Measuring Poverty in Japan from a Multidimensional Perspective

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Outline

- Motivation
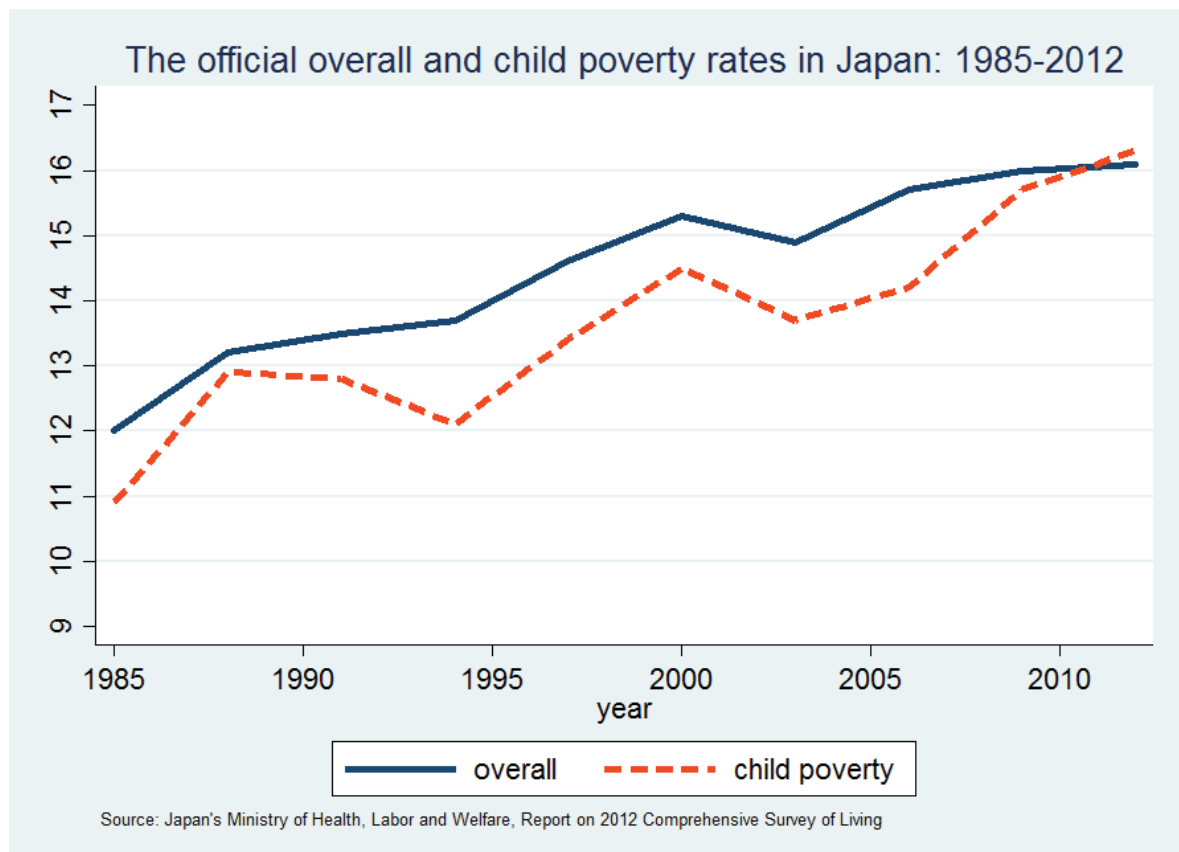- Method
- Data and the MPI
- Results
- Conclusion

The monetary and child poverty rates in Japan: 1985-2012

表 12　貧困率の年次推移

	昭和 1985	1988	平成 1991	1994	1997	2000	2003	2006	2009	2012
	%	%	%	%	%	%	%	%	%	%
相対的貧困率 Monetary poverty rate	12.0	13.2	13.5	13.7	14.6	15.3	14.9	15.7	16.0	16.1
子どもの貧困率 Child poverty rate	10.9	12.9	12.8	12.1	13.4	14.5	13.7	14.2	15.7	16.3
子どもがいる現役世帯	10.3	11.9	11.7	11.2	12.2	13.1	12.5	12.2	14.6	15.1
大人が一人	54.5	51.4	50.1	53.2	63.1	58.2	58.7	54.3	50.8	54.6
大人が二人以上	9.6	11.1	10.8	10.2	10.8	11.5	10.5	10.2	12.7	12.4
名 目 値	万円	万円	万円	万円	万円	万円	万円	万円	万円	万円
中　央　値　（a）	216	227	270	289	297	274	260	254	250	244
貧　困　線　（a/2）	108	114	135	144	149	137	130	127	125	122
実 質 値 (昭和60年基準)										
中　央　値　（b）	216	226	246	255	259	240	233	228	224	221
貧　困　線　（b/2）	108	113	123	127	130	120	116	114	112	111

