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# Income Inequality and Demographic Changes in Japan

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# Introduction: the effects of an aging population on income inequality.

- Growing income inequality may be caused by a change in demographic structure.
  - A change in the age structure changes income inequality, even if the mean income within each age group or age-specific income inequality does not change (Burtless 2009; Lam 1997).

- Japan not only has the highest aging rate at present, but also the fastest speed of aging than that of Western countries.

- In Japan, income inequality has widened throughout the 1990s and 2000s.

→ The Japanese case can be a leading example.

# Problems with using the age of household head for analysis of income inequality

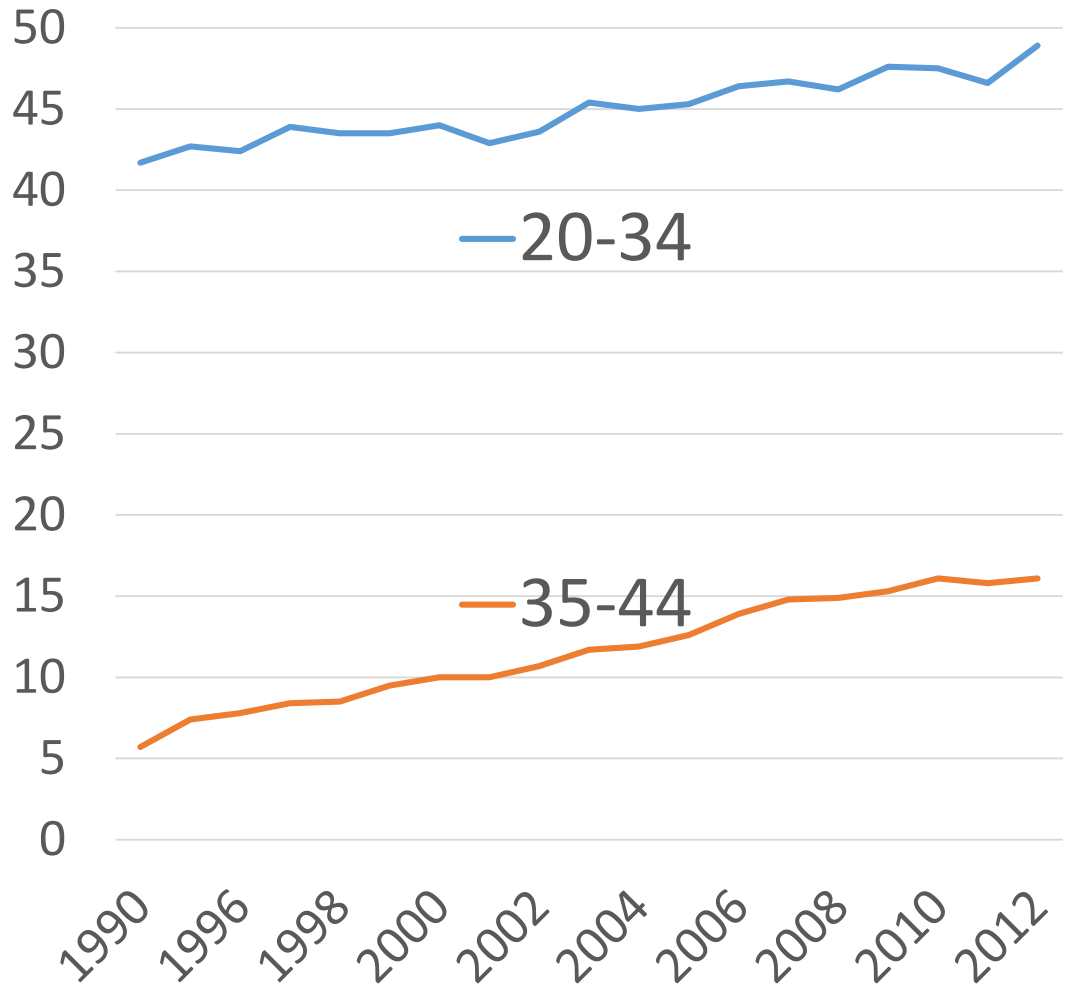
Many previous studies indicate the increase in income inequality was caused by the Population ageing in Japan.(Kitao and Yamada 2019; Kohara and Ohtake 2014; Ohtake 2005; Ohtake 2008; Ohtake and Saito 1998; Oshio 2006; Shirahase 2018; Shirahase and Takeuchi 2009)

- The inequality among elderly is relatively high.
- The income inequality within each age group remained unchanged.
- The share of old ages has grown.

Almost studies, however, use age of household head for analysis.

- The age of the household head is dependent on who becomes head.
- It may differ from structure of actual age of individual.

# The ratio of people who remain unmarried and continue to live with their parents (%)




Sorce: Nishi(2013, 2015)

- An increase in the proportion of Japanese young adults who remain unmarried and continue to live with their parents (Fukuda 2009; Suzuki 2007).
- The ratio of young adults based on age of household head would decline.
- Change in age structure of household head would be differ from that of individual age.

# Research questions

- The population in terms of the age of household head may become "older" than the actual age structure.

→ a decomposition analysis of the effects of both the age of the household head and individual age on the change in income inequality.

- These family changes would also affect income inequality.
  - Increase in youth who remain unmarried and continue to live with their parents.
  - Decrease in the ratio of older people living with their children.

→ a decomposition analysis of the effects of family living arrangements on the change in income inequality among children, young adults, middle-aged, and elderly.

# Data & Method

# National Survey of Family Income and Expenditure (NFSIE)

NFSIE

- Conducted every 5 years by *Ministry of Internal Affairs and Communications*
- This survey uses personal account book.
- We use the data of 1994, 1999, 2004 and 2009.
- Each surveys contains about 50,000 households.

- The NFSIE, along with the Comprehensive Survey of Living Conditions (CSLC), is the most used data for studying income inequality in Japan.

# Equivalent Disposable Income (EDPI)

Disposable Income (DPI) = Market income + Social Security benefit

- Household's tax - social insurance premiums

- Micro simulation model to estimate each household's tax and social insurance premiums and calculate disposable income (Tanaka and Shikata 2012)

EDPI = DPI/√n of household member

- Calculating EDPI for individual income unit
- Whether household or individual ages, the overall index of inequality will be exactly the same.

# RIF-regression

- Re-centered Influence Function (RIF) regressions to decompose the Gini coefficient (Firpo et al. 2009; Firpo et al. 2018; Fortin et al. 2011; Rios Avila 2019)

$$RIF\left(y, Gini_y\right) = 1 + \frac{2}{\mu^2} R_Y - \frac{2}{\mu} R_Y \left[ y_i \left(1 - F_Y\left(y\right)\right)\right]$$

- Estimating the coefficients by regressing the RIF of the Gini coefficient of income on the characteristic variables.

