THE CONSUMER BEHAVIOR OF ELDERLY HOUSEHOLDS AND PRICE INDEXES

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Price Comparison across Age Groups

- We calculate price indexes for each age group in Japan with considering:
  - The differences in consumed goods,
  - The differences in outlets at which households expend.
    - Recent papers show that prices vary across shops/stores.
    - Shopping behavior varies across age groups
    - Japanese official data allow us to construct price and weights by outlets.
- Comparison of cost-of-living by age should be important.
  - To compare welfare level across age,
  - For more adequate price indexation of public pension.
  - Previous studies focus on the price index for the elderly.
    - Amble and Stewart (1994) find the price index rose faster for the elderly.
    - Goda, Shoven, and Slavov (2011) focus on the medical expenditure to show the elderly experienced higher inflation.

Definition of True Cost-of-Living Index

- If households minimize their cost-of-living, the expenditure function can be written as

$$X = e(p, \bar{u}; \delta)$$

  - X: household expenditure
  - p: price vector
  - $\bar{u}$: attained utility level
  - δ: "taste" parameters
- Following the literature, we define the "true" price index as

$$P_1 = \frac{e(p_1, \bar{u}; \delta)}{e(p_0, \bar{u}; \delta)}$$

  - Comparison of the minimized expenditures under different price vectors (p_1 and p_0).
    - Price index is defined as "relative to the base".
  - See, for example, Diewert (1981).

What We **DID NOT DO**: Taste and Prices

- Conceptually, it looks possible to compare the required expenditures to attain some utility level across individuals:

$$\mathrm{R} = \frac{e(p, \bar{u}; \delta_1)}{e(p, \bar{u}; \delta_0)}.$$

  - The minimized expenditure could be different even if all households face the same price vector.
  - Whether do the younger or the older face higher "prices"?
- However, this comparison is impossible.
  - Empirically, it is difficult to identify $\bar{u}$ from δ.
    - At least, we need the *cardinal* utility and some specification of utility function.
    - Different behavior would be caused not only by different taste but also by different utility levels
  - Conceptually, it is impossible to compare utility "levels" across individuals under the *ordinal* utility assumption.

Comparison of the Inflation rates by Age

- It is still possible to compare the inflation rates across households with different taste

$$P_1^k \equiv \frac{e(p_1, \bar{u}; \delta_k)}{e(p_0, \bar{u}; \delta_k)}.$$

  - the taste parameters can be fixed.
  - If $P_1^k > P_1^l$,
    - Does mean that households with taste "*k*" have experienced *higher inflation* than those with taste "l".
    - Does NOT mean those with taste "*k*" face higher prices.

Measuring the Age-Specific Inflation Rate

- Our goal should be

$$P_1^k \equiv \frac{e(p_1, \bar{u}; \delta_k)}{e(p_0, \bar{u}; \delta_k)}.$$

  - Estimating demand system and deriving the expenditure function.
    - Need price variations;
    - Address the endogeneity problem of prices.
- Usual practical method
  - Constructing a Laspeyres index.
    - Give us an upper-bound of true index:

$$CPI_1^k \equiv \frac{p_1 \cdot q_0^k}{p_0 \cdot q_0^k} \geq \frac{e(p_1, \bar{u}; \delta_k)}{e(p_0, \bar{u}; \delta_k)}.$$

What We **DID**

- Constructing the following index:

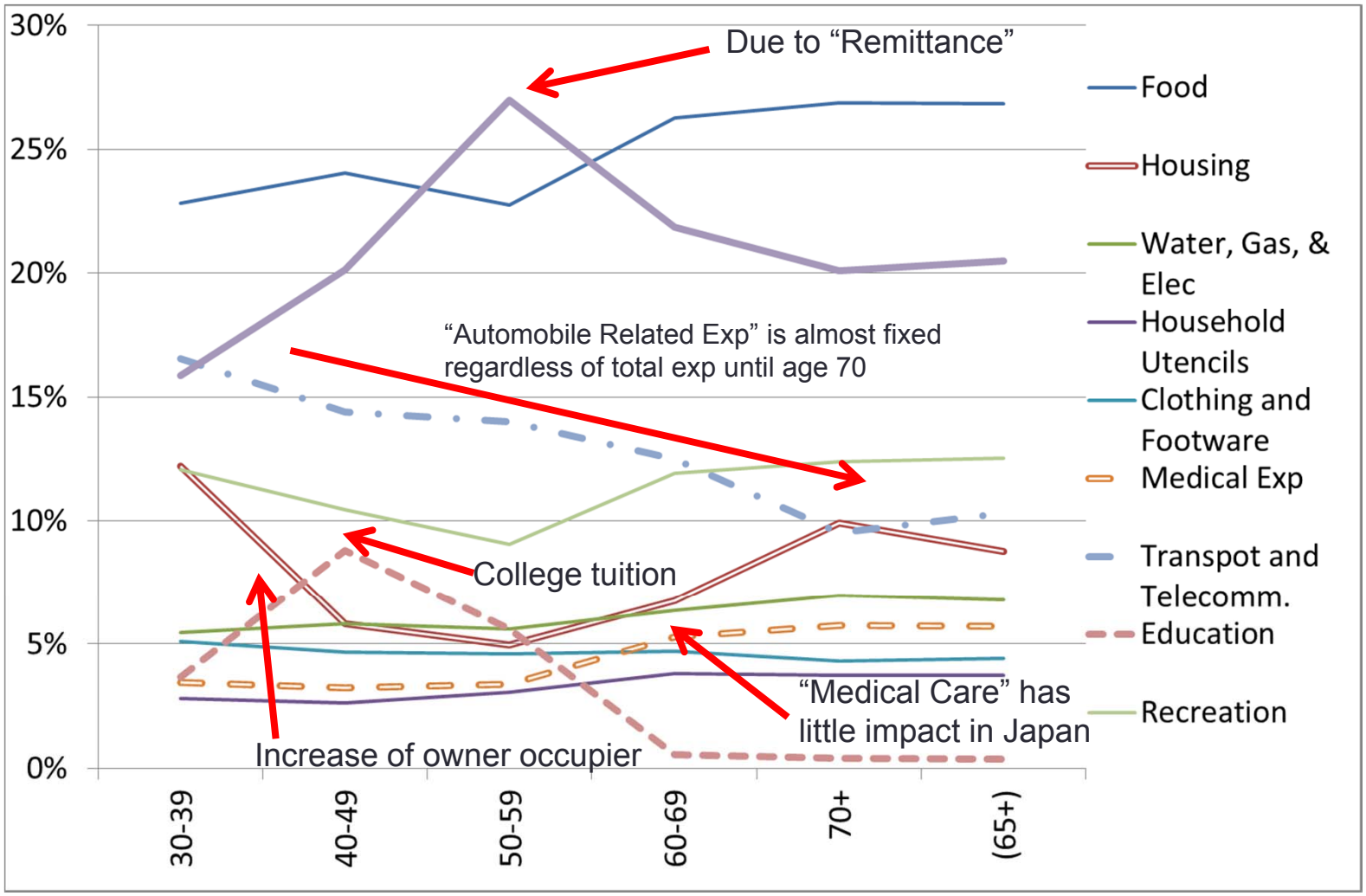
$$CPI_t^k \equiv \sum_i w_{i0}^k \left(\sum_s w_{is0}^k \frac{p_{ist}}{p_{is0}} \right)$$

- Price Data
  - Retail Price Survey (Kouri Bukka Toukei Chousa)
    - Time-series of an “average” price by goods
    - Source for Consumer Price Index
    - Available monthly
  - National Survey of Retail Prices (Zenkoku Bukka Toukei)
    - Cross-sectional price comparison **across outlets**
    - Every 5 year (1987, 1992, 1997, 2002, and 2007)
- Weight Data
  - National Survey of Family Income and Expenditure (Zenkoku Shouhi Jittai Chousa)
  - Expenditures on each item **by outlets** and by age groups
  - Every 5 year (we use 2004 as the base year)

