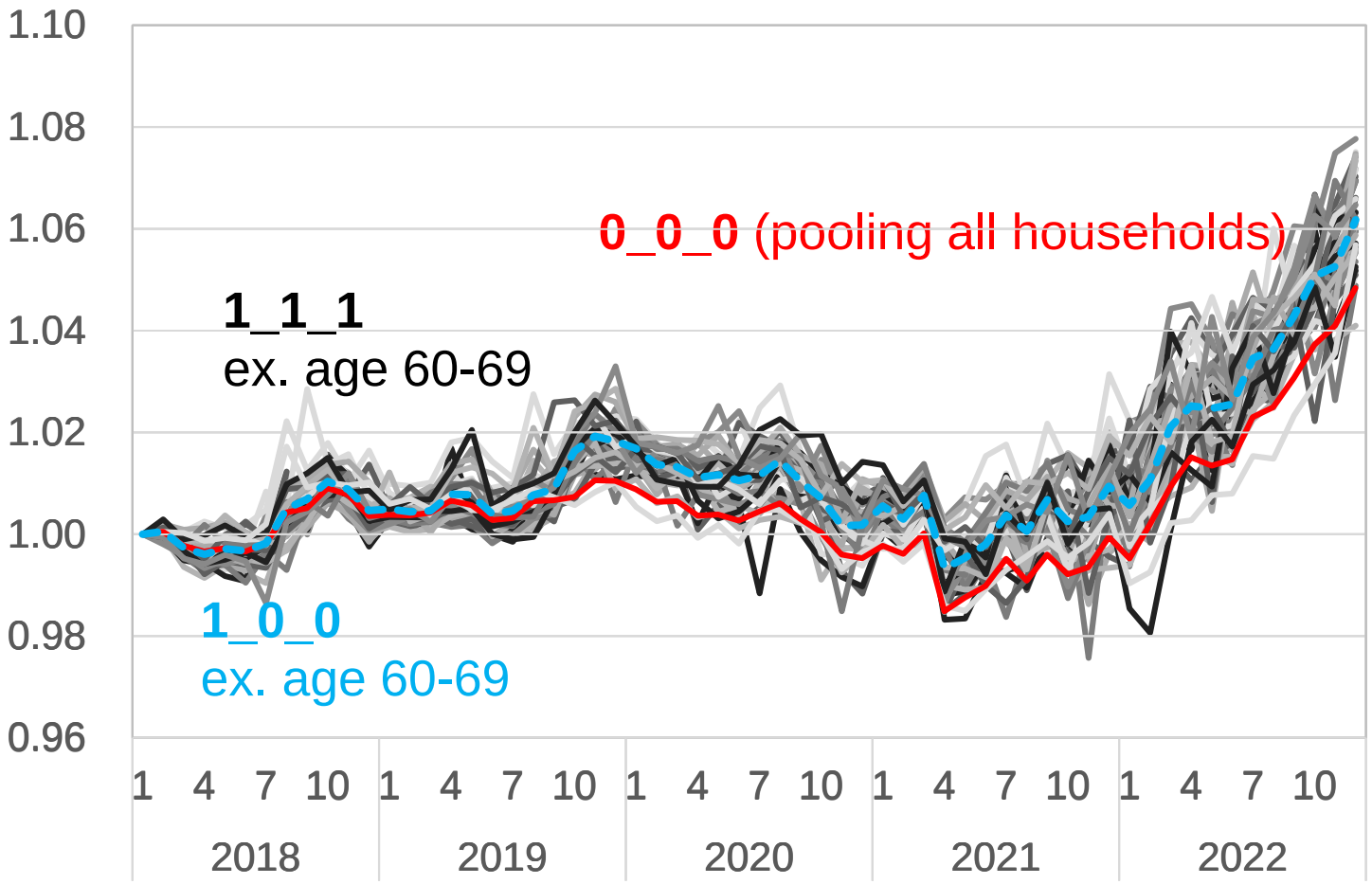
1. As measures of inequality, we calculate the logarithmic variance and Gini coefficient for monthly household expenditure.

2. When calculating the real value of household expenditures, we use 8 price indices (Fisher), ranging from “000” to “111”.

3. We check how the choice of price indices affects inequality.

No.	Age (6 category)	Income (5)	Region (8)	# of Price Indexes
000	0	0	0	1
001	0	0	1	8
010	0	1	0	5
011	0	1	1	40
100	1	0	0	6
101	1	0	1	48
110	1	1	0	30
111	1	1	1	240

Fisher (000, 010, 001, and 111)