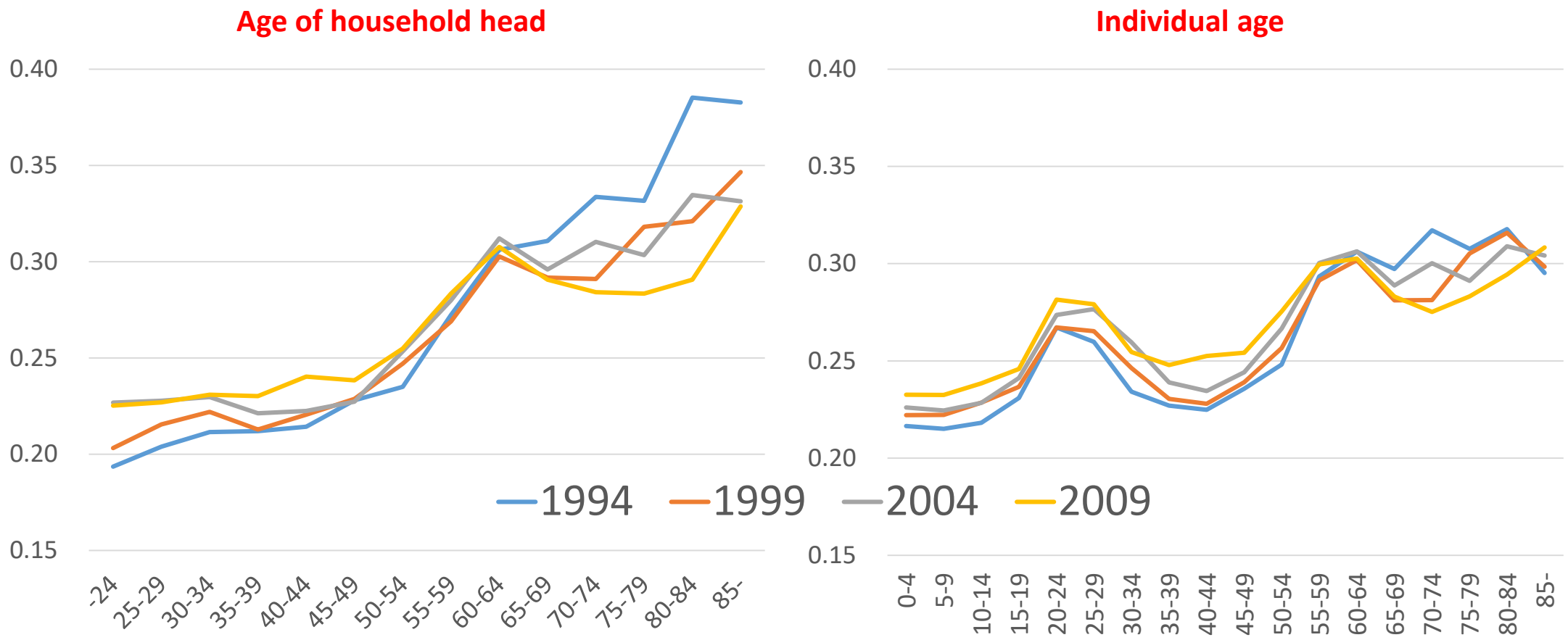
$$\hat{I}_G = E\left(RIF\left(y_i; Gini_Y\right)\right) = \hat{\beta}_0 + \sum_{m=1}^{M} \hat{\beta}_m \overline{X}_m$$

- A detailed decomposition using the Oaxaca-Blinder decomposition (Blinder 1973; Oaxaca 1973).

$$\Delta \hat{I}_G \equiv \hat{I}'_G - \hat{I}_G = \left(\hat{\beta}'_0 - \hat{\beta}_0\right) + \sum_{m=1}^{M} \overline{X}'_m \left(\hat{\beta}'_m - \hat{\beta}_m\right) + \sum_{m=1}^{M} \left(\overline{X}'_m - \overline{X}_m\right) \hat{\beta}_m$$

# Results of decomposition analysis based on age

# Gini coefficient by age of household head and individual age



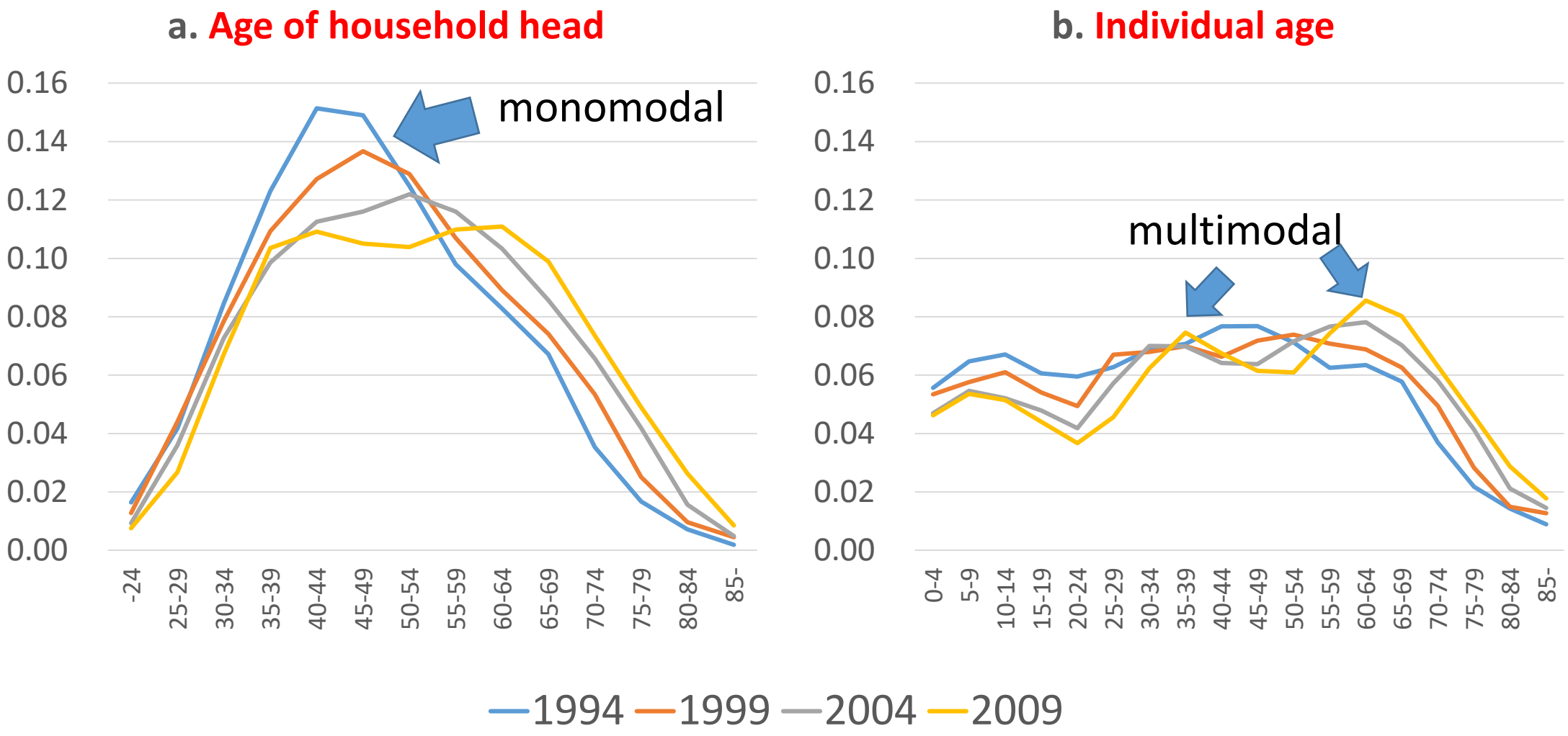

For age of household head

The income inequality increase as the age gets older. Income inequality in old age decreased significantly from 1994 to 2009.