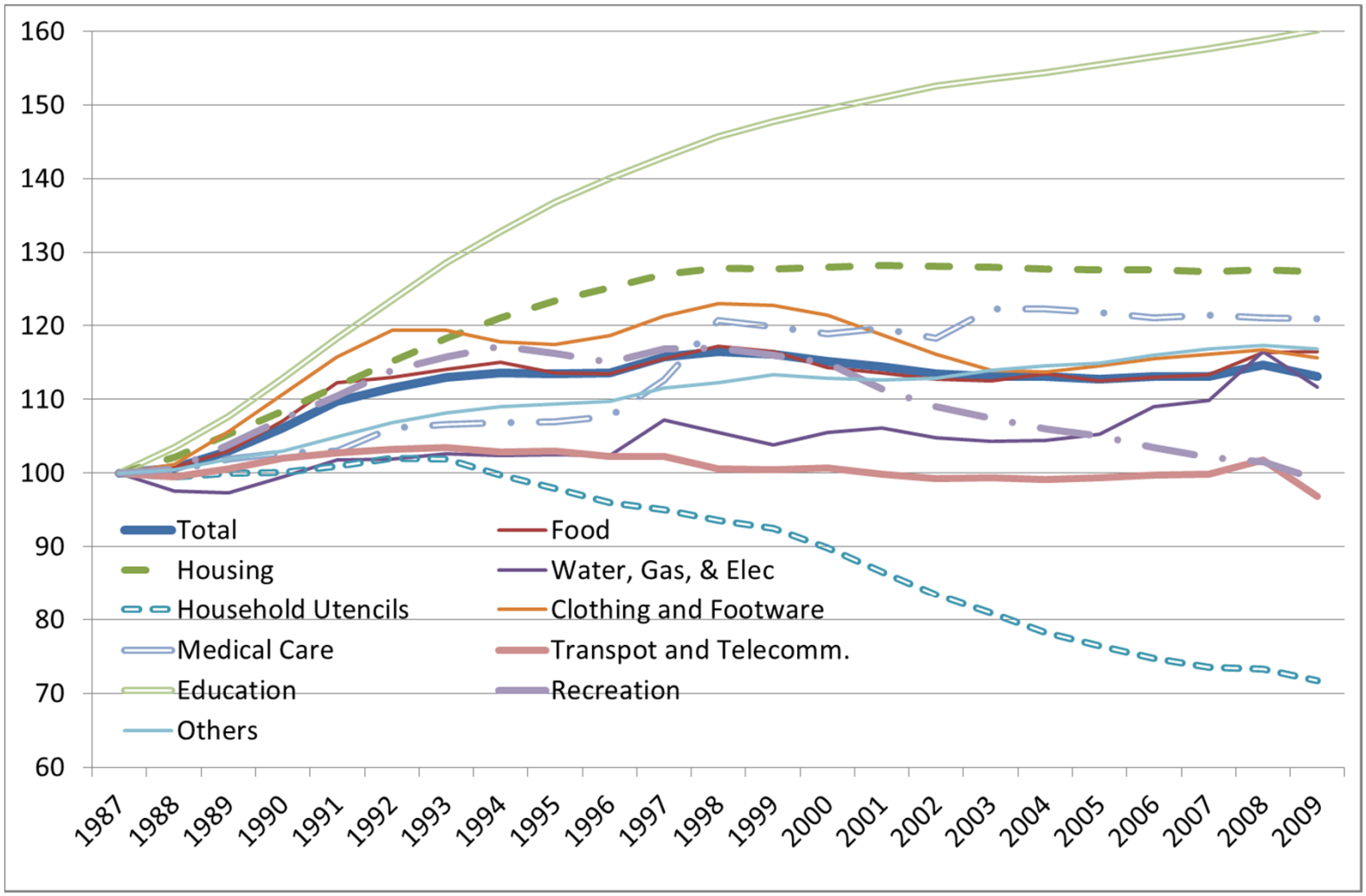
Differences in "Taste" across Age Groups