注：1)　平成6年の数値は、兵庫県を除いたものである。
　　2)　貧困率は、OECDの作成基準に基づいて算出している。
　　3)　大人とは18歳以上の者、子どもとは17歳以下の者をいい、現役世帯とは世帯主が18歳以上65歳未満の世帯をいう。
　　4)　等価可処分所得金額不詳の世帯員は除く。
　　5)　名目値とはその年の等価可処分所得をいい、実質値とはそれを昭和60年（1985年）を基準とした消費者物価指数（持家の
　　　帰属家賃を除く総合指数（平成22年基準））で調整したものである。

Note: Japan's Ministry of Health, Labor and Welfare, Report on 2012 Comprehensive Survey of Living
http://www.mhlw.go.jp/toukei/saikin/hw/k-tyosa/k-tyosa13/

The official overall and child poverty rates in Japan: 1985-2012

Source: Japan's Ministry of Health, Labor and Welfare, Report on 2012 Comprehensive Survey of Living

Amartya Sen's capability approach

- A person's well-being should be defined and assessed not only by resources but also by functionings and capabilities
  - Functionings: being and doing that people value and reason to value
  - Capabilities: the various combinations of functionings that the person can achieve (Sen, 1992, p.40)

- According to the capability approach, a person's well-being should be multidimensional in nature.

The aims of paper

- Poverty issues are often discussed in terms of just an economic dimension such as income. However, given that a person's well-being is considered to be multidimensional, concentrating only on income may fail to provide a real image that we want to capture.

- We try to measure poverty from a multidimensional point of view. Specifically, we define a multidimensional poverty index consisted of three dimensions such as consumption, wealth, and dwelling environment. Then, the exercise can shed light on a new aspect of poverty issue in Japan.

The aims of paper (contd.)

- The paper tries to capture poverty profiles for Japan from a multidimensional perspective.

- We will focus on intertemporal changes in multidimensional poverty in Japan. Based on the Japan's National Survey of Family Income and Expenditures (the NSFIE), we compute the nationwide MPI for the 1989, 1994, 1999 and 2004 survey.

- When households are classified as four categories such as single parent, both parent, three generation and no child household, we calculate the MPI by household types.

Literature Review

- Conceptual framework on multidimensionality of well-being
  - Seminal works of Amartya Sen

- Representative theoretical studies on multidimensional poverty
  - Tsui (2002)
  - Atkinson (2003)
  - Bourguignon and Chakravarty (2003)
  - Alkire and Foster (2011): the Alkire-Foster methodology

Literature Review (contd.)

- Intertemporal changes in multidimensional poverty
  - Alkire et.al. (2015) Chap. 9
  - Levine, S., Muwonge, J., and Batana, Y. M. (2014): analysis in recent reductions in poverty in Uganda

- Child poverty in Japan using the NSFIE

  - Movshuk (2015) : comparing consumption based poverty measure with income based poverty measure. Consumption is a better measure compared to income.

  ⇒ My paper stands at the intersection of two lines of researches

The Alkire-Foster methodology

- Alkire and Foster (2011)

  ・Specify a class of multidimensional poverty measures

  ・An extension of a class of the unidimensional poverty measure by

  Foster, Greer, and Thorbecke (1984)

The Alkire-Foster method: Identification

- Achievement matrix:

$$\begin{bmatrix} y_{11} & \cdots & y_{1D} \\ \vdots & \ddots & \vdots \\ y_{N1} & \cdots & y_{ND} \end{bmatrix}.$$

- The achievement of individual i in dimension d,

$$y_{id} \geq 0.$$

- The $1 \times D$ vector z, with

$$z_d > 0$$

the deprivation cutoff in dimension d.

The Alkire-Foster method: Identification (Contd.)