For individual age

the inequality for the 20s is larger than for the 30s and the 40s. Getting older does not necessarily increase in income inequality. Income inequality in old age narrowed slightly from 1994 to 2009.

# Distribution of age of household head and individual age



# Effects of baby-boomer and their children

- Twin peaks of age structure are constructed by the generation of baby-boomer and the second-generation of their children.
- However, the peaks of second-generation baby-boomer cannot be seen in the figure based on the age of household head.
- Because unmarried person living with their parents increased.
- In addition, higher income inequality for the 20s was seen in individual age, because many of them live with their parents. They do not emerge if using the age of household head.

**Table 1** Detailed decomposition analysis of the change in GINI coefficient by age of household head and age of individual using the RIF-regression method.

| | Age of household head | | | Age of individual | | |
|---|---|---|---|---|---|---|
| | Composition | Unexplained | total | Composition | Unexplained | total |
| 0-4 | | | | -1.0 | -5.8 | -6.8 |
| 5-9 | | | | 0.1 | -5.1 | -5.0 |
| 10-14 | | | | 1.0 | 0.5 | 1.4 |
| 15-19 | | | | 0.3 | -0.7 | -0.5 |
| 20-24 | -5.8 | 1.5 | -4.3 | -6.6 | -2.6 | -9.2 |
| 25-29 | -2.3 | 2.5 | 0.1 | -4.1 | 1.7 | -2.4 |
| 30-34 | -2.0 | -0.6 | -2.5 | -0.4 | -0.9 | -1.4 |
| 40-44 | 0.2 | 12.9 | 13.2 | -0.2 | 7.1 | 6.8 |
| 45-49 | -0.4 | 1.3 | 1.0 | -2.0 | 0.6 | -1.4 |
| 50-54 | -6.0 | -1.6 | -7.6 | -5.1 | 2.7 | -2.5 |
| 55-59 | 7.0 | -7.6 | -0.6 | 6.7 | -7.2 | -0.5 |
| 60-64 | 15.0 | -8.8 | 6.2 | 9.5 | -11.1 | -1.6 |
| 65-69 | 12.9 | -15.9 | -3.0 | 6.5 | -13.4 | -6.9 |
| 70-74 | 16.4 | -17.4 | -1.0 | 8.0 | -15.8 | -7.8 |
| 75-79 | 15.7 | -8.3 | 7.4 | 8.1 | -6.0 | 2.1 |
| 80- | 14.9 | -7.3 | 7.6 | 9.5 | -5.0 | 4.5 |
| cons | | 83.5 | 83.5 | | 131.0 | 131.0 |
| total | 65.7 | 34.3 | 100.0 | 30.2 | 69.8 | 100.0 |

# Contributions from “age structure”

By age of household head

Change in the age structure is more significant.

By individual age

Change in inequality within each age group is more significant.

- Many young people belong to the older age groups of household head where income inequality is high.
- The significant decrease in inequality among elderly cancels out the impact of the increase in inequality within the working-age.
- Using the age of household head causes over-evaluation of demographic changes.

Changes in living arrangements among children, working age and old age.

# Types of living arrangements

- From 1994 to 2009, income inequality increased for most of the age groups under 68, while income inequality decreased for the age groups 65 and older.

- We construct types of living arrangements for each individual age groups by their marital status and whether or not they live with their family

  - Children(aged 0-19): Two parents, Two parents with grand parents, Single parent, Single parent with grand parents, other.
  - Working age (aged 20-64): Single (living alone), Single with parents, Couple, Couple with their parents, other.
  - Elderly (aged 65 and over): Living alone, Couple only, Living with unmarried children, Living with married children, other.

# Decomposition analysis of changes in GINI*1000 using the RIF-regression method

| | Children (0-19) | | Working age(20-64) | | Elderly (65-) | |
|---|---|---|---|---|---|---|
| | Composition | unexplained | Composition | unexplained | Composition | unexplained |
| age | 0.8 | -2.7 | 0.3 | 3.3 | 2.6 | 6.9 |
| Living arrangements | 4.1 | -4.1 | 1.6 | 7.7 | 21.4 | 10.8 |
| N of children(< 18) | -0.1 | 4.7 | -0.9 | 0.7 | | |
| Work types of head | -0.3 | 3.8 | 4.2 | 5.8 | -14.9 | 21.5 |
| Constant term | | 8.0 | | -7.7 | | -68.5 |
| total | 4.3 | 9.6 | 5.3 | 9.8 | 9.2 | -29.3 |
| GINI 1994 ×1000 | 229.6 | | 263.7 | | 305.4 | |
| GINI 2009 ×1000 | 243.5 | | 278.8 | | 285.2 | |
| Difference | 13.9 | | 15.1 | | -20.1694 | |

# Conclusion

- In the previous studies the increase of aging population mainly account for growing inequality in Japan (Ohtake 2005, Oshio 2006, Shirahase 2018).

- If the age of household heads, population aging is the main factor for the increase in inequality. Instead, if individual age is used, the change in income inequality within each age group has substantial effects on the increase in overall inequality.
- Because of the increase in young people who do not marry and live with their parents, aging process of population looks more advanced than actual change.

- Decreasing inequality among the elderly is large, which partly offsets the increasing inequality among the working-age population.

- The widening inequality among young adults is caused, to some extent, by the increase in singles living with parents.

- among the elderly, the change in living arrangements contributes to an increase in income inequality, although the overall income inequality within age has been narrowing.