- It is evident that the expenditure pattern of the older are different from that of the younger.
  - The older consume different items from the younger.
    - Price movements vary across goods categories.
    - "Taste difference" usually means this difference.
    - Statistical Bureau publish the official "age-specific CPI".
      - Using age-specific weights that is constructed from Family Expenditure Survey.
  - The older purchase commodities at different outlet (shop type).
    - Prices of identical goods vary across outlets.
    - **Our contribution!**
- Constructing weight and price data by item and outlet
  - If *N* is the number of goods and *K* is that of outlets, price and weight vector are (N·K)-vector.
  - Japanese data allow us to do this

Expenditure Pattern by Age



Inflation Rate by goods



Outlet and Preference

- Recent studies find a large price difference among outlets
  - Using scanner data (for example, Abe and Tonogi, 2007)
  - Not national representative data
- Different outlets offer different “retail services”.
  - “Retail stores” (Mom-Pop store) provide customized service;
  - “Supermarkets” are usually cheapest price for groceries;
  - “Discount stores” are specialized outlet;
  - “Department stores” give a large variety and highquality;
  - “Convenient stores” are literally convenient (that is, open 24/7);
  - “Cooperative stores” require their membership for a discount.
- Price differences across outlets do not necessarily mean the violation of the “law of one price”.
- Commodity purchased at a different outlet is a “different goods”.

Differences in “Outlet” Choice by Age

They sometime offer delivery service

		Retail Store	Supermarket	Discount Store	Convenience Store	Department Store	Cooperative Store	Others
Food (Excl. "Alcohol" and "Eating Out")	Ave	16%	56%	3%	4%	5%	9%	7%
	30–	13%	58%	3%	13%	3%	5%	4%
	30–39	12%	60%	4%	7%	4%	10%	5%
	40–49	12%	60%	3%	5%	3%	12%	5%
	50–59	15%	58%	3%	3%	5%	10%	7%
	60–69	19%	54%	2%	2%	6%	8%	8%
	70+	22%	51%	2%	2%	8%	7%	8%
	(65+)	21%	52%	2%	2%	7%	7%	8%
Recreational Durable Goods	Ave	29%	3%	53%	0%	2%	1%	13%
	30–	17%	3%	62%	0%	2%	3%	15%
	30–39	24%	2%	51%	0%	3%	0%	20%
	40–49	26%	2%	60%	0%	1%	0%	11%
	50–59	27%	2%	58%	0%	1%	1%	10%
	60–69	36%	3%	49%	0%	2%	0%	11%
	70+	43%	5%	41%	0%	1%	2%	7%
	(65+)	46%	5%	40%	0%	2%	1%	6%

Don’t like a “mass sales” outlet?

Prefer more “traditional” or customized outlet?

Online Shopping?

Price Differences across Outlets

- Cross Sectional Price Difference

	Retail Store	Supermarket	Discount Store	Convenience Store	Department Store	Cooperative Store	Others
Meat	101.4	98.8	94.7	96.2	127.6	97.8	97.7
Snacks	105.8	92.7	91.2	101.3	126.0	94.2	106.1
Kitchen Items	99.1	100.5	94.6	103.0	110.4	100.5	104.5
Household Appliances	102.2	95.3	97.4	NA	109.0	98.4	90.7
Recreational Durables	102.0	100.6	97.6	NA	103.9	102.0	NA
Shampoo and Cosmetics	99.1	101.8	97.0	101.3	105.6	102.0	NA

"Cheapest" outlet

"Most expensive" outlet

- This may be caused by the difference in retail services.
- Our results would not be affected unless the contained service has been changed large.
  - Fixed weights for outlet, too.
- What is more important for our purpose is not the level but the changes of prices of each outlet.