- Deprivation matrix *by following rule*

$$d_{id} = \begin{cases} 1 \ if \ y_{id} < z_{d,} \\ 0 \ otherwise. \end{cases}$$

- The weighted deprivation score for person i

$$c_i := \sum_{d=1}^{D} w_d d_{id},$$

where w_d is a weight for dimension d and $\sum_{d=1}^{D} w_d = 1$.

The Alkire-Foster method: Identification (Contd.)

- Identification function ρ_k *is given as*

$$\rho_k(\boldsymbol{y_i}, \boldsymbol{z}) = \begin{cases} 1 \ if \ c_i \geq k, k = 1, \dots D, \\ \qquad 0 \ otherwise. \end{cases}$$

, where $\boldsymbol{y_i}$ is the $1 \times D$ vector.

- Two polar cases
  - ◆ Union approach: *k=1*.
  - ◆ Intersection approach: *k=D*.

The Alkire-Foster Methodology: Aggregation

- The headcount ratio is defined by

$$H = \frac{\sum_{i=1}^{N} \rho_k(\boldsymbol{y_i}, \boldsymbol{z})}{N}$$

- The intensity of poverty is defined by

$$A = \frac{\sum_{i \in P(k)} c_i}{|P(k)|D}$$

, where $P(k)$ is the set of the poor in terms of *k*.

- The adjusted headcount ratio is defined by

$$M0 = \frac{\sum_{i \in P(k)} c_i}{N \cdot D}$$

The Alkire-Foster Methodology: Aggregation (contd.)

- Fundamental relationship among H, A, and M_0:

$$M_0 = H \times A$$

- Useful properties of M_0
  - Calculate from ordinal data
  - Dim. Monotone
  - Decomposability
    - dim. breakdown
    - sub-group decomposition

Data

- The National Survey of Family Income and Expenditures
  - The Japan's Ministry of Internal Affairs and Communications
  - Conducted by every five years
  - The unit of the survey is households in the whole area of Japan

- Survey Years: 1989, 1994, 1999, and 2004
  - The 2009 and 2014 surveys are not available

- 2 or more persons household

- No items on health dim. (e.g. child mortality) and educational dim. (e.g. years of schooling)

Dimensions, Indicators, Cutoffs, and Weights

Dimensions	Indicators	Deprived if:	Weights
Consumption			
	Equivalent non-durable consumption	One half of median non-durable consumption	1/3
Wealth			1/3
	Amenities	10 items	(1/6)
	Savings	One million yen	(1/6)
Dwelling Environment	Living space	Minimum living space	1/3

Data Cleaning

# of unreliable information	1989	1994	1999	2004
non-durable consumption	0	0	0	0
amenities	1,384	1,544	2,307	3,033
savings	2,030	1,830	1,362	3,825
living space	0	0	0	0
whole sample size	44,537	44,687	44,540	43,861
unreliable information dropped	3,386	3,345	3,616	4,737
remaining sample size	41,151	41,342	40,924	39,124

Table 2:

Median equivalent non-durable consumption

	1989	1994	1999	2004
the entire nation	127,767	146,766	145,008	142,911
childless	142,071	160,188	157,209	153,515
single parent	84,389	111,711	101,720	101,539
two parents	115,008	132,689	129,749	127,480
three generation	123,928	149,050	147,381	143,390

Table 3: the median equivalent nondurable consumption per month (JPY)

	1989	1994	1999	2004
system kitchen	18.6%	28.0%	43.0%	57.0%
water heater	46.2%	51.6%	55.6%	61.1%
wash stand		34.3%	45.8%	63.4%
combined toilets		23.5%	42.0%	59.2%
refrigerator	98.1%	98.7%	99.2%	99.1%
wash machine	98.9%	99.4%	99.3%	99.2%
air conditioner	65.0%	79.3%	84.3%	87.1%
piano	38.2%	42.0%	41.4%	27.5%
video recorder	68.7%	68.8%	78.9%	82.0%
color tv	98.3%	99.2%	99.3%	97.3%
video camera	17.4%	33.9%	39.8%	41.9%
camera	86.8%	89.7%	87.5%	81.0%
computer	12.5%	16.4%	37.8%	69.7%
word processor	25.0%	43.7%	45.3%	
vacuum cleaner	97.6%	98.9%	99.2%	99.4%
rice cooker		78.1%	81.7%	85.6%
microwave	73.0%	89.4%	95.3%	97.6%
dish washer	4.5%	5.2%		19.3%
sawing machine	68.7%	73.5%	70.7%	67.7%
desk		62.3%	64.9%	64.8%
stereo	60.1%	54.9%	50.0%	81.0%
radio-cas/cd/md	76.3%	68.0%	78.1%	
fax		9.5%	33.1%	51.3%
golf equipment	33.8%	41.1%	42.2%	38.7%
mobile phone		43.7%	64.7%	85.0%
phone	81.4%			
car	79.3%	81.4%	85.2%	86.6%
house	(75.5%)	72.8%	76.5%	80.4%

Table 4: List of amenities and diffusion rates for the entire nation

Equivalent savings:
median and 25 percentile

median (25 percentile)	1989	1994	1999	2004
entire Japan	310 (144)	428 (200)	470 (203)	517 (227)
childless	445 (202)	640 (297)	707 (308)	762 (333)
single parent	135 (32)	238 (92)	197 (53)	201 (55)
two parents	204 (101)	279 (141)	277 (130)	289 (135)
three generation	270 (138)	375 (196)	387 (189)	396 (188)

Table 5: Equivalent savings for household: median and 25 percentile (ten thousand yen)
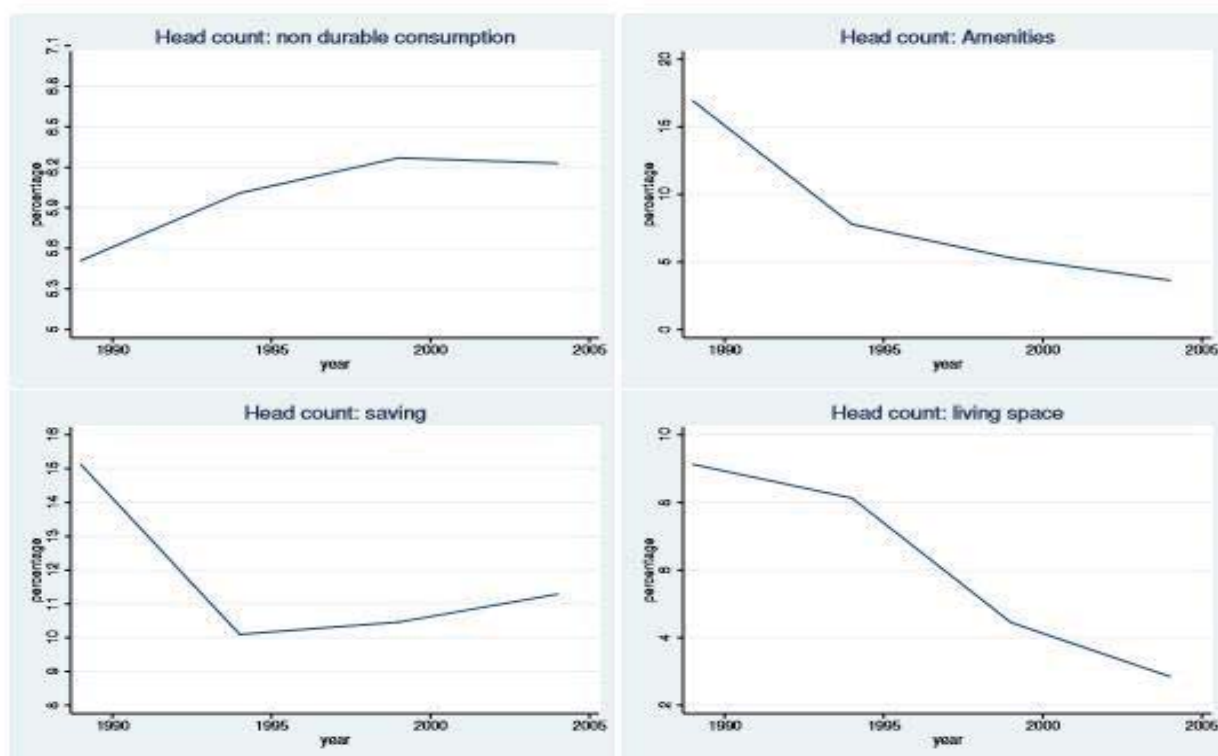

Figure 3: the headcount ratios by indicators

The MPI for Japan

Estimate	Value	Standard Error	Confidence Interval (95%)
		1989	
M_0	7.25%	0.085%	(7.08%, 7.41%)
H	16.55%	0.18%	(16.2%, 16.9%)
A	43.8%	0.18%	(43.5%, 44.1%)
		1994	
M_0	5.91%	0.076%	(5.77%, 6.06%)
H	14.23%	0.17%	(13.9%, 14.6%)
A	41.57%	0.18%	(41.2%, 41.9%)
		1999	
M_0	4.52%	0.068%	(4.39%, 4.65%)
H	10.82%	0.15%	(10.5%, 11.1%)
A	41.77%	0.20%	(41.4%, 42.6%)
		2004	
M_0	3.84%	0.064%	(3.72%, 3.97%)
H	9.19%	0.15%	(8.9%, 9.5%)
A	41.82%	0.21%	(41.4%, 42.2%)

Table 6: The MPI for the entire nation ($k = 0.3$)

- The M_0 value for the entire Japan decreases, but the degree of intertemporal changes in the value have become smaller through time.

  ⇒Why the M0 decrease?

- As a simple explanation for this, improvements for both amenities and dwelling environment (see Fig. 3, the right two panels) dominates worse-off for consumption and savings (shown in Fig. 3, the left two panels) .

M0 measures by household types

	1989			1994			1999			2004		
	M_0	H	A	M_0	H	A	M_0	H	A	M_0	H	A
Single parent	22.35	44.79	49.91	13.11	27.52	47.66	13.38	27.43	48.77	11.15	21.74	51.3
Two parents	10.22	23.23	43.99	7.61	18.11	42.0	6.01	14.24	42.24	4.47	11.04	42.3
Three generation	5.94	14.3	41.54	4.83	12.40	38.94	3.91	9.80	39.93	3.53	8.63	40.94
Childless	5.99	13.52	44.34	5.03	12.05	41.75	3.69	8.92	41.39	3.37	8.19	41.13
Entire Japan	7.25	16.55	43.8	5.91	14.23	41.57	4.52	10.82	41.77	3.84	9.19	41.82

Table 7: The measures M_0, H and A by sub-groups ($k = 0.3$)

- The MPI values for single and two parents household are higher than the national level for every survey year.

- The two types of households are always the most vulnerable ones from a multidimensional perspective.

Simple statistical test on intertemporal changes

Difference	94-89			99-94			04-99		
	ΔM_0	ΔH	ΔA	ΔM_0	ΔH	ΔA	ΔM_0	ΔH	ΔA
Single parent	-9.24***	-17.27***	-2.25	0.26	-0.09	1.11	-2.22	-5.69**	2.53
Two parents	-2.61***	-5.12***	-1.99***	-1.59***	-3.87***	0.24	-1.35***	-3.20***	0.06
Three generation	-1.11***	-1.90***	-2.59***	-0.92***	-2.60***	0.98*	-0.38	-1.17**	1.01
Childless	-0.96***	-1.47***	-2.59***	-1.34***	-3.13***	-0.36	-0.32***	-0.72***	-0.26
Entire Japan	-1.33***	-2.32***	-2.23***	-1.39***	-3.41***	0.20	-0.68***	-1.63***	0.05

Table 8: Subgroup decomposition of intertemporal changes in the mpi values

*** statistically significant at $\omega = 0.01$, ** statistically significant at $\omega = 0.05$, * statistically significant at $\omega = 0.10$.

- During 1999 through 2004, we find a sharp contrast between changes in H and in A. Namely, all changes in H are statistically significant whereas these in A are not.

- From the statistical test, almost all changes in both M_0 and H are statistically significant and decreases in M_0 are mainly due to decreases in H.

- On the other hand, we also find that almost all changes in A are not statistically significant during the periods between 1994 and 2004 while these are significant during the first five years.

- This might suggest that seriousness of poverty among the poor became stable around mid-1990s

Summing up

- Given the MPI designed in the paper, the M_0 value for the national level decreases, but the degree of intertemporal changes in the value have become smaller through time

⇒It seems that this finding perhaps is not consistent with the result of the government official reports

Summing up (contd.)

- The MPI values for single and two parents household are still high compared to the national level across every survey year.

⇒From a multidimensional perspective, the two types of households are always the most vulnerable ones.

- Decreases in M_0 are mainly due to decreases in the H. On the other hand, the A has became stable around mid-1990s across almost all subgroup including the entire Japan.

Future researches

- Robustness test

- Calculate multidimensional child poverty rates

- Why differences between unidimensional monetary poverty and multidimensional poverty occur?

  → Comparing monetary and multidimensional poverty in Japan.

Thanks for your attention!

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