実証的なモラル・サイエンス
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Age, Income, Region Specific CPI and Consumption Inequality

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PART I

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.

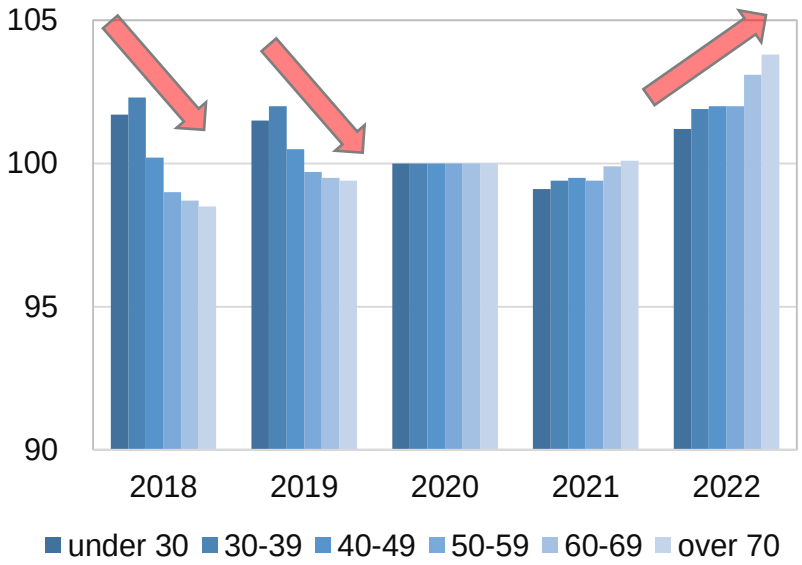
Moretti (2013, *Applied Econ*.)

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)

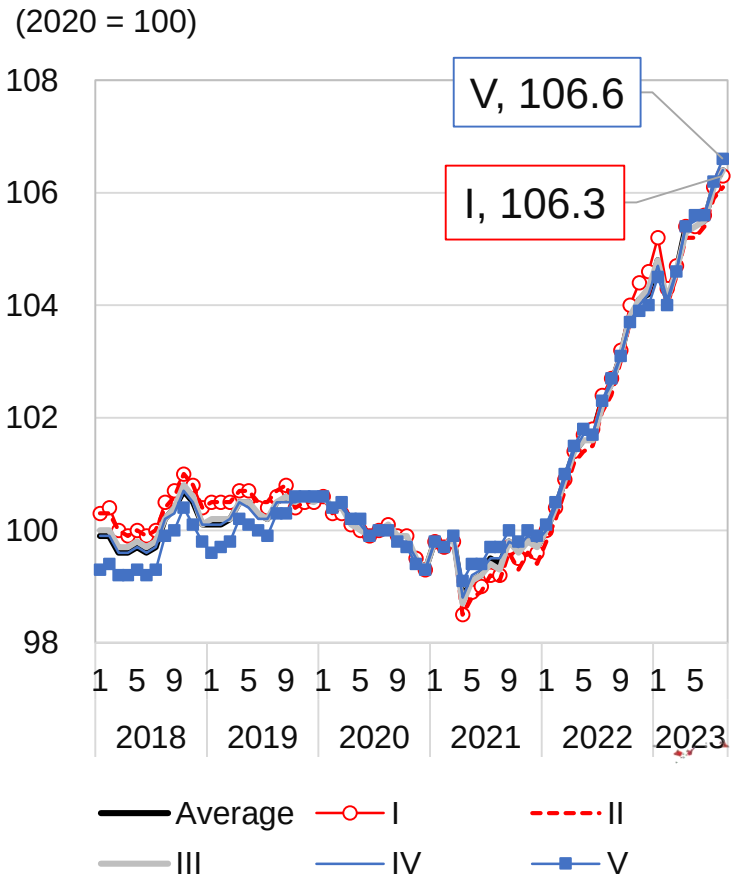
By Age



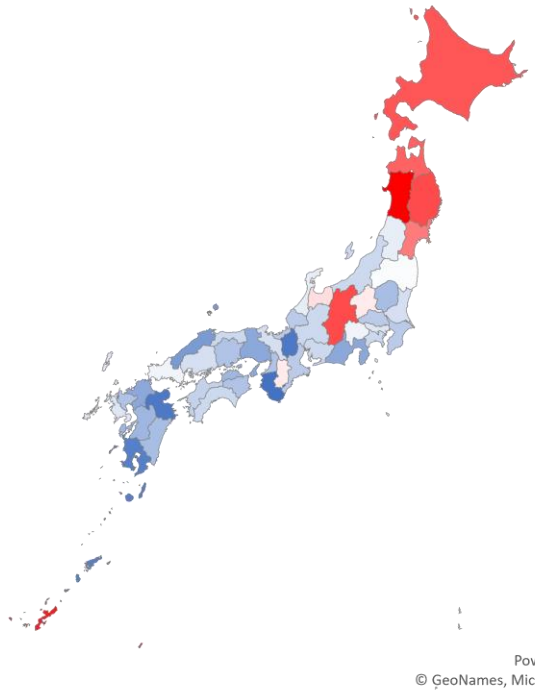
Note: Only the annual average value is available

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

By Income



By Region (August 2023)

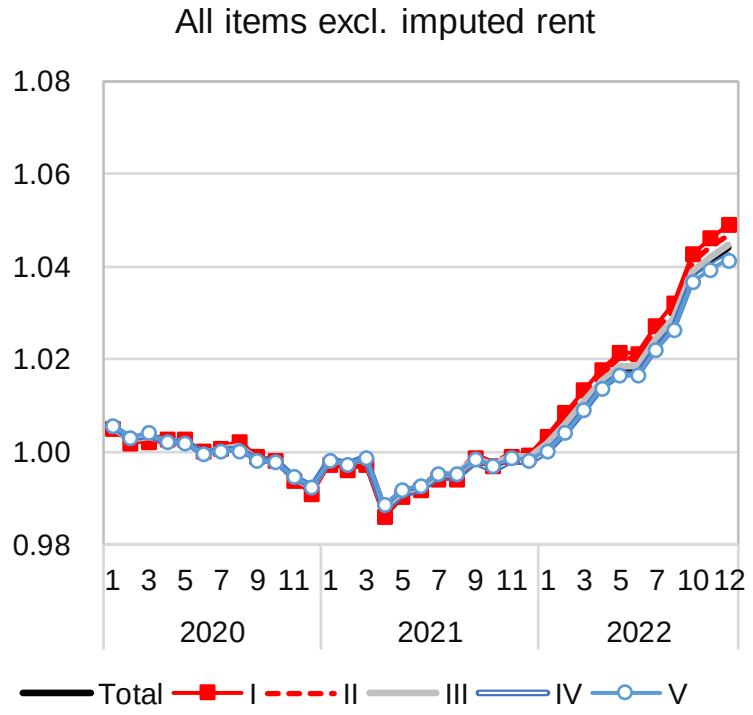


Is it necessary to consider price indices that take into account not just one but two or more attributes simultaneously?