Inflation Rates by the outlets

- What type of outlet experienced the most rapid inflation?

$$P_{st} \equiv \sum_i \overline{w}_{i0} \frac{p_{ist}}{p_{is0}}$$

	1992	1997	2002	2007
Ave.	108.9	111.0	107.8	108.5
Retail Store	110.6	111.7	108.4	109.5
Supermarket	110.0	111.2	106.0	105.0
Discount Store	105.1	108.3	104.4	100.8
Convenience Store	107.5	112.3	108.6	108.3
Department Store	110.5	113.0	112.7	119.8
Coop	104.5	109.4	107.2	104.9
Others	108.0	107.5	104.3	102.1

Results: Age-Specific CPI

	Age Specific Goods-Outlet Weights（1987=100）							
	Ave	30-	30-39	40-49	50-59	60-69	70+	(65+)
1992	108.9	108.7	108.0	108.8	108.8	109.2	109.9	109.7
1997	111.0	110.8	109.3	110.7	110.9	111.3	113.0	112.5
2002	107.8	108.0	105.9	107.5	107.8	108.0	109.9	109.4
2007	108.5	108.4	106.1	107.8	108.7	109.1	111.0	110.5

2 percent point more
(0.2 percent point per year between 1987-97)

The older experienced slightly smaller deflation

Decomposing the Differences

- Constructed index

$$CPI_t^k \equiv \sum_i w_{i0}^k \left(\sum_s w_{is0}^k \frac{p_{ist}}{p_{is0}} \right)$$

- Differences in consumed goods

$$\widehat{CPI}_t^k \equiv \sum_i w_{i0}^k \left(\sum_s \overline{w}_{is0} \frac{p_{ist}}{p_{is0}} \right)$$

  - If the shopping behavior is same for all households.

- Differences in outlets

$$\widetilde{CPI}_t^k \equiv \sum_i \overline{w}_{i0} \left(\sum_s w_{is0}^k \frac{p_{ist}}{p_{is0}} \right)$$

  - If the consumption pattern is same for all households.

Decomposing the Differences

Differences are mainly caused by consumption pattern

$\widehat{CPI}_t^k$	Age Specific Goods Weight （Deviation from the Average）						
	30歳未満	30～39歳	40～49歳	50～59歳	60～69歳	70歳以上	65歳以上
1992年	-0.04	-0.76	-0.07	-0.09	0.18	0.84	0.66
1997年	-0.35	-1.59	-0.23	-0.04	0.26	1.87	1.40
2002年	0.02	-1.80	-0.05	0.10	0.08	1.73	1.27
2007年	-0.35	-2.25	-0.17	0.24	0.35	1.87	1.49

$\widetilde{CPI}_t^k$	Age Specific Outlet Weight （Deviation from the Average）						
	30歳未満	30～39歳	40～49歳	50～59歳	60～69歳	70歳以上	65歳以上
1992年	-0.10	-0.11	-0.06	0.00	0.10	0.19	0.18
1997年	0.14	-0.11	-0.10	-0.03	0.02	0.15	0.13
2002年	0.10	-0.10	-0.25	-0.07	0.11	0.36	0.27
2007年	0.26	-0.17	-0.54	-0.08	0.20	0.64	0.49

The outlet that the older prefer experienced higher inflation rate

Conclusion

- The older households experienced the higher inflation
  - 0.2 percent point higher than the average CPI btw 1987-97.
- Three quarter of the deviation were caused by the differences in consumption pattern over items
  - The older spend more on “Housing” and “Medical Care”.
  - It is not a bias (systematic deviation) but the results of changes of economy structure.
- The outlet that the older prefer experienced higher inflation rate
  - This would be a bias if this is caused by less mobility and/or poor shopping information of the elderly.

Caveats

- We ignore the “biases in CPI” pointed out by Boskin et al. (1996).
  - Laspeyres index always overstates the true inflation.
  - The size of bias may be different across age while we did not care.
  - Previous studies find that the biases in CPI are smaller in Japan.
- Education and Medical Care may suffer from quality adjustment problem
  - Quality adjustment is difficult for services in general.
  - Cost of living may be over estimated with the official price data.