The Relationship Between Price Indices and Inequality

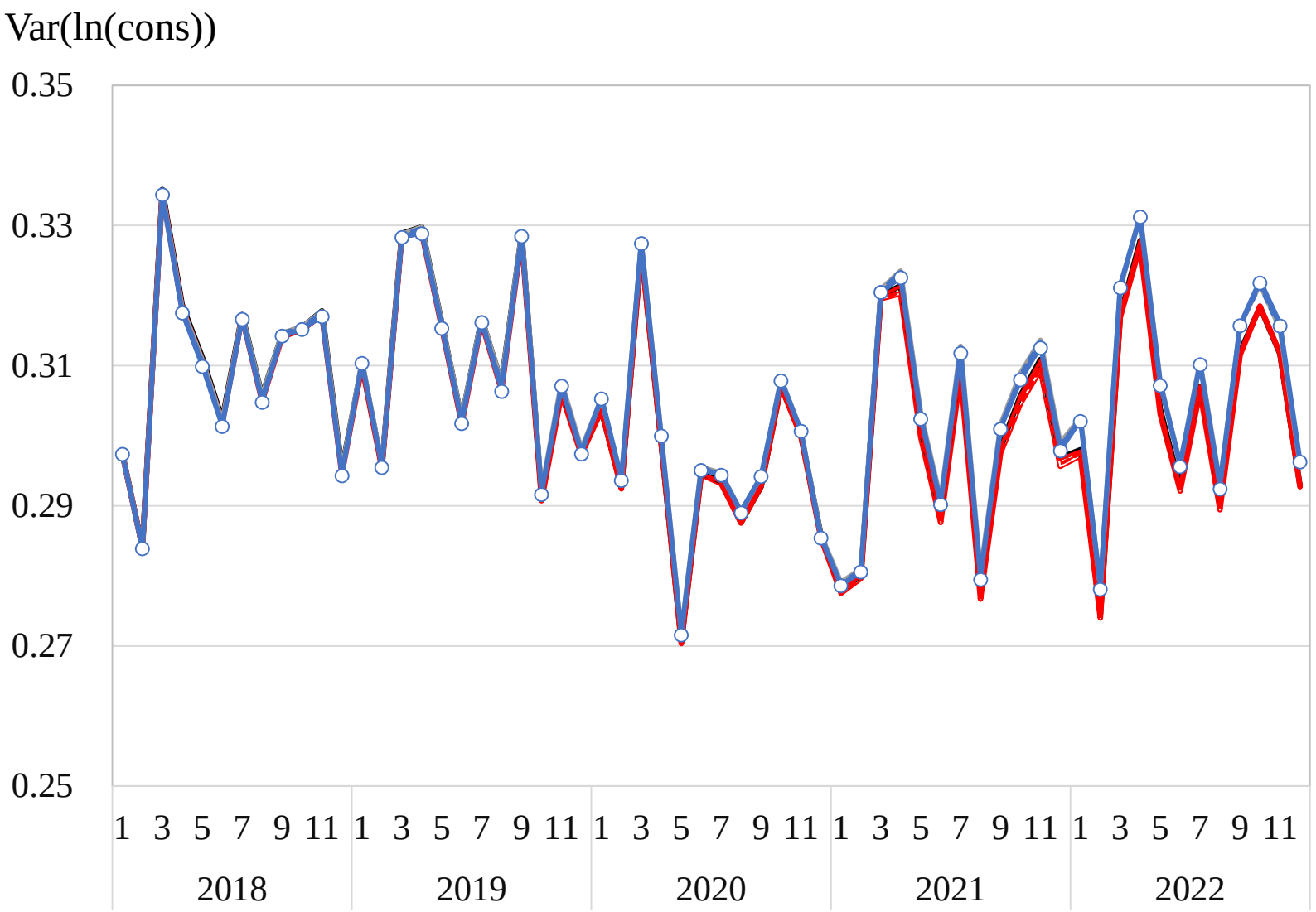
$C_{i,t}$: Nominal Monthly Expenditure for attribute *i* at time *t*

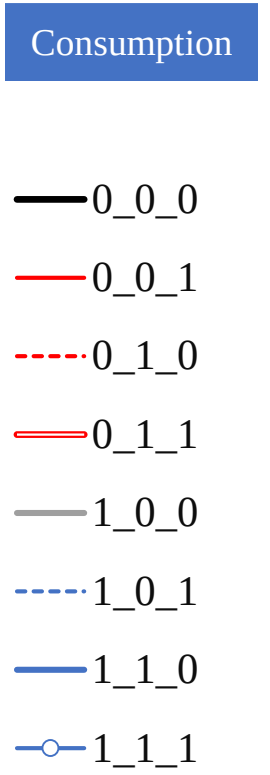
$P_{i,t}^{k}$: Price Index for attribute *i* at time *t*

$k = \{000, 001, 010, 011, 100, 101, 110, 111\}$

$Corr(C_{i,t}, P_{i,t}^{k})$	Real expenditure	Inequality in real expenditure
> 0 (ex. Households with higher nominal consumption expenditures experience higher inflation rates.)	↓ for rich ↑ for poor	↓
< 0	↑ for rich ↓ for poor	↑

Inequality and Price Index (Fisher): Var(ln(cons))





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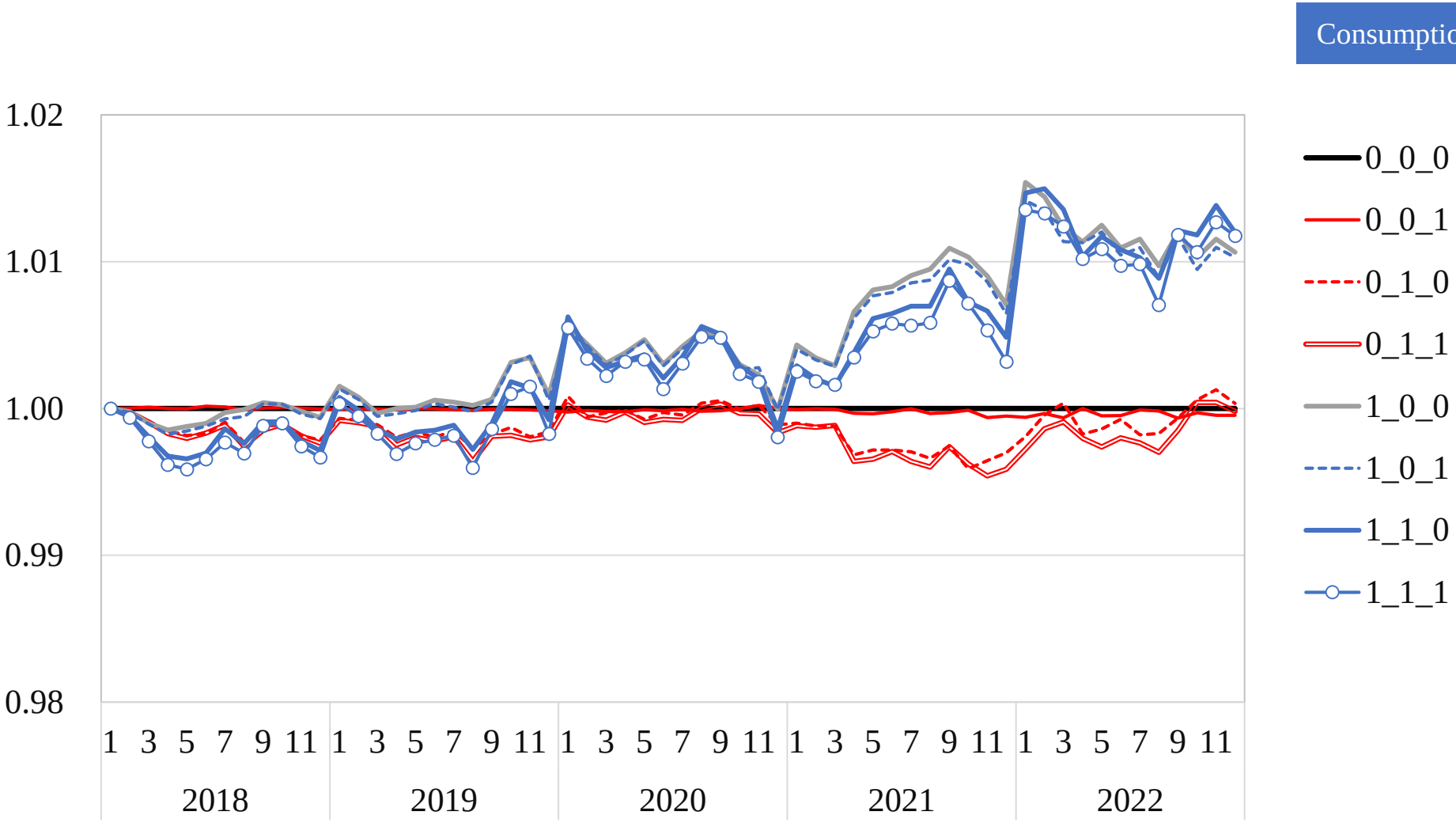
011	0	1	1	40
100	1	0	0	6
101	1	0	1	48
110	1	1	0	30
111	1	1	1	240

Data source: Estimates from microdata of Family Income and Expenditure (households with two or more members), and Consumer Price Index.

Ratio of Real to Nominal: Var(ln(cons))



Consumption

- 0_0_0
- 0_0_1
- 0_1_0
- 0_1_1
- 1_0_0
- 1_0_1
- 1_1_0
- 1_1_1

No.	Age (6 category)	Income (5)	Region (8)	# of Price Indexes
000	0	0	0	1
001	0	0	1	8
010	0	1	0	5
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101	1	0	1	48
110	1	1	0	30
111	1	1	1	240

Comparison among Price indices

Slide for Gini coefficient

Findings & Future Tasks

Findings:

- ✓ Inequality measurement is influenced by the choice of price index used.
- ✓ During recent periods of rising inflation, not considering age tends to underestimate inequality.
- ✓ However, it appears that adding more attributes can either increase or decrease variance of consumption.

Future Tasks:

- ✓ Extending the analysis period to examine the impact of factors such as natural disasters and changes in the consumption tax rate on inequality.
- ✓ Calculating price index that takes into account the price differences among the 47 prefectures
- ✓ Considering differences in acquisition prices based on household attributes as much as possible (it may be challenging…)