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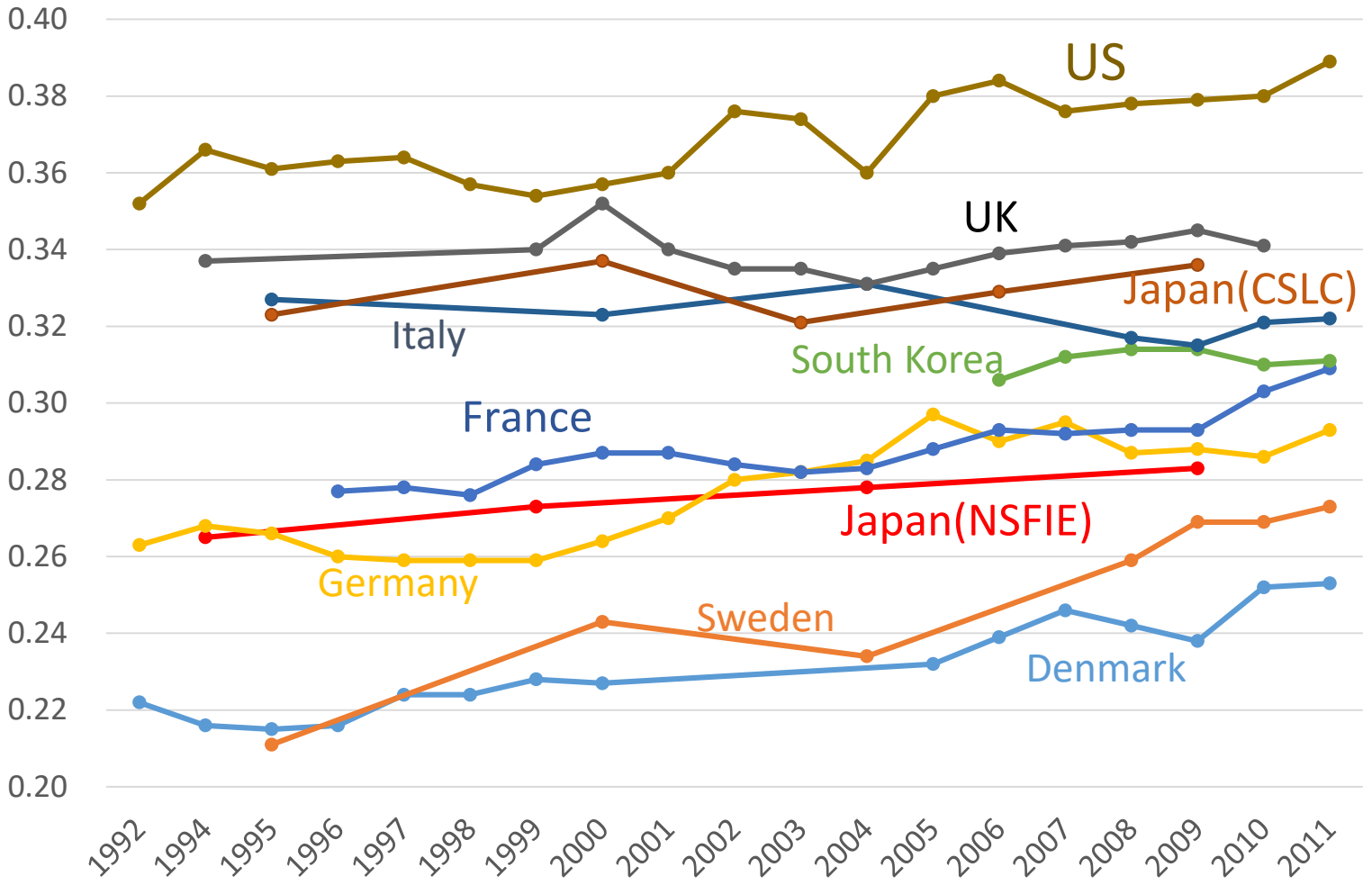
# Appendix

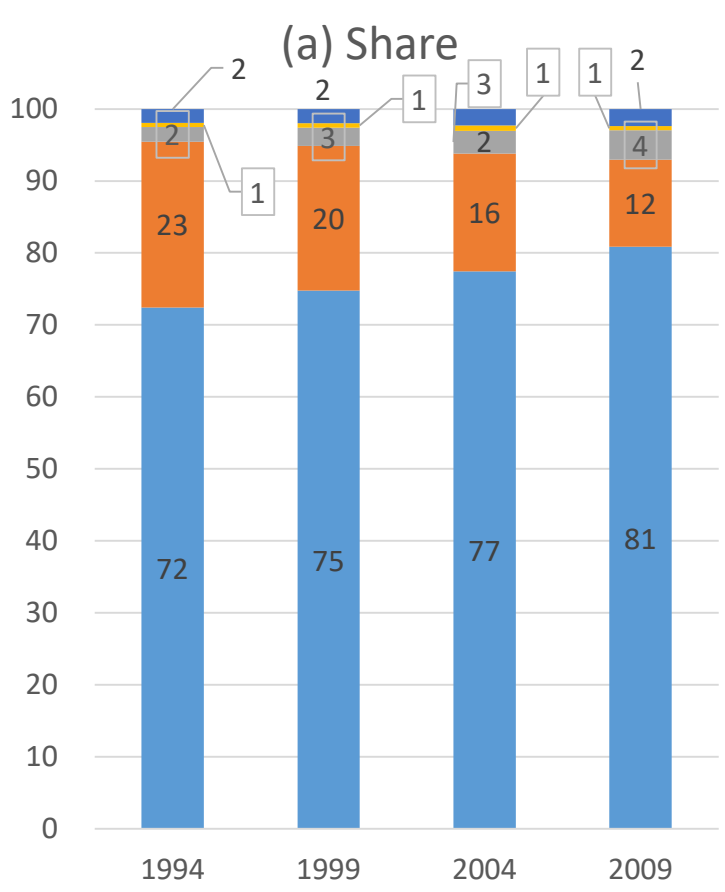
# Gini coefficient of Japan and selected countries