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

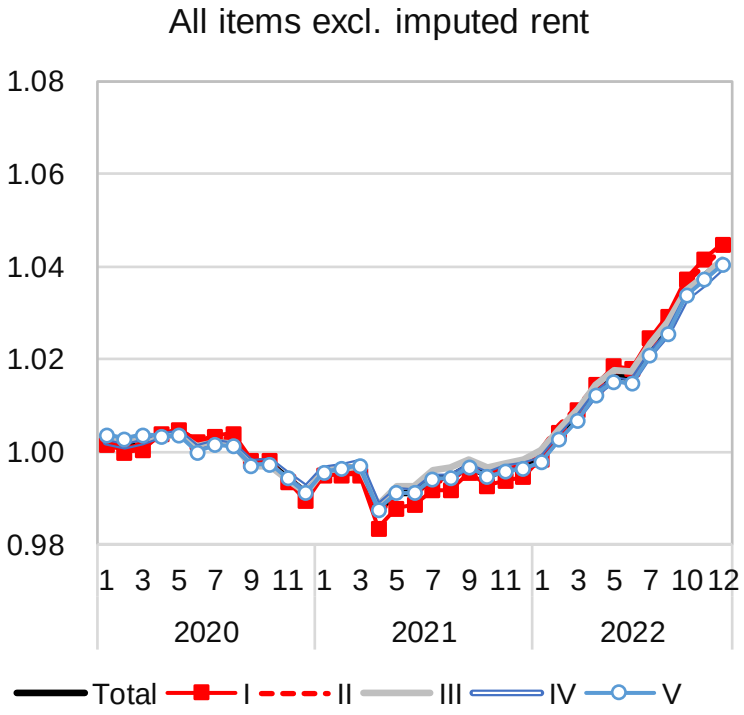
(Dec 2022) I-V= 0.008

Japan



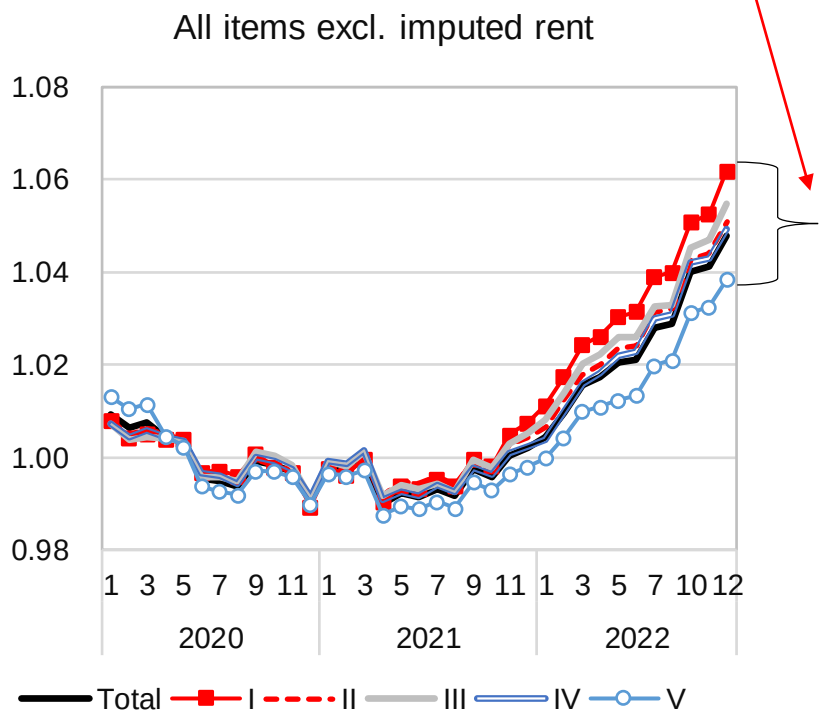
(Dec 2022) I-V= 0.004

Tokyo



(Dec 2022) I-V= 0.023

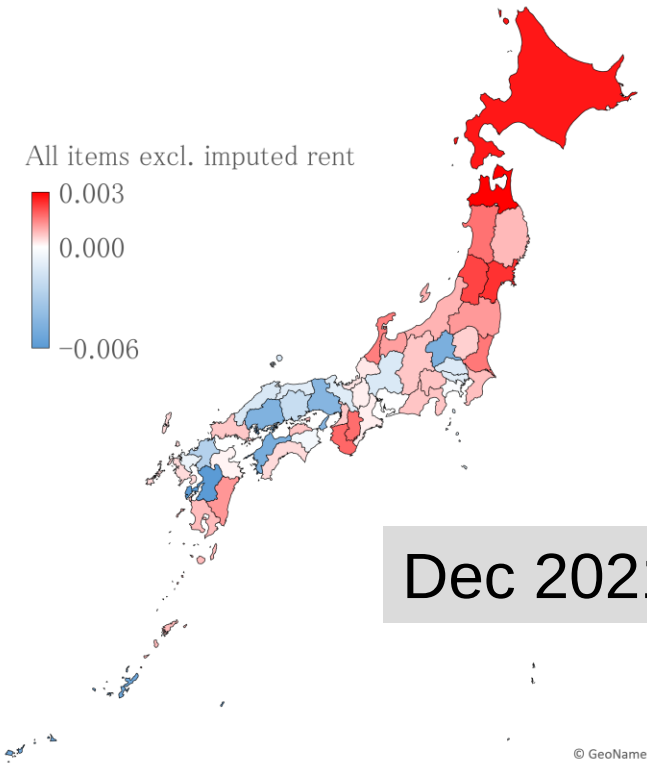
Miyagi



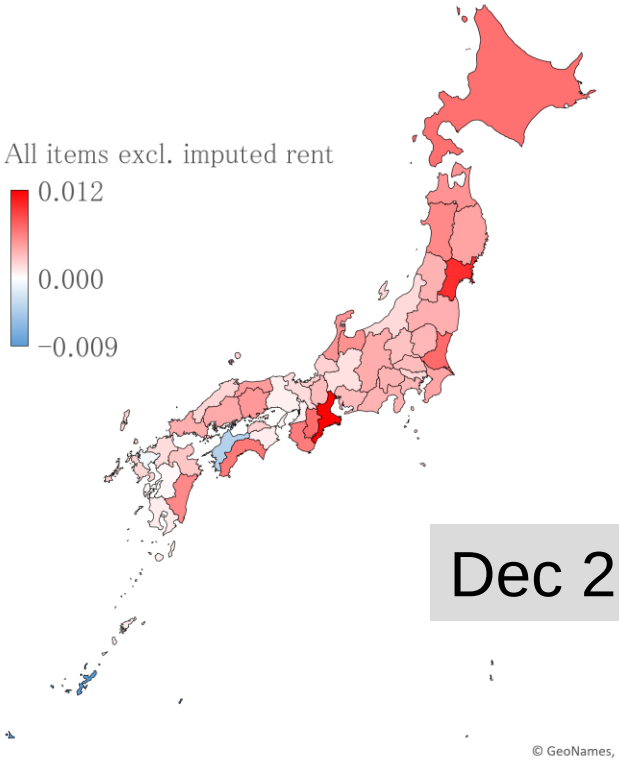
Data source: Estimates by Abe and Inakura (2023) from the Ministry of Internal Affairs and Communications' "National Family Income and Expenditure Survey (2019)", "Household Survey," and '"Consumer Price Index."

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

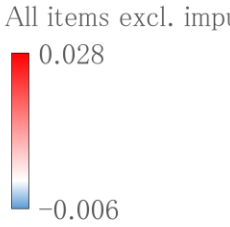
Dec 2020



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:

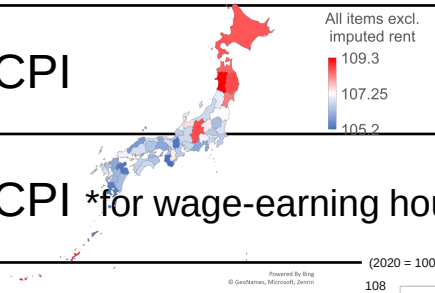
- ✓ Covering all consumption categories, including services.
- ✓ Targeting a representative sample of households (approximately 8,000 households monthly).
- ✓ Utilizing high-precision household-specific expenditure data by diary basis.

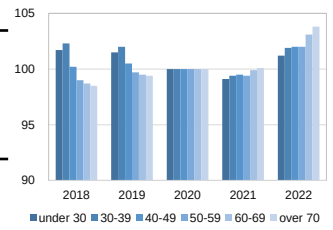
Our purpose is to clarify how the choice of price indices impacts the measurement of inequality in real consumption expenditure.

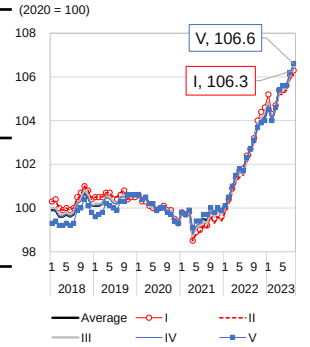
How many indices do we attempt to calculate?

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

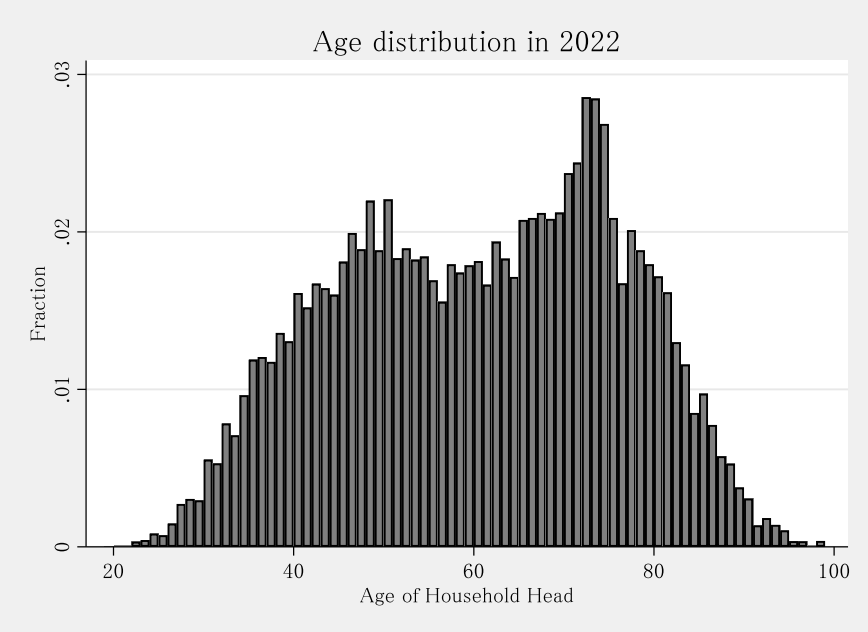
Age (of the head of household)
under 40
40-49
50-59
60-69
70-79
over 80

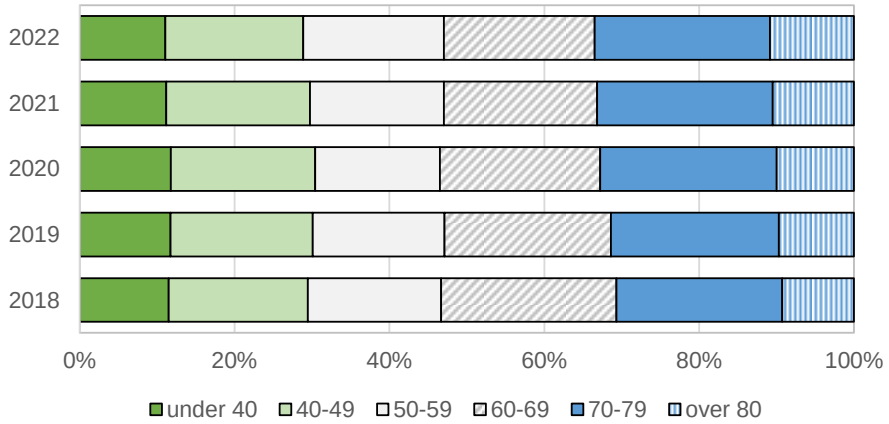
Household income
I
II
III
IV
V

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

Age distribution in Japan

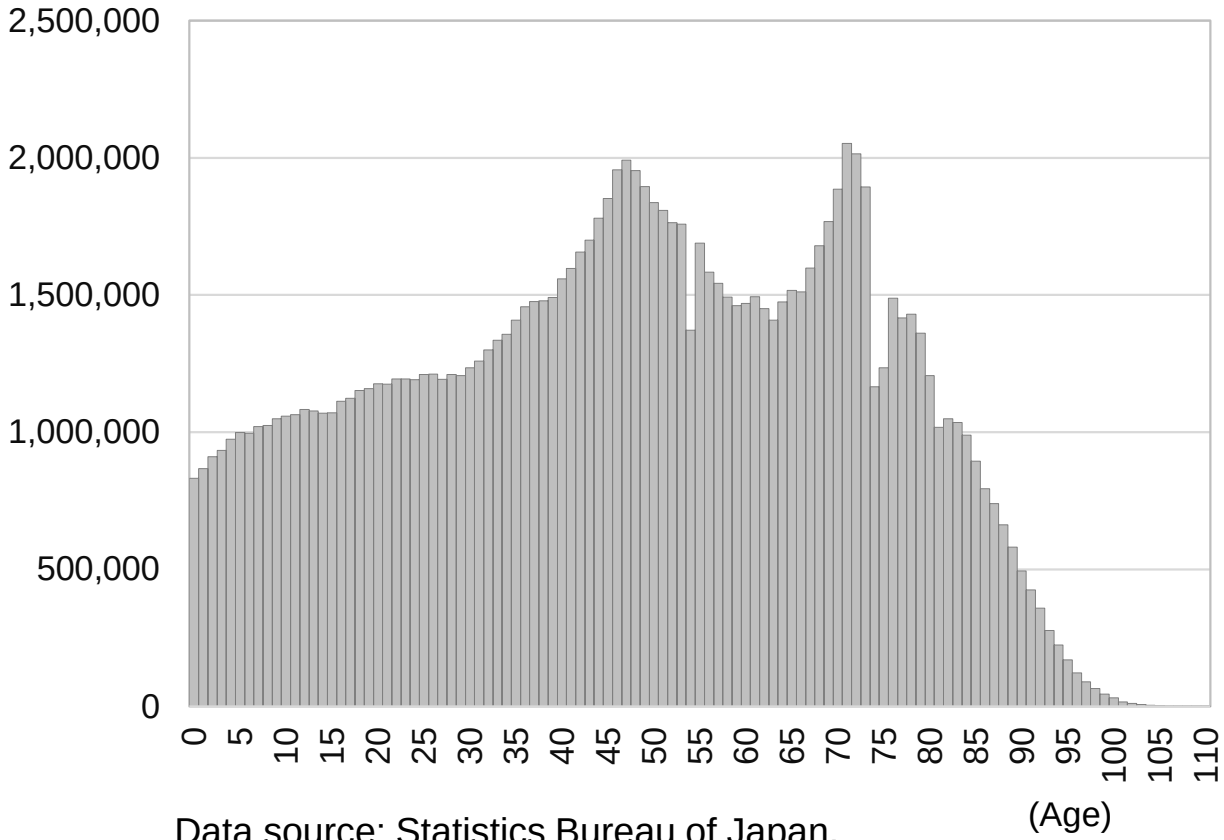
Family Income and Expenditure





Note: Limited to households with two or more members.