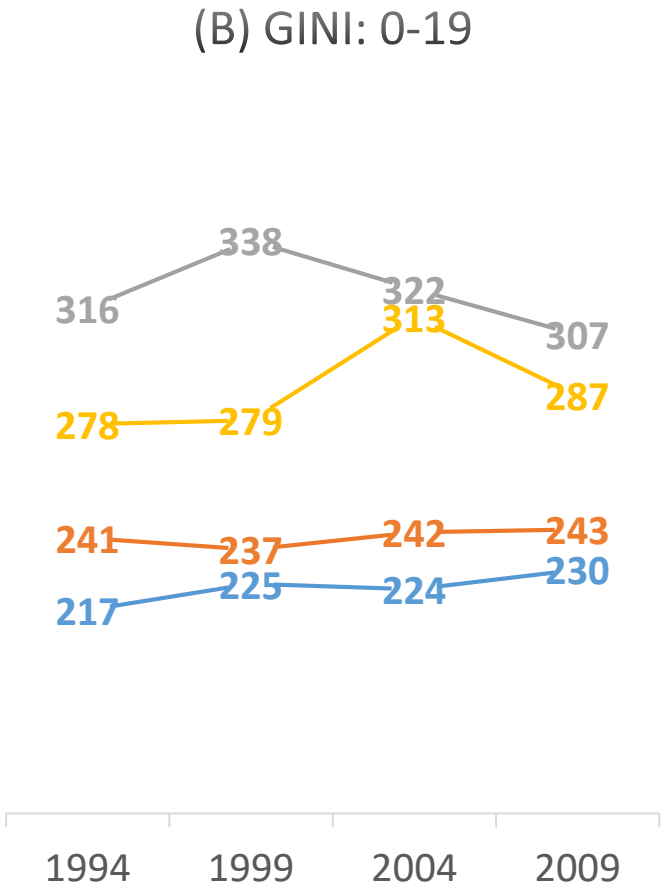


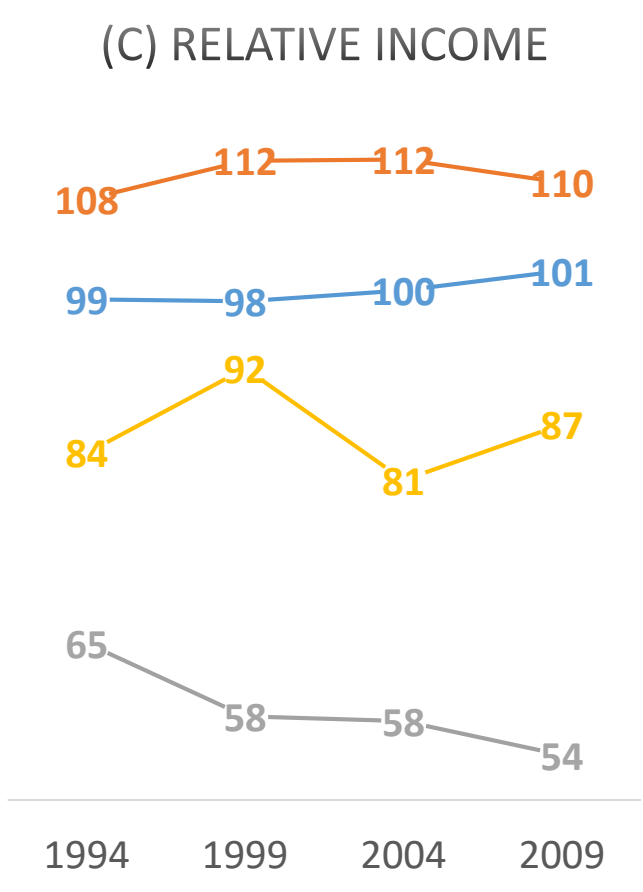

NSFIE: National Survey of Family Income and Expenditure
CSLC: Comprehensive Survey of Living Conditions

Data Source: OECD.Stat & Japan Statistics Bureau

# Population share(%) and, Gini ( ×1000) and relative Mean of equivalent disposable income(EDPI:%) by living arrangements among children aged 0-19.




Two-parent

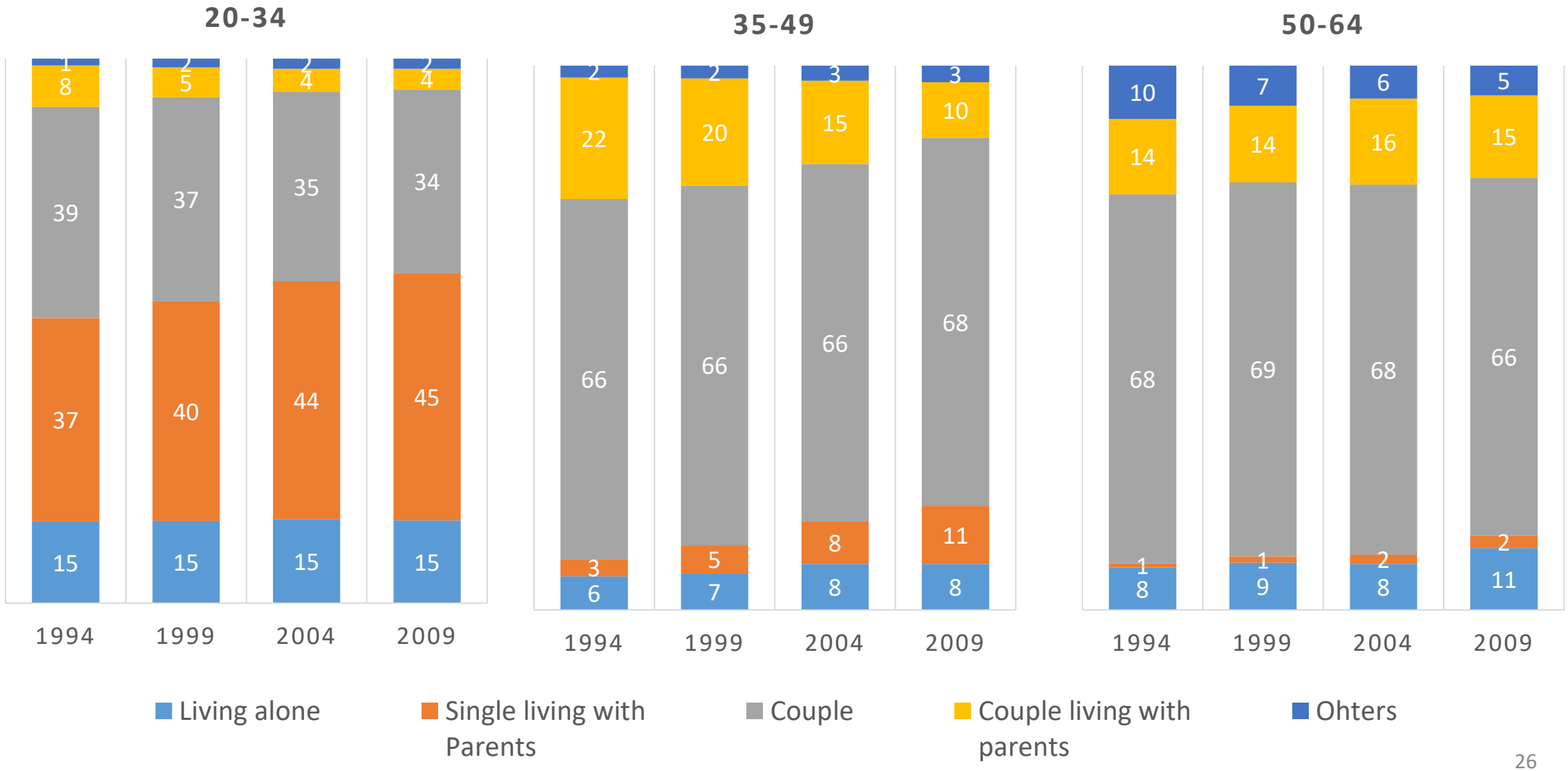
Two-parent with grandparents

Single parent

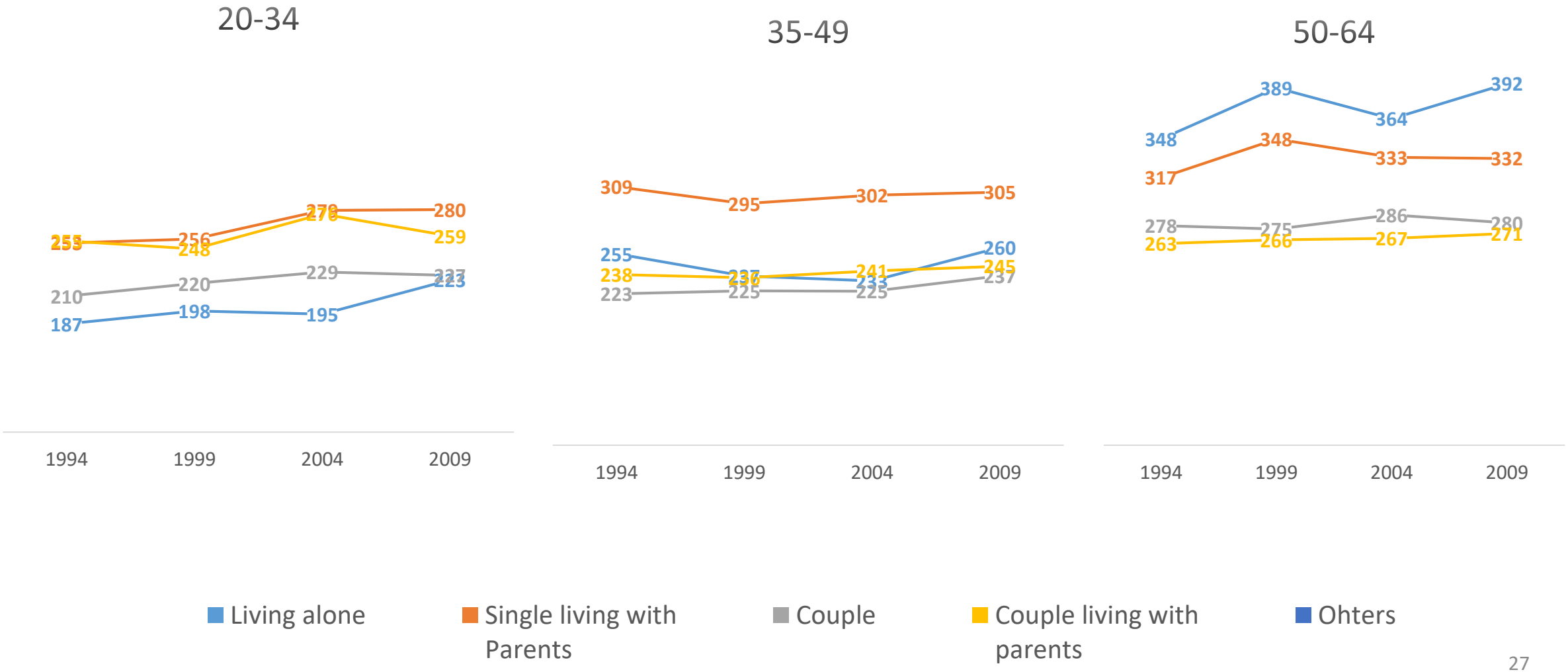
Single parent With grandparents

Ohters

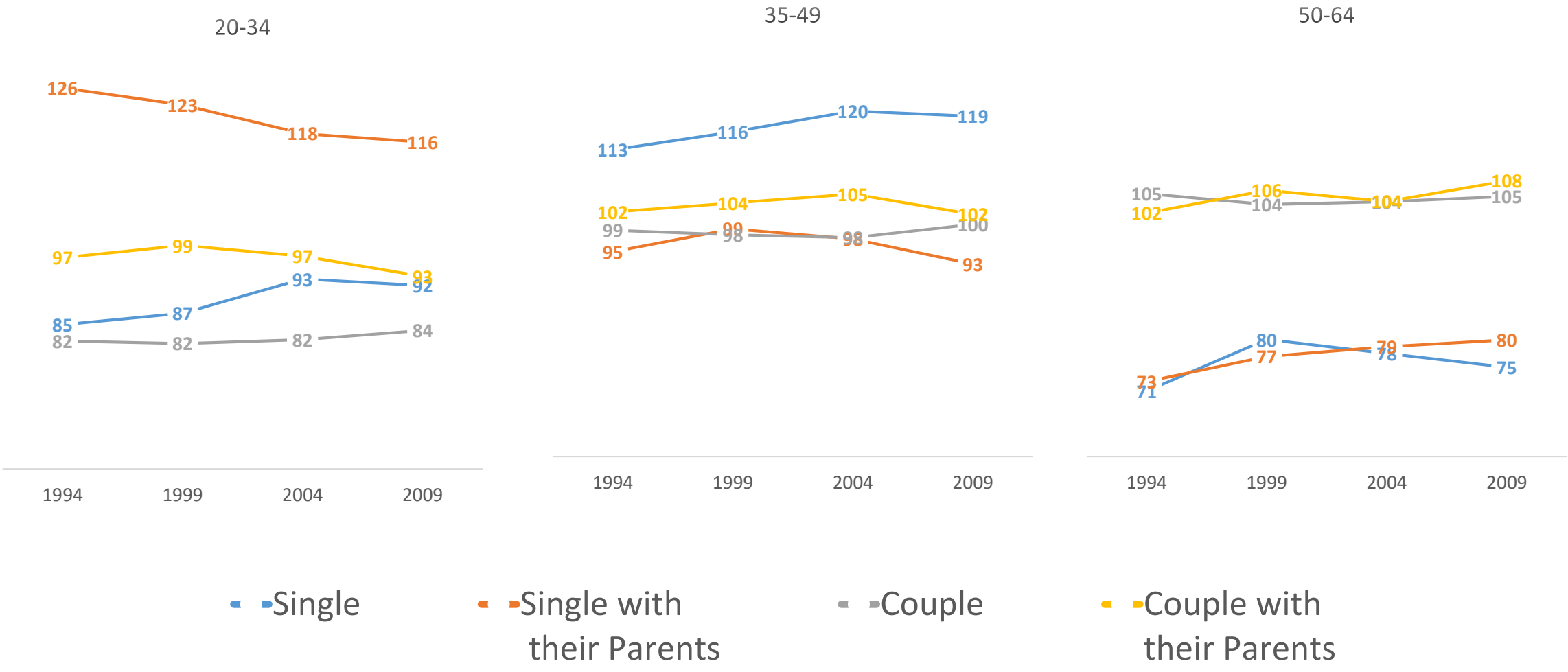
# Population share(%) by living arrangements among working-age aged 20-34, 35-49 and 50-64 years



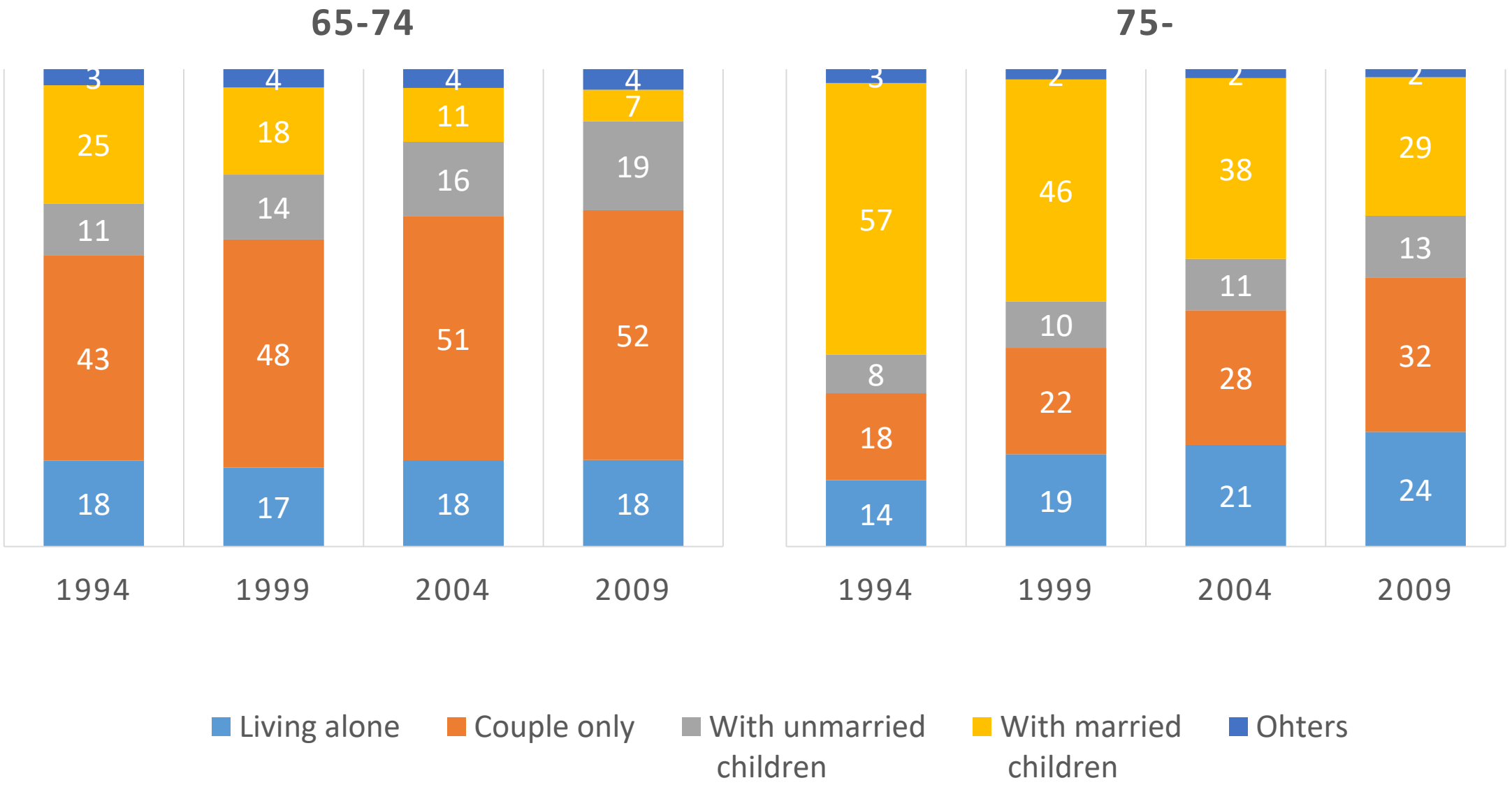
# Gini(×1000) of equivalent disposable income by living arrangements among individuals aged 20-34, 35-49 and 50-64 years



# Relative mean of equivalent disposable income(EDPI:%) by living arrangements among individuals aged 20-34, 35-49 and 50-64 years .



# Population share(%)  by living arrangements among individuals aged 65-74 and 75 and over



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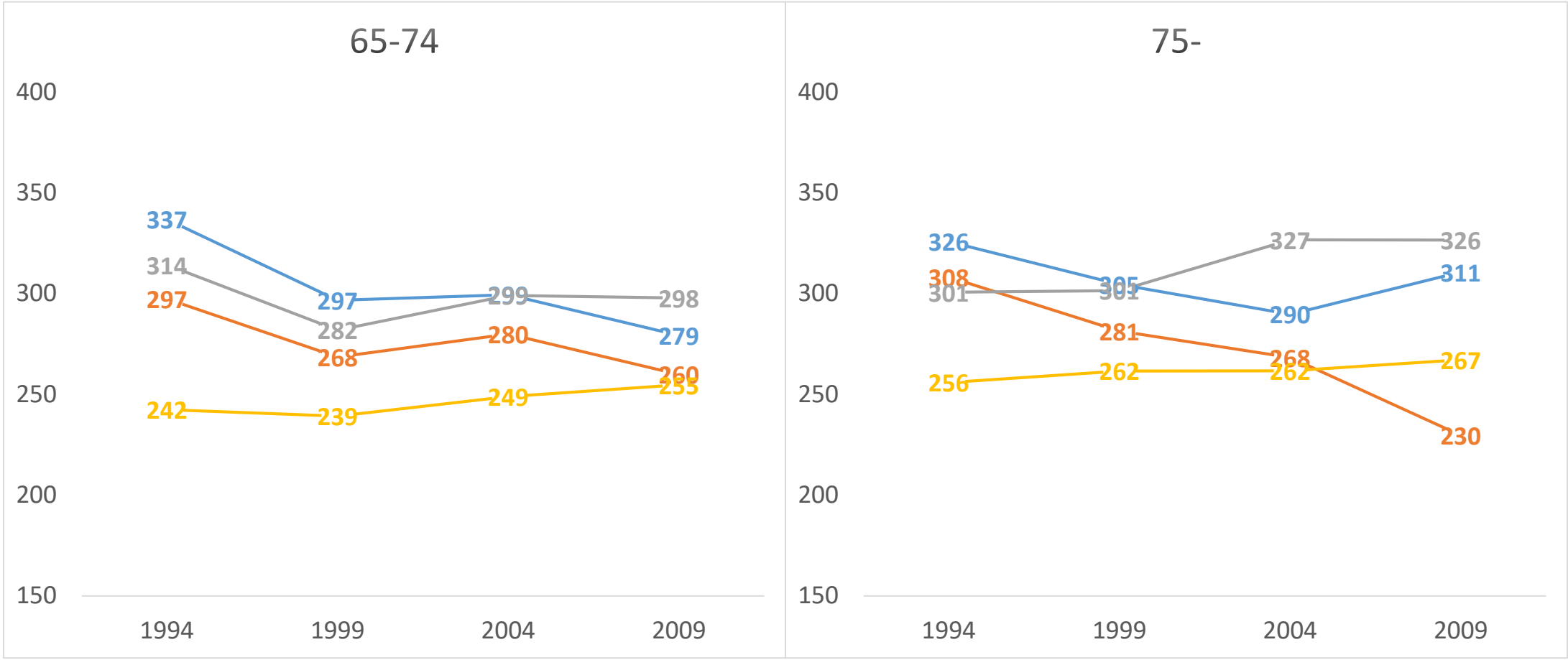

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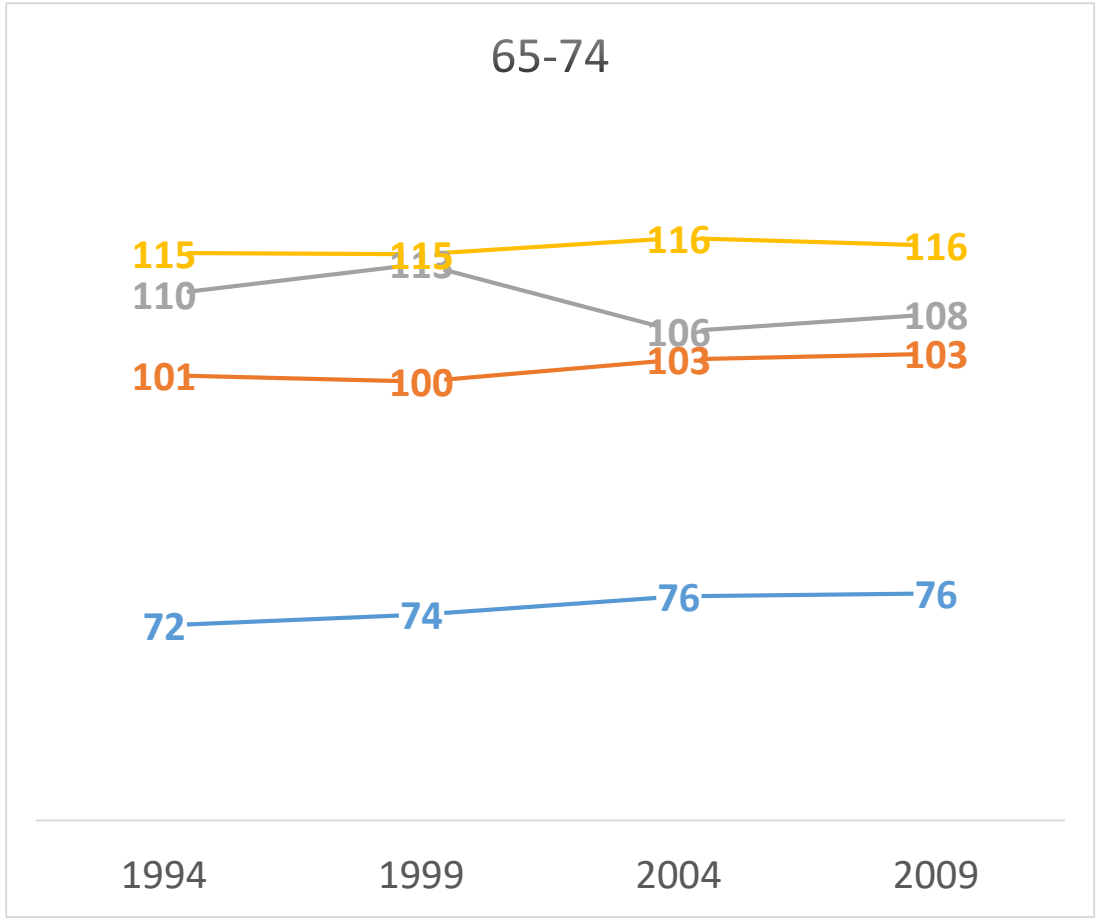


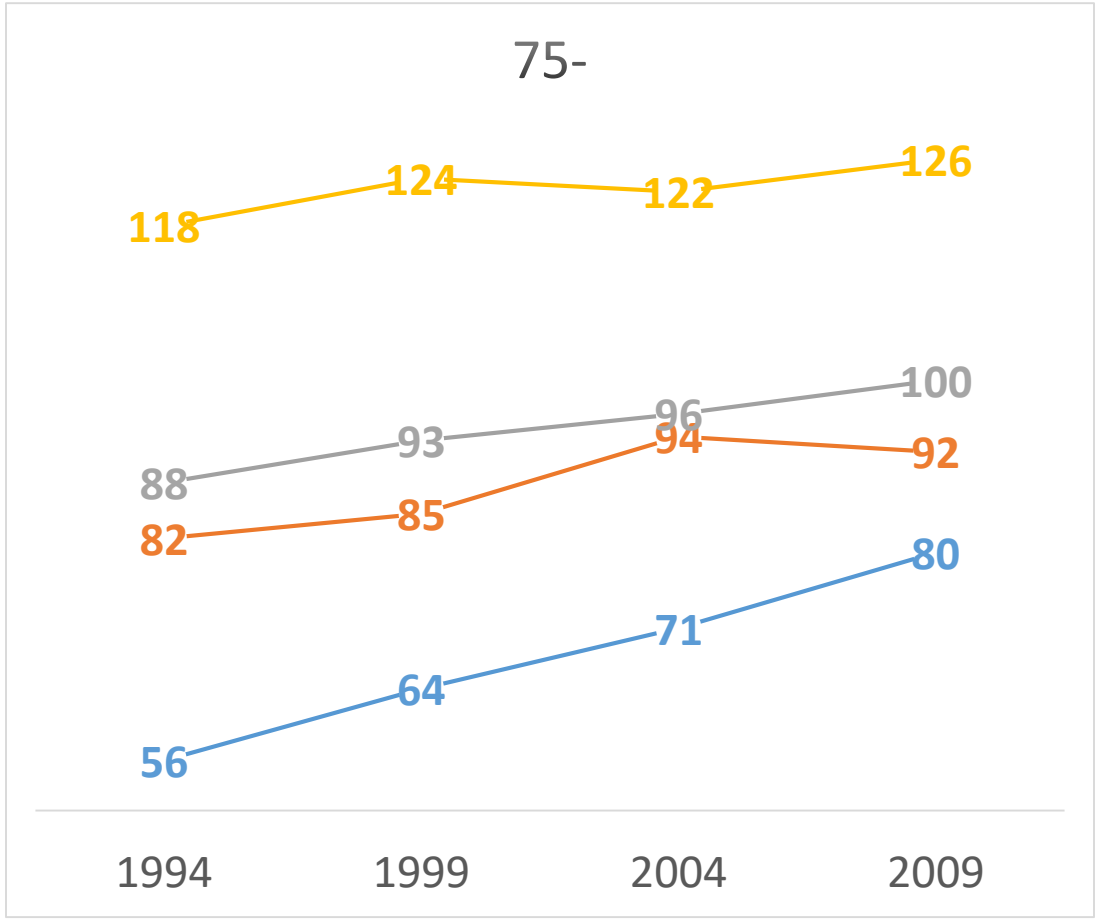


- -Living alone
- -Couple only
- -With unmarried children
- -With married children

# Results of decomposition analysis by Living arrangements.

# Decomposition analysis of changes in GINI*1000 using the RIF-regression method

| | Children (0-19) | | Working age(20-64) | | Elderly (65-) | |
|---|---|---|---|---|---|---|
| | Composition | unexplained | Composition | unexplained | Composition | unexplained |
| age | 0.8 | -2.7 | 0.3 | 3.3 | 2.6 | 6.9 |
| Living arrangements | 4.1 | -4.1 | 1.6 | 7.7 | 21.4 | 10.8 |
| N of children(< 18) | -0.1 | 4.7 | -0.9 | 0.7 | | |
| Work types of head | -0.3 | 3.8 | 4.2 | 5.8 | -14.9 | 21.5 |
| Constant term | | 8.0 | | -7.7 | | -68.5 |
| total | 4.3 | 9.6 | 5.3 | 9.8 | 9.2 | -29.3 |
| GINI 1994 ×1000 | 229.6 | | 263.7 | | 305.4 | |
| GINI 2009 ×1000 | 243.5 | | 278.8 | | 285.2 | |
| Difference | 13.9 | | 15.1 | | -20.1694 | |

# Decomposition analysis of changes in GINI*1000 using the RIF-regression method

| | 20-34 | | | | 35-49 | | | | 50-64 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | Female | | Male | | Female | | Male | | Female | |
| | Composition | unexplained | Composition | unexplained | Composition | unexplained | Composition | unexplained | Composition | unexplained | Composition | unexplained |
| age | 0.2 | -8.4 | -1.8 | 3.9 | -0.8 | -4.8 | 0.0 | 9.4 | -1.0 | -26.7 | 0.3 | -20.2 |
| Living arrangements | 5.9 | 7.0 | 5.8 | 8.6 | 4.5 | 15.9 | 5.5 | 55.6 | 7.3 | 59.7 | -0.1 | -9.7 |
| N of children(< 18) | -0.8 | -2.1 | -2.6 | 2.2 | 0.9 | -2.9 | 0.7 | -9.9 | 0.1 | -1.2 | 1.4 | -0.2 |
| Own work types | 1.0 | 4.0 | -1.1 | -5.0 | 2.3 | -2.2 | -6.6 | -7.6 | 1.7 | 11.3 | -6.5 | 0.8 |
| Constant term | | 12.1 | | -2.3 | | 10.1 | | -31.1