Census (2020)

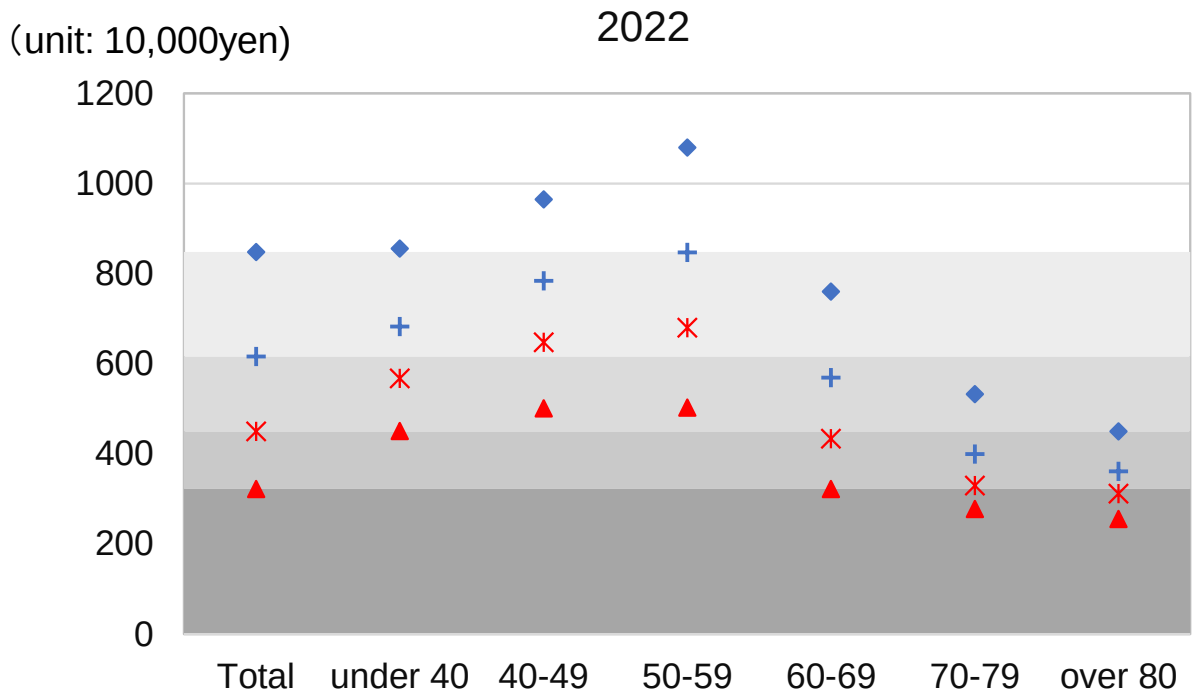


Data source: Statistics Bureau of Japan, 2020 Population Census.

Calculation method for income quintiles

Income quintiles are calculated within age categories by year,

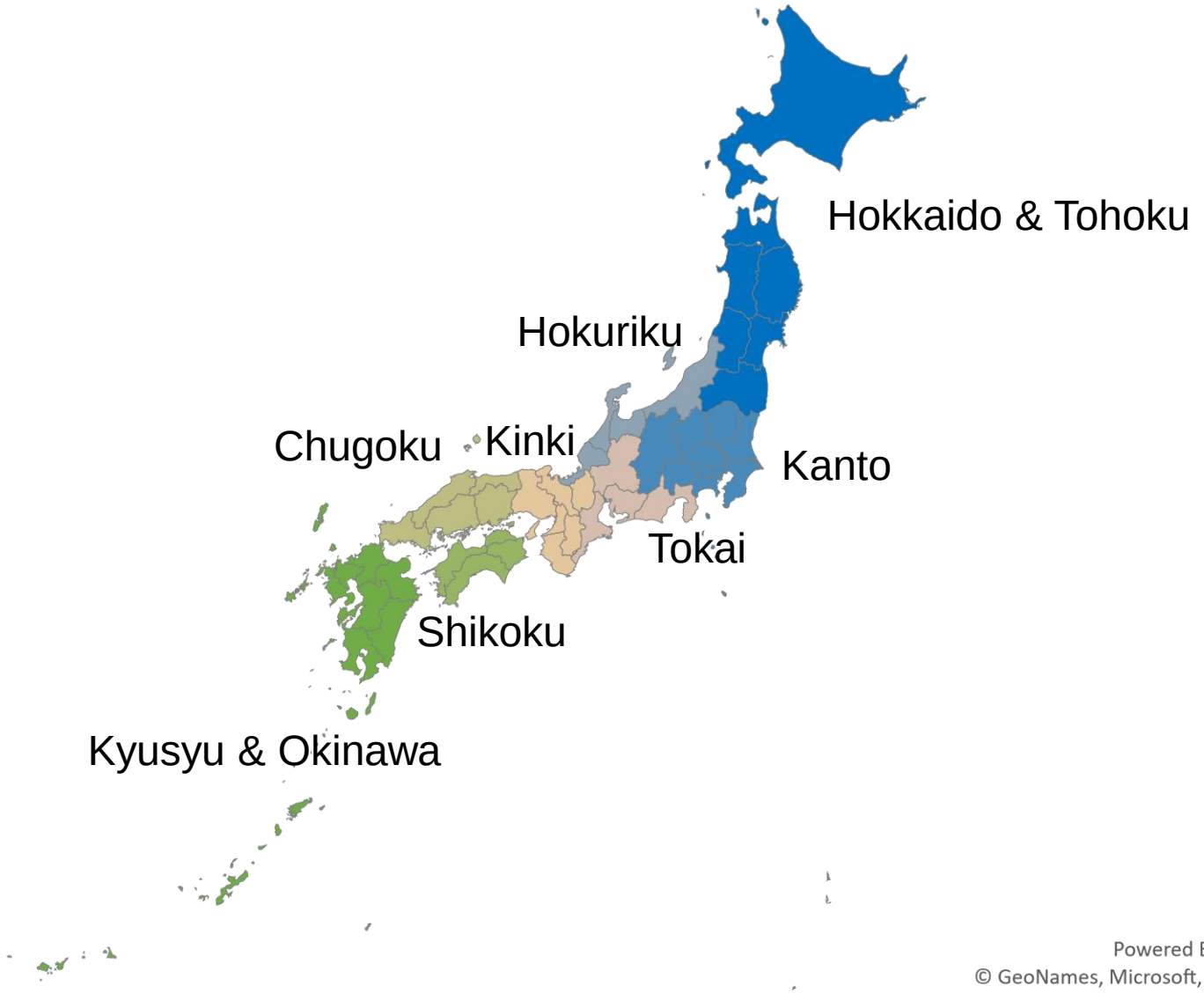
not pooled across all households.



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

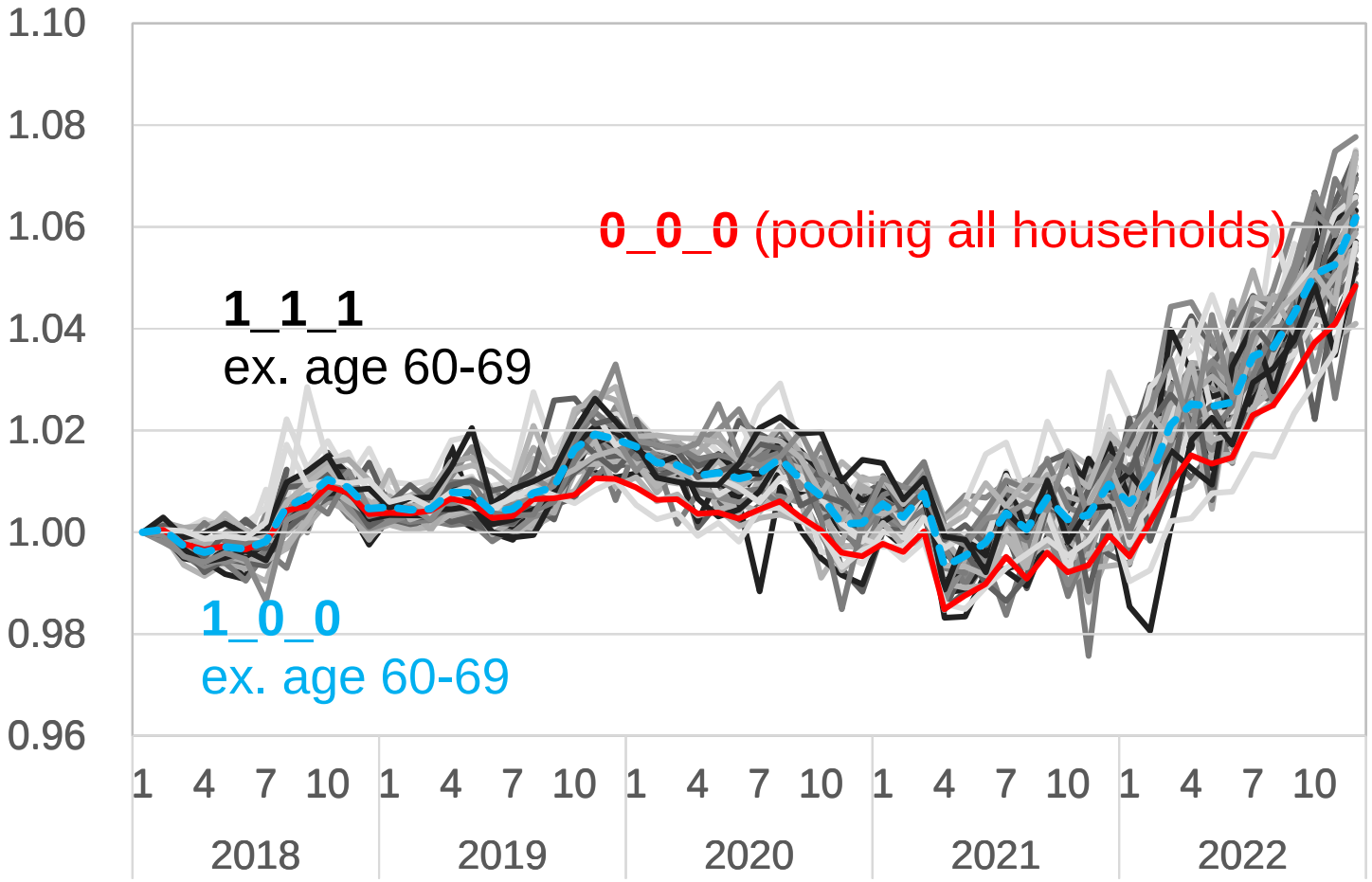
1. As measures of inequality, we calculate the logarithmic variance and Gini coefficient for monthly household expenditure.

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

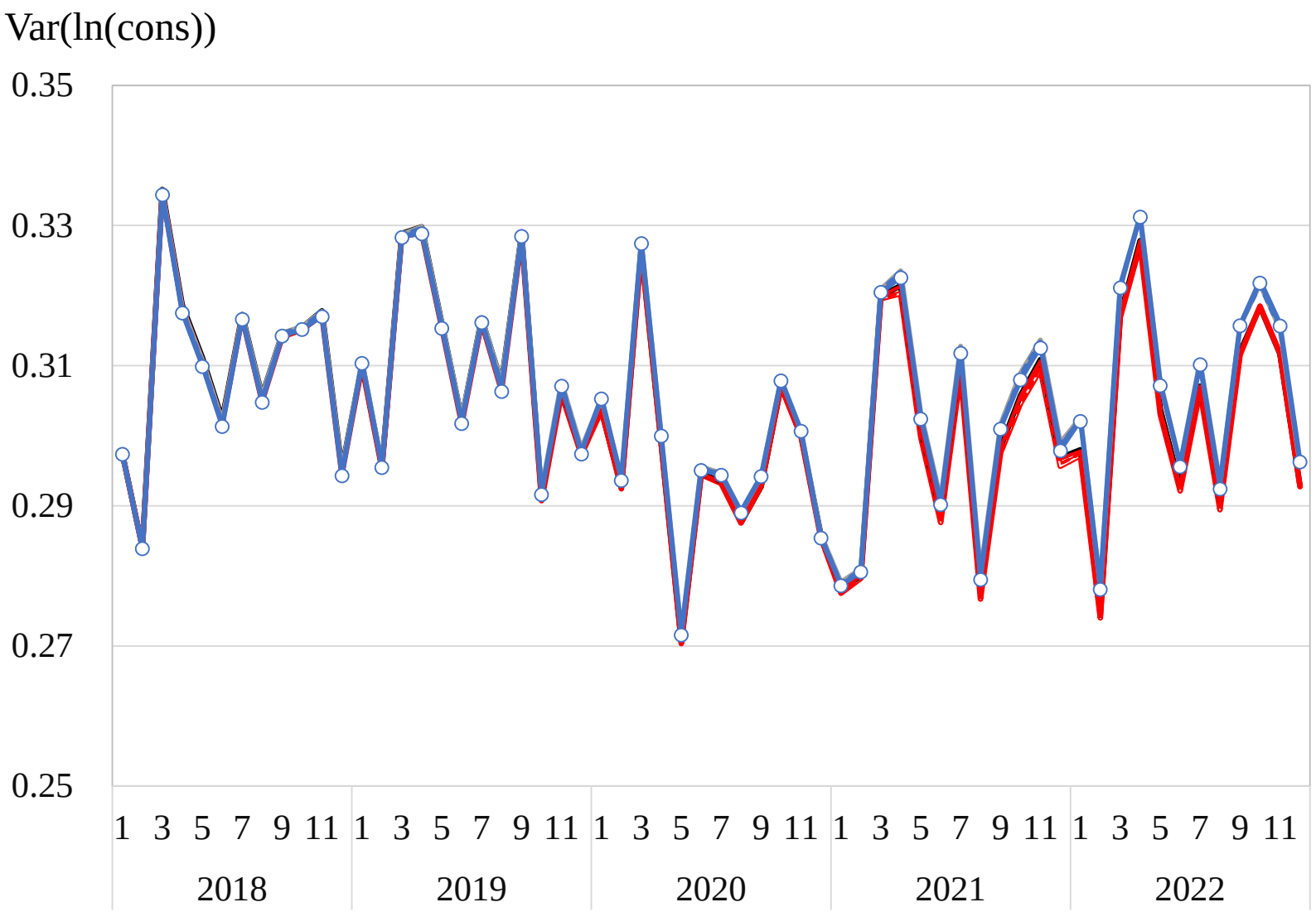
$C_{i,t}$: Nominal Monthly Expenditure for attribute *i* at time *t*

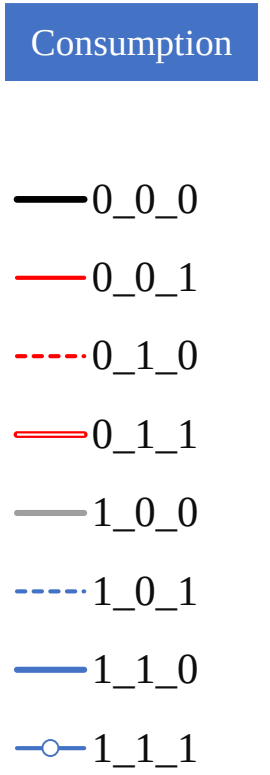
$P_{i,t}^{k}$: Price Index for attribute *i* at time *t*

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

$Corr(C_{i,t}, P_{i,t}^{k})$	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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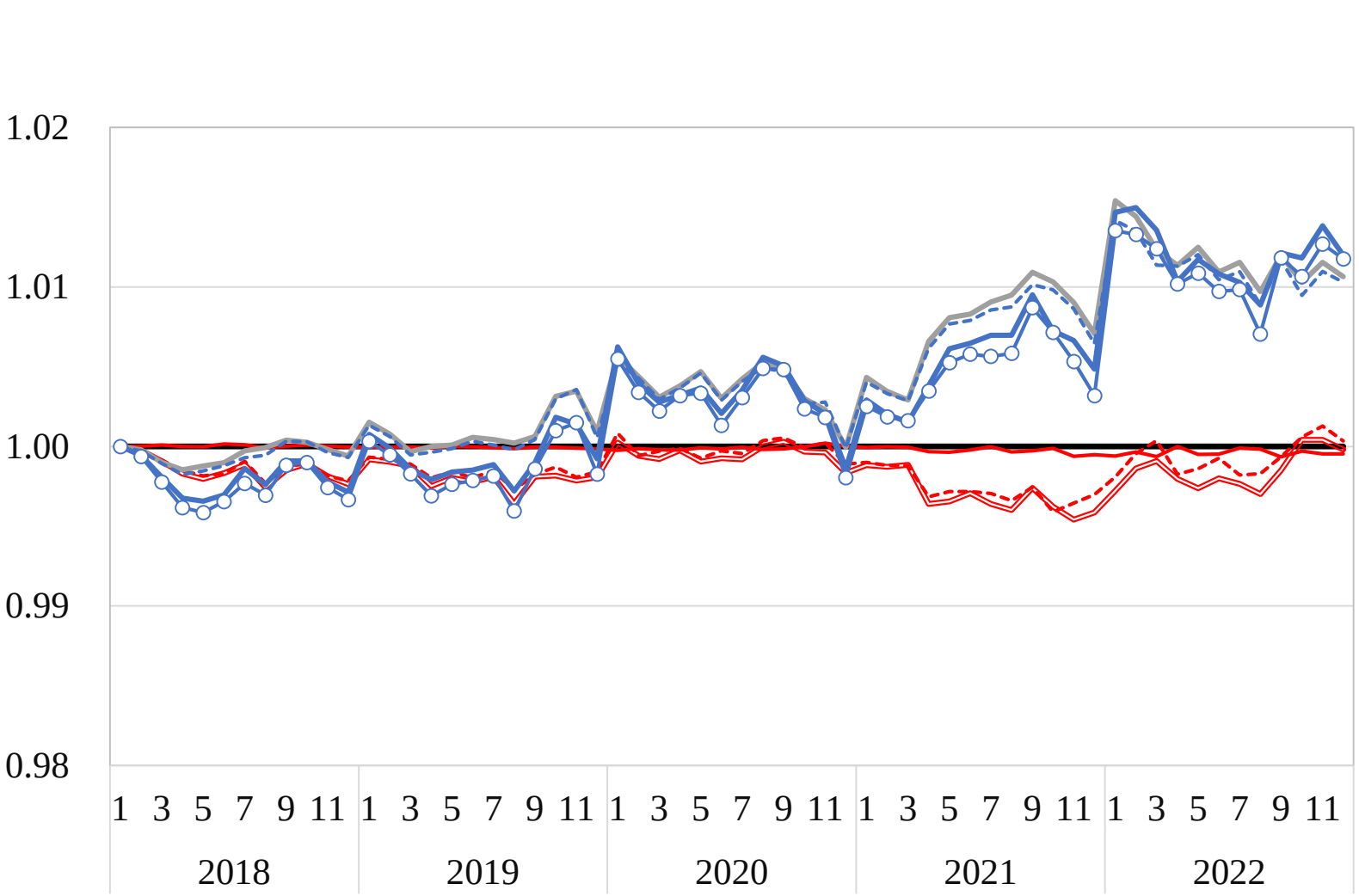
011	0	1	1	40
100	1	0	0	6
101	1	0	1	48
110	1	1	0	30
111	1	1	1	240

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
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

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…)

PART II

Considering differences in acquisition prices based on household attributes

医療・教育をめぐる価格指数の課題

① 医療や教育の質をどのように価格指数に反映するか？→本研究では踏み込ま（め）ない

② 子育て支援策等で、子どもの医療費や教育費が「実質無償化」される場合

（あるいは、それに近いレベルまで自己負担が減る場合）、消費格差をどのように計測するか？

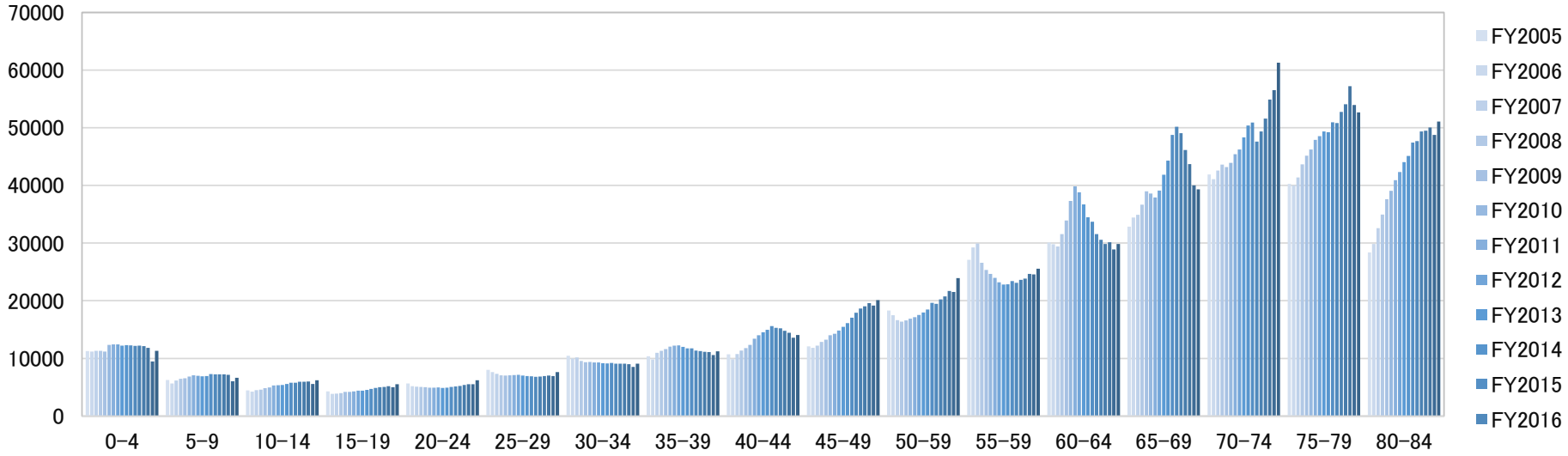
指数や格差の計測に用いる変数	無償化による変化	例
価格	ゼロ or 欠損（調査中止）	2020年基準のCPIでは「幼稚園保育料」が指数品目から消えた
支出金額	家計簿に記録される支出金額は減少	『家計調査』の「医療診療代」や「幼児教育費用」がゼロになる世帯もありうる。 ※ただし、ゼロ円で消費したのか、そもそも利用していないか、は識別できない（次のスライド）

ある品目（例：医療）の「支出」金額を「世帯共通の価格指数」で実質化した場合の実質消費格差は、

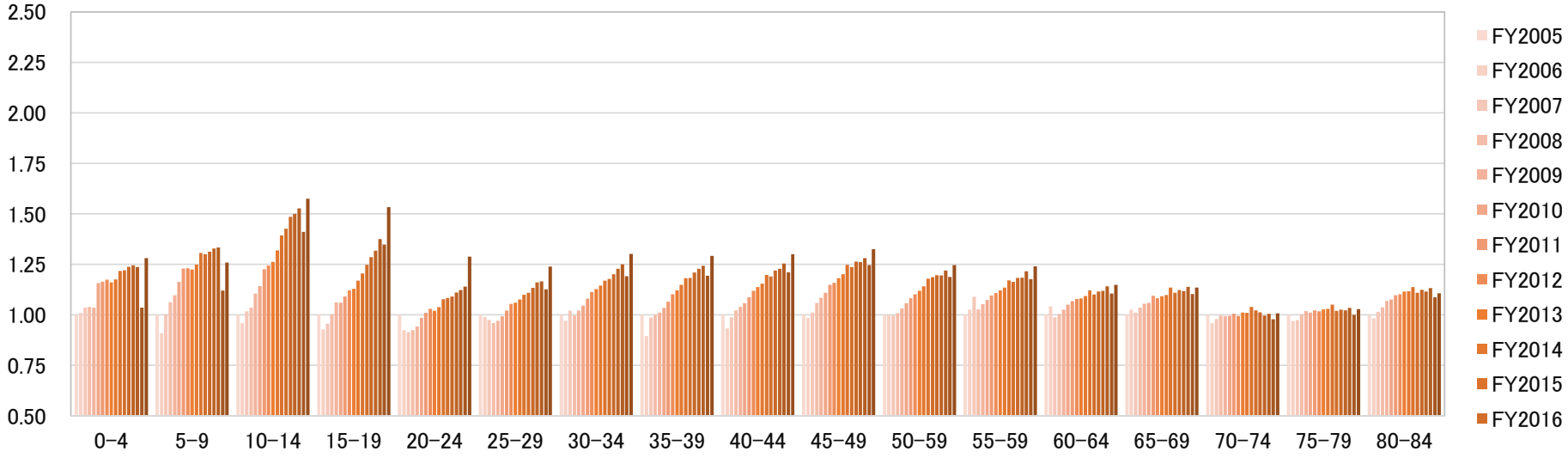
無償化され、自己負担が減る世帯 ＜ 所得制限等の要件から、無償化されない世帯

『国民医療費』: 総数

①国民医療費（単位：億円）: 総数

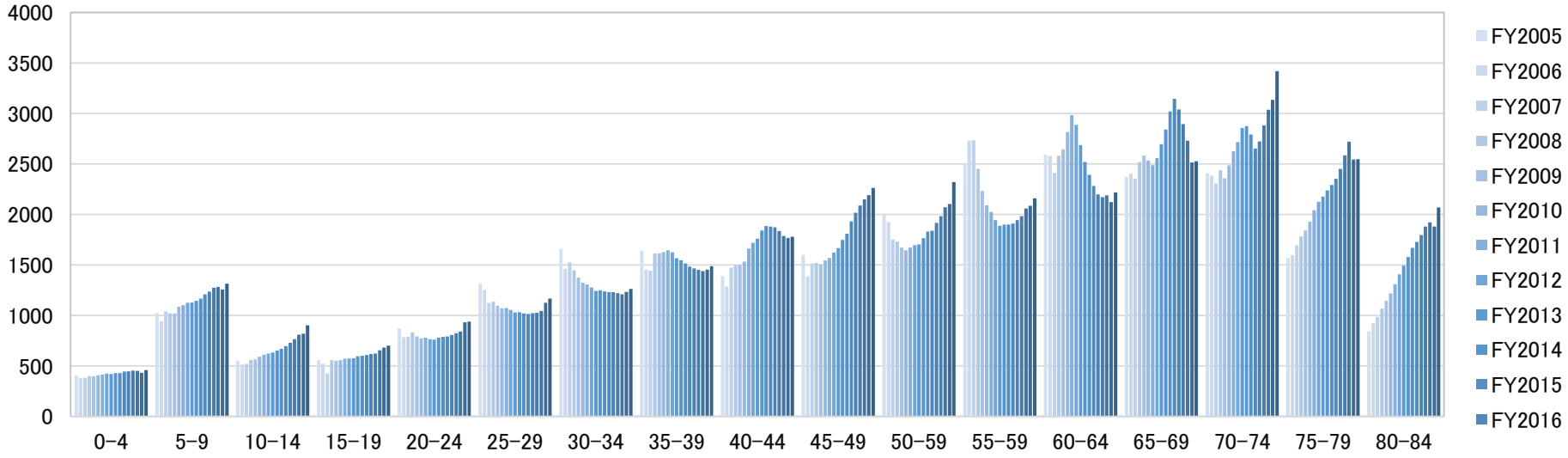


②1人当たり・国民医療費（2005年=1）: 総数

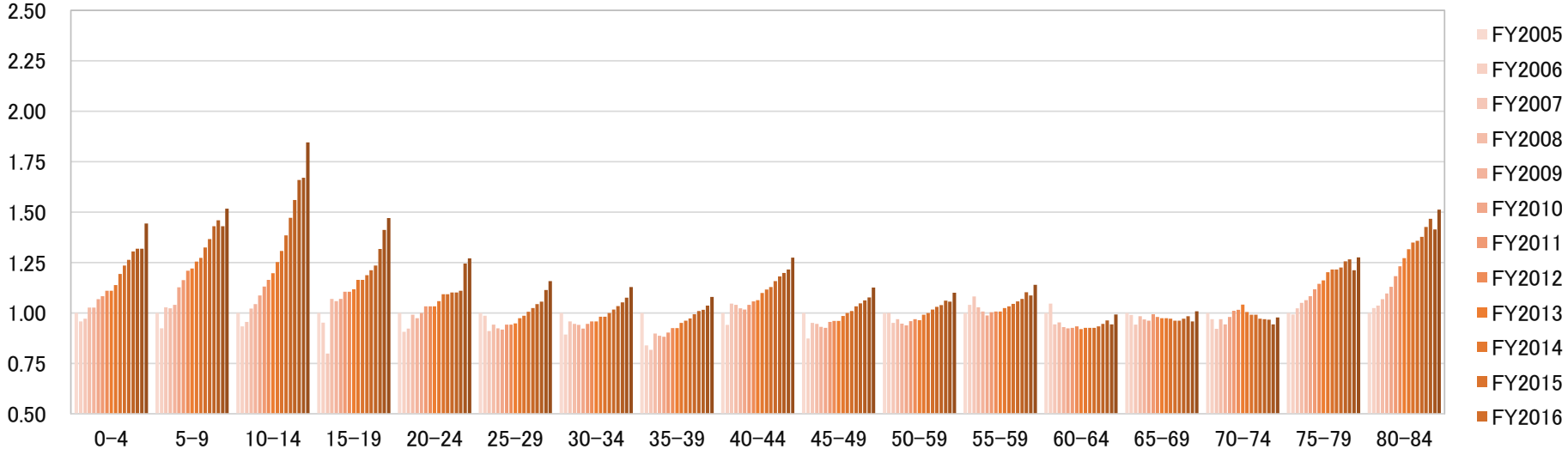


『国民医療費』:歯科診療

①国民医療費(単位:億円): 歯科診療

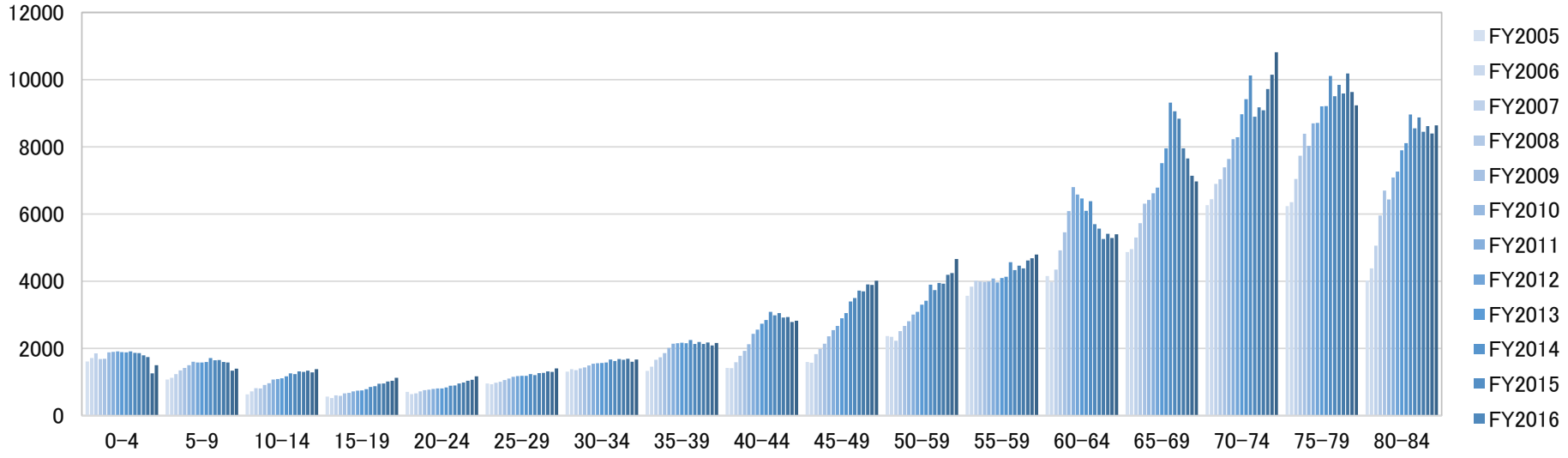


②1人当たり・国民医療費(2005年=1): 歯科診療

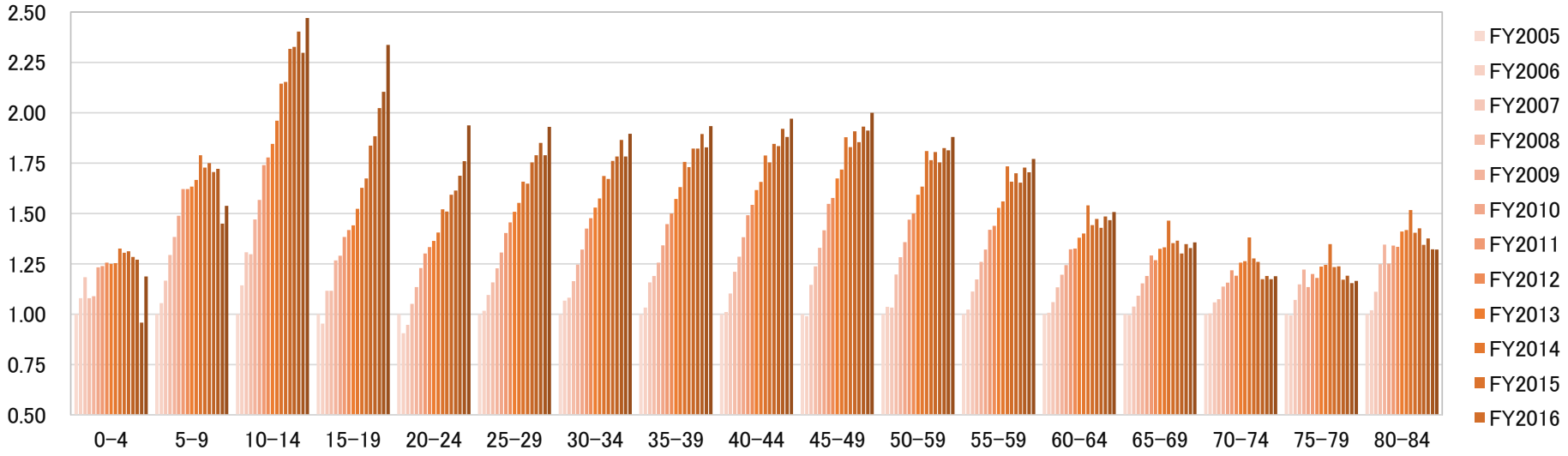


『国民医療費』:薬局調剤

①国民医療費(単位:億円): 薬局調剤



②1人当たり・国民医療費(2005年=1): 薬局調剤

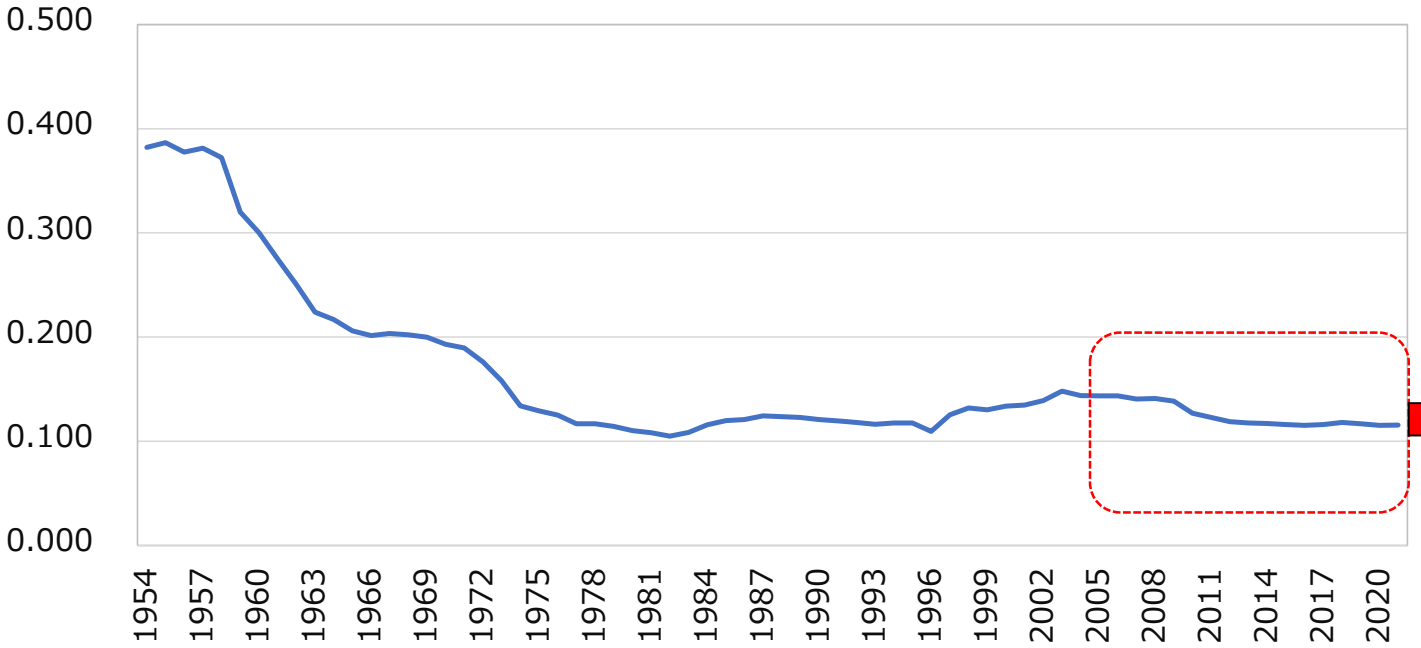


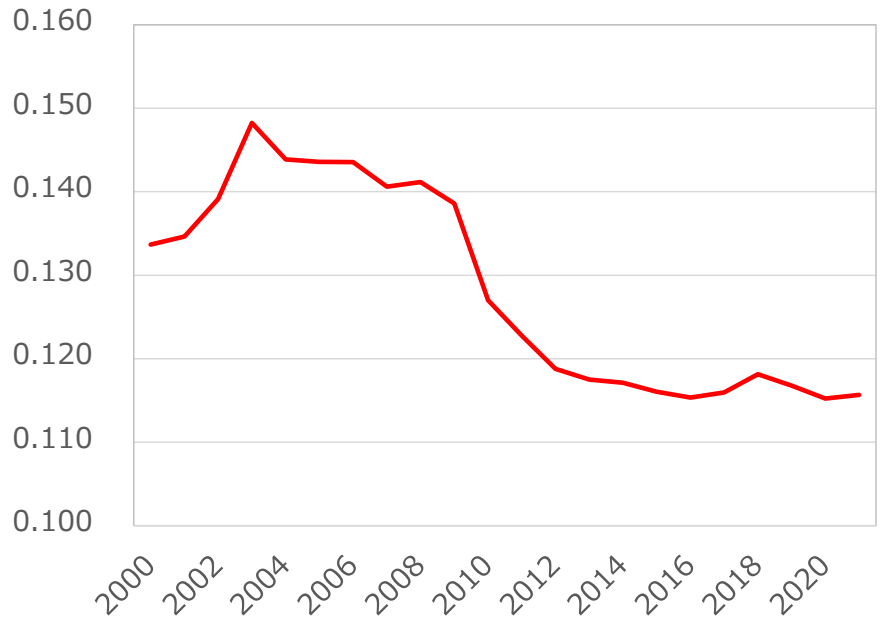
世帯の実質消費格差の計測方法

・Cross section方向の格差、Time series方向の格差を分析

・世帯属性や、時点により、自己負担割合が異なる点を反映した価格指数を推計

患者負担割合の推移





データ出所）厚生労働省『国民医療費』第5表　国民医療費，財源・年次別、より作成

筆者らの知る限り、年齢別の患者負担割合（の時系列データ）は公表されていない

世帯属性別・「保健医療サービス指数」の推計

h :世帯属性（年齢×世帯年収カテゴリー）

p_t :世帯属性間で共通の医療サービス価格→GDPデフレータ（保健衛生・社会事業）を使用

s_t^h :世帯属性別・自己負担率→『家計調査』、『国民医療費』より推計

E_t^h :（『家計調査』に記録されている自己負担分の）支出金額

q_t^h :数量→推計値として登場

$$E_t^h = s_t^h p_t q_t^h$$

$$\frac{E_t^h}{E_{t-1}^h} = \frac{s_t^h p_t q_t^h}{s_{t-1}^h p_{t-1} q_{t-1}^h}$$

$$\frac{q_t^h}{q_{t-1}^h} = \left(\frac{E_t^h}{E_{t-1}^h}\right) \Big/ \left(\frac{s_t^h p_t}{s_{t-1}^h p_{t-1}}\right)$$

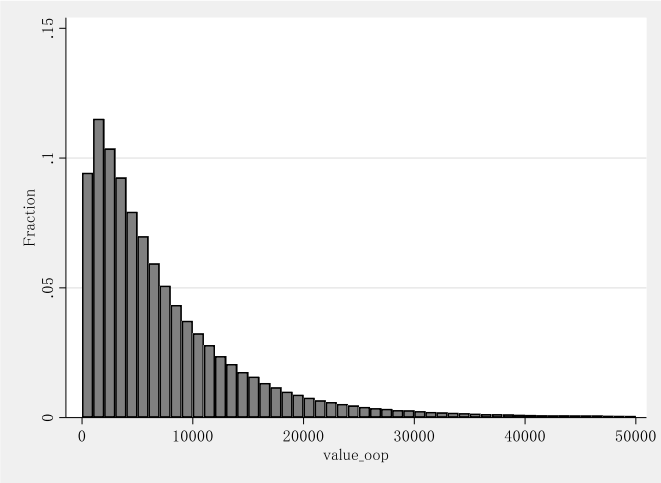
支出金額をデフレートする
世帯属性別・価格指数

『家計調査』における「医療サービス」自己負担額（世帯/月）

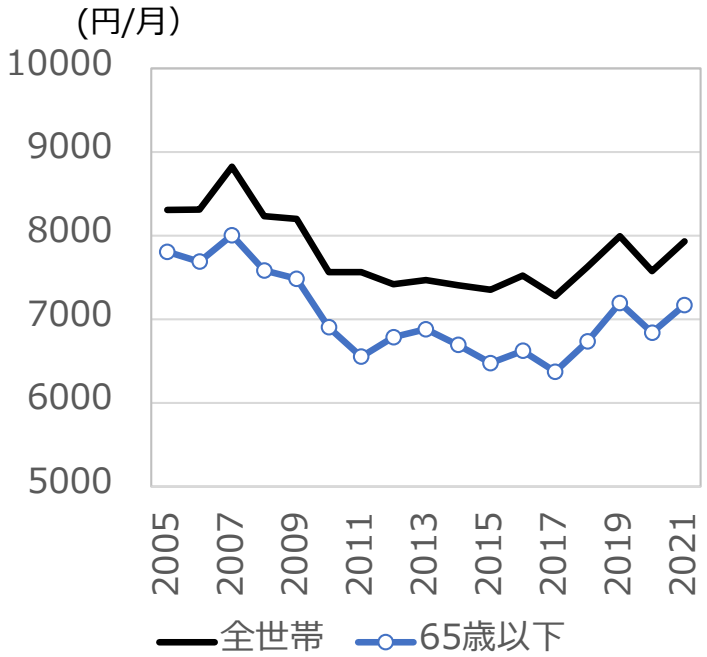
① 基本統計量（2005年～2021年）

N	Mean	Std. dev.	Min	Max
1,576,069	7802.048	28251.73	0	5,132,979

注）二人以上世帯に限定



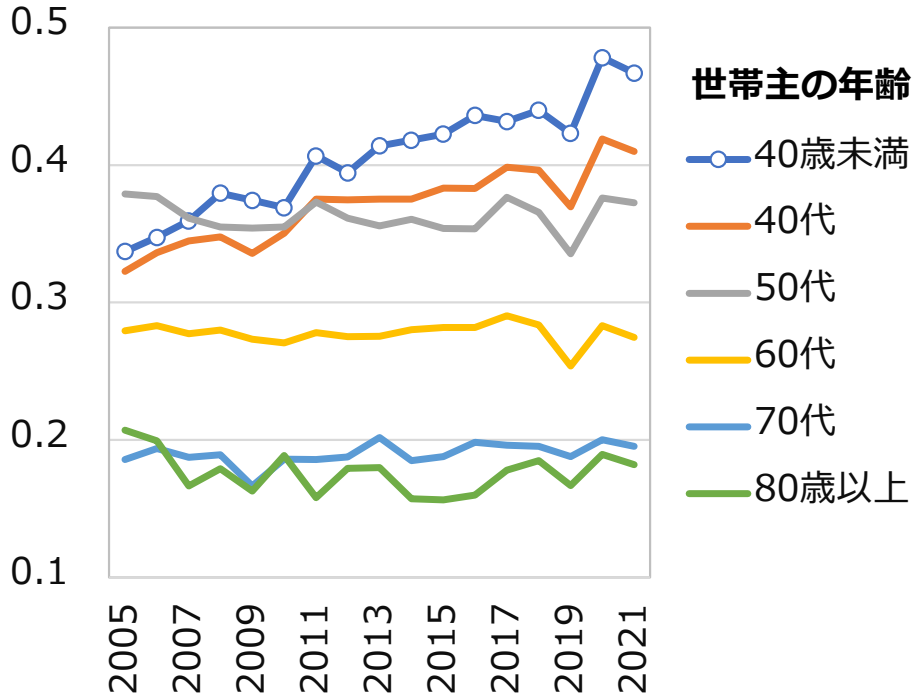
注）自己負担額>0に限定



② 支出金額ゼロ円の世帯

・全期間pool→28.9%

・世帯主年齢カテゴリー別



世帯単位の自己負担割合

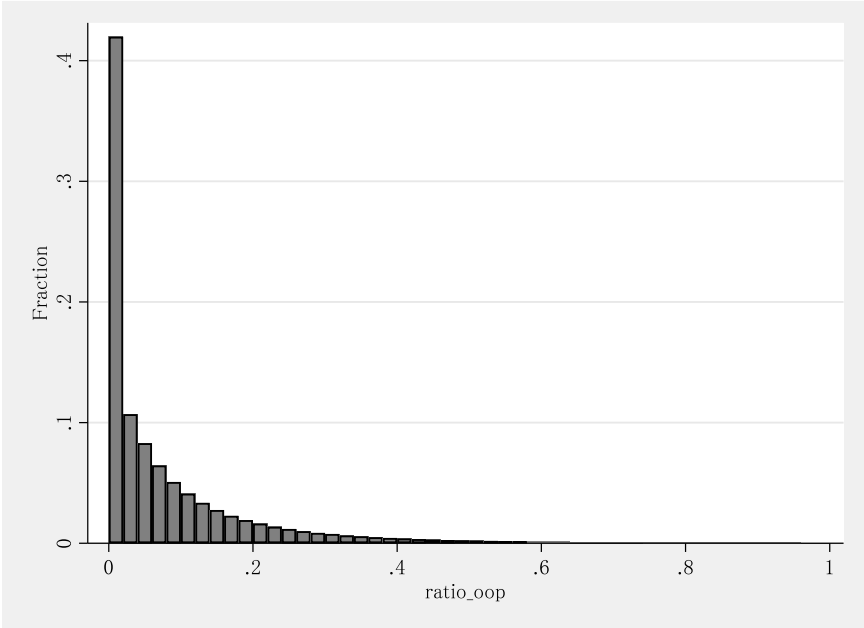
① 計算方法

世帯番号	(a) 医療サービス支出金額 (『家計調査』)	(b) 世帯員の年齢	(c) 年齢カテゴリー別・1人あたり医療費 (『国民医療費』)	世帯別・自己負担割合
1	E_t^1	68	M_t^{65-69}	$s_t^1 = \frac{E_t^1}{\left(M_t^{65-69} + M_t^{75-79}\right)}$
		75	M_t^{75-79}	
2	E_t^2	45	M_t^{45-49}	$s_t^2 = \frac{E_t^2}{\left(M_t^{45-49} + M_t^{45-49} + M_t^{10-14} + M_t^{0-4}\right)}$
		45	M_t^{45-49}	
		13	M_t^{10-14}	
		0	M_t^{0-4}	

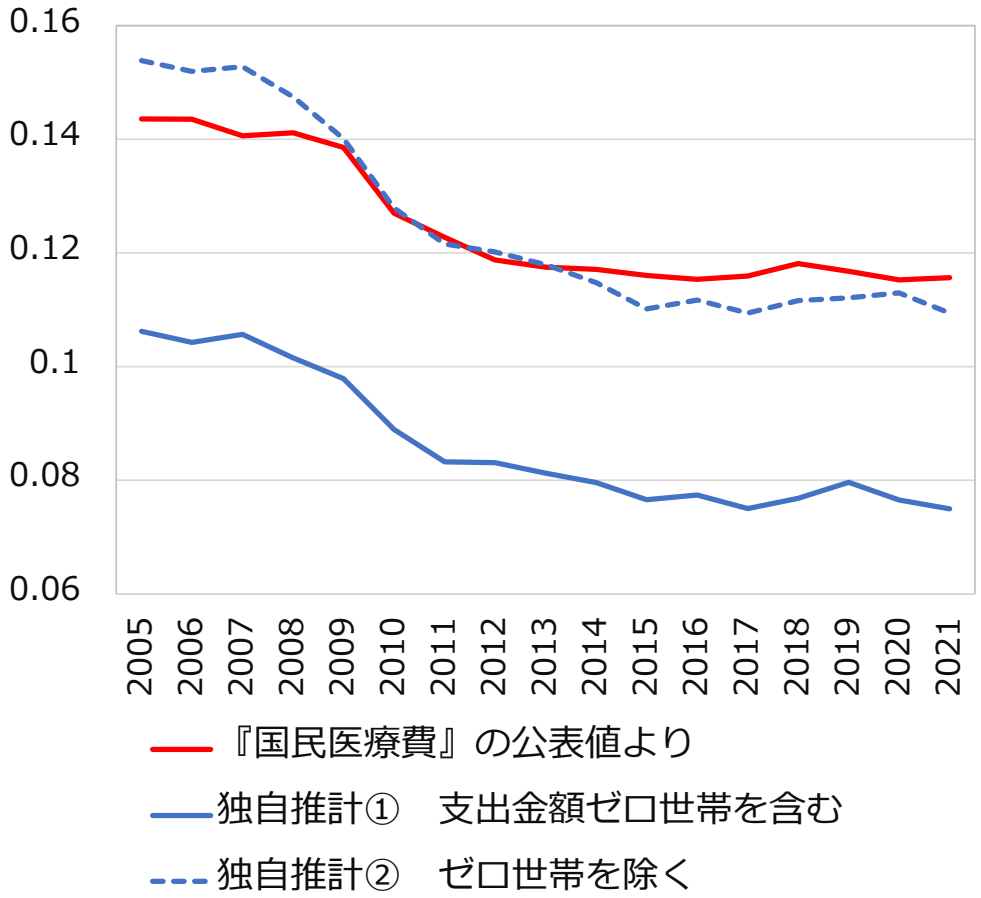
世帯単位の自己負担割合（つづき）

② 基本統計量

N	Mean	Std. dev.	Min	Max
1,576,069	0.124	0.529	0	135.1



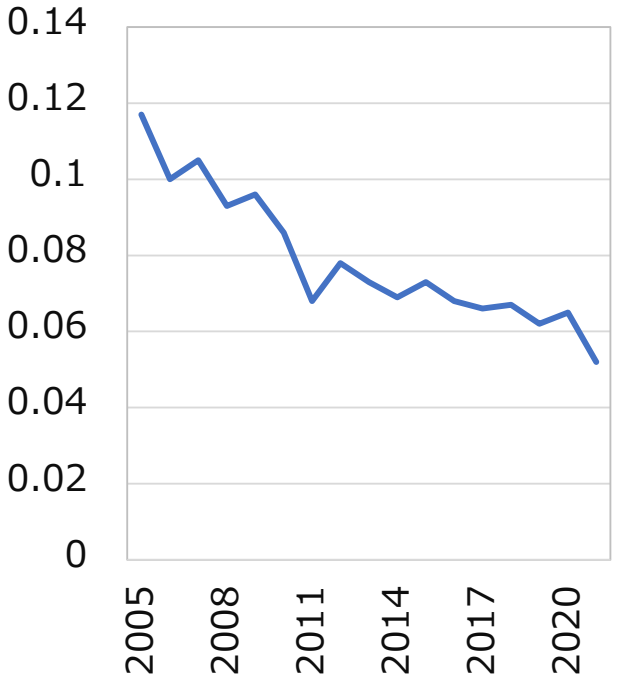
注）自己負担割合<1に限定



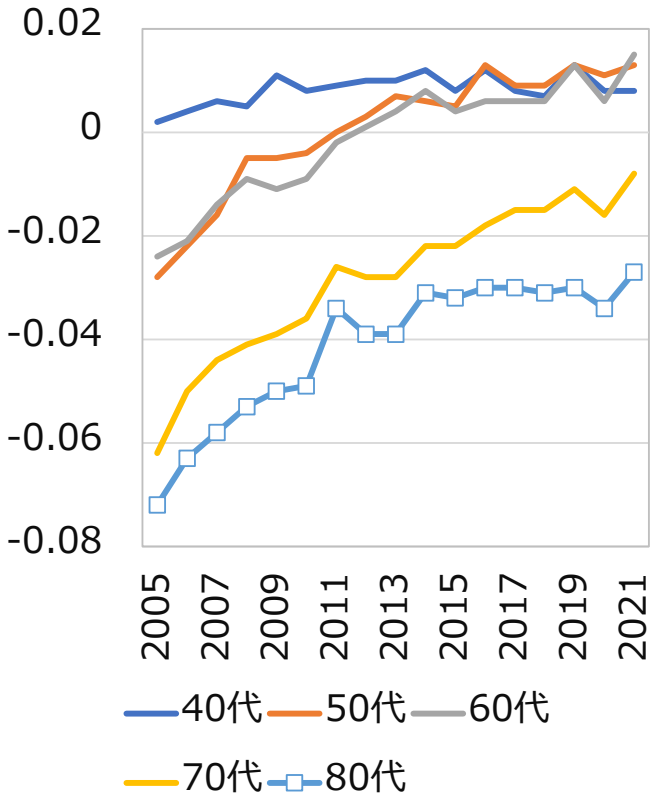
係数推計値の推移　※yearごとに推計

被説明変数	世帯別・自己負担割合：s_t^i
説明変数	世帯主の年齢カテゴリー（ベース：40歳未満）
	世帯年収階級（ベース：下位25%）
	都道府県（ベース：北海道）

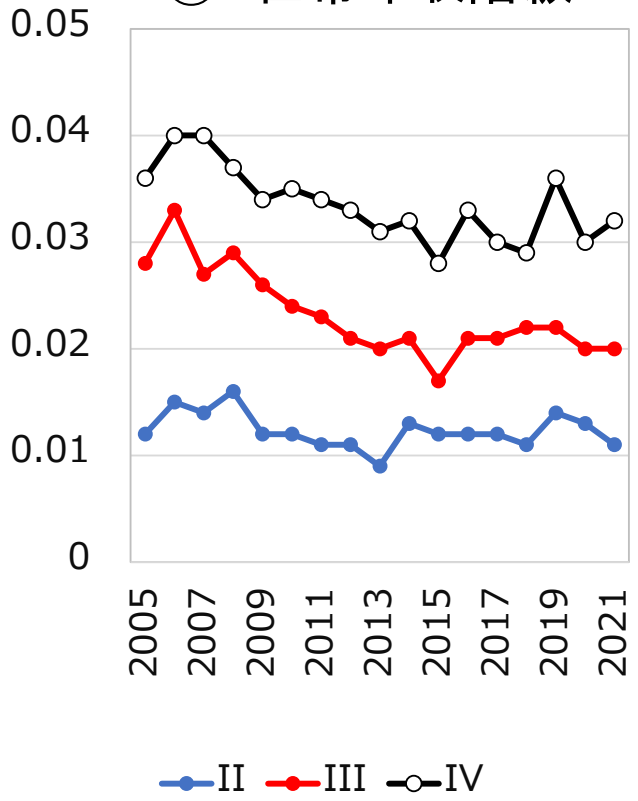
① 切片



② 年齢カテゴリー

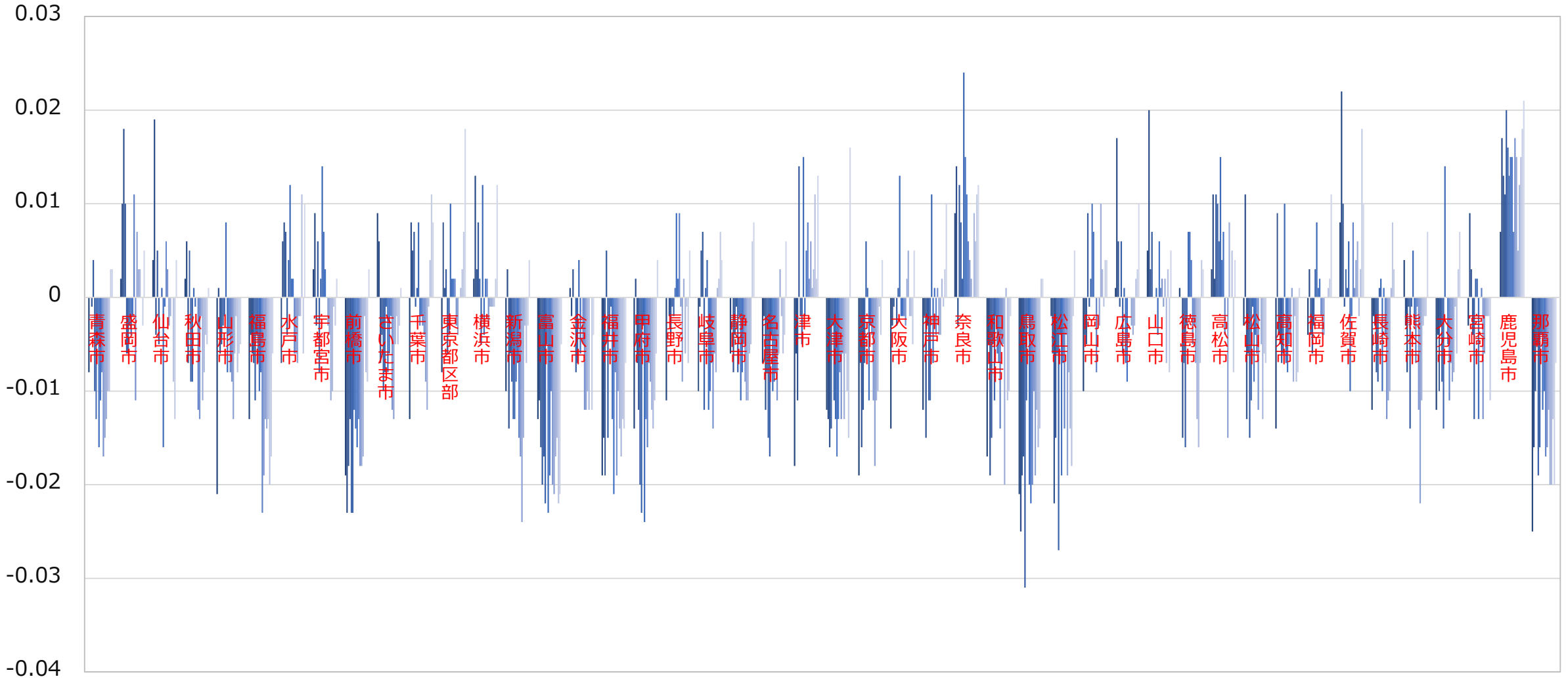


③ 世帯年収階級



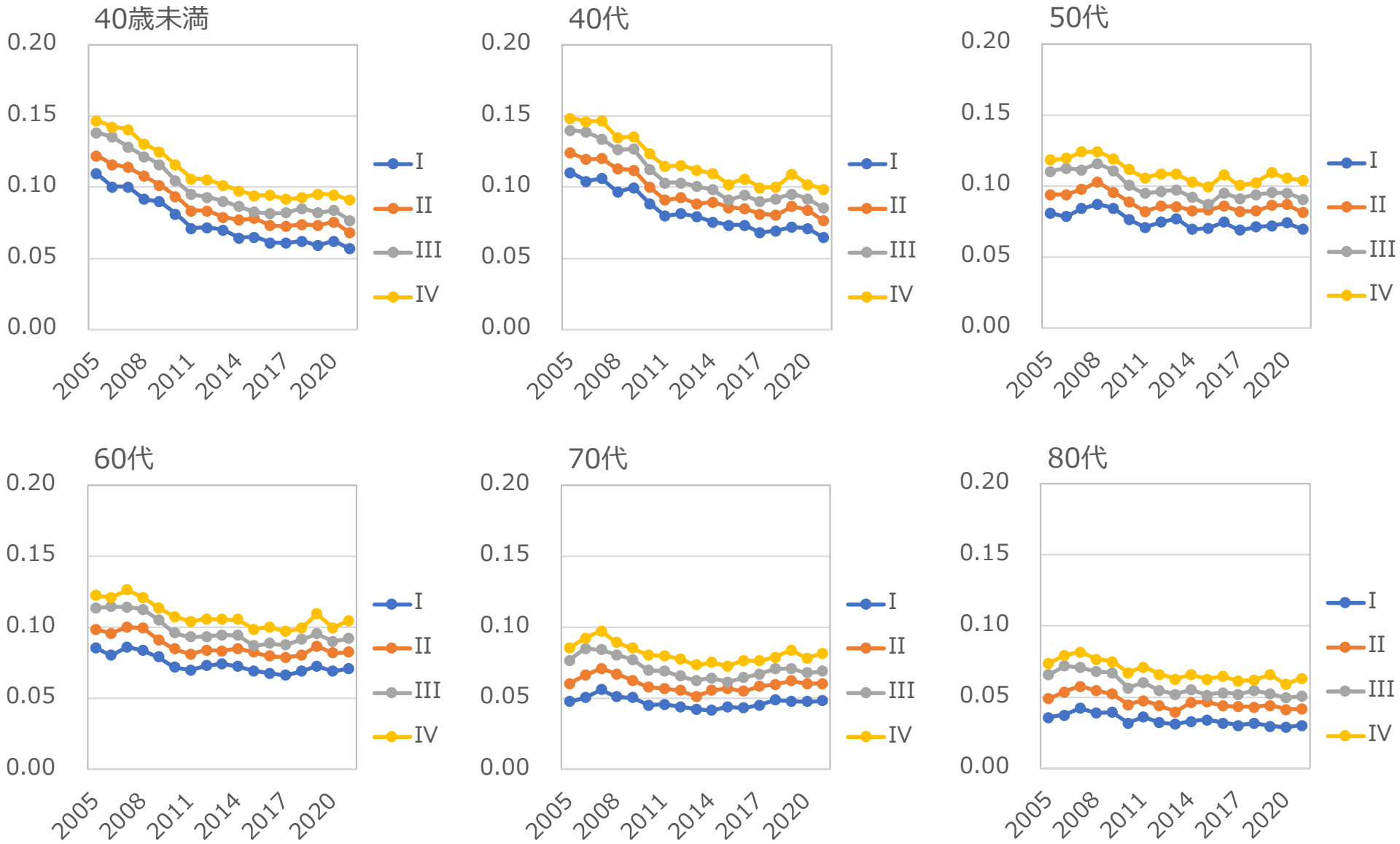
係数推計値の推移（つづき）

④ 都道府県



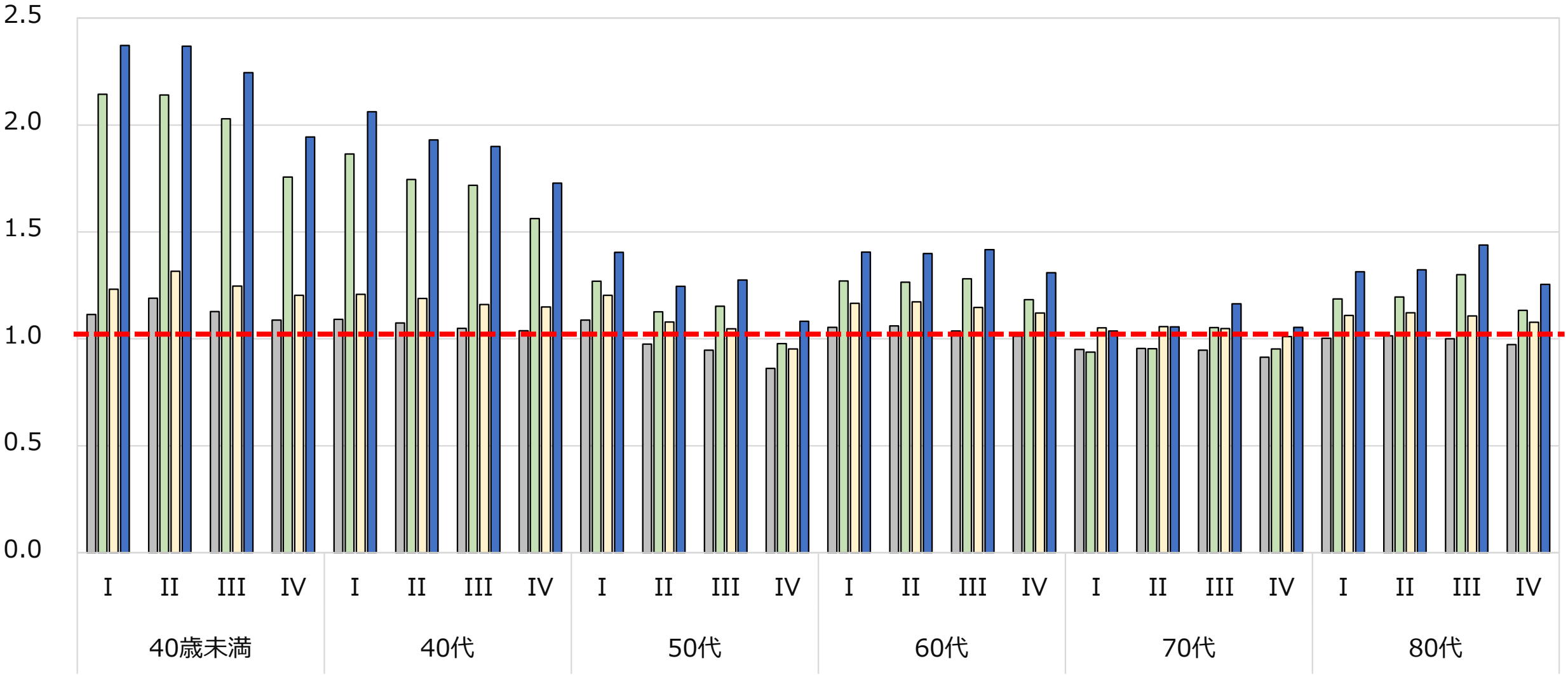
Fitted Value: $\widehat{s_t^i}$

N	Mean	Std. dev.	Min	Max
1,576,069	0.087	0.025	0.010	0.169



2005年→2021年の数量変化率

$$\frac{q_t^h}{q_{t-1}^h} = \left(\frac{E_t^h}{E_{t-1}^h}\right) \Big/ \left(\frac{s_t^h p_t}{s_{t-1}^h p_{t-1}}\right)$$



PART IIのまとめ

「医療サービス」の実質変化率について、以下の方法による違いを確認

(a) 世帯共通のデフレータを使用

(b) 世帯属性別・自己負担割合を考慮したデフレータを使用

世帯属性別・自己負担割合を考慮することで、「医療サービス」の実質変化率は:

・40代以下の世帯で、大幅に増加

・同一年齢カテゴリー内では、世帯年収の低いグループの増加率が高い

世帯共通のデフレータを用いることは、

実質消費格差に重大な誤差をもたらすことを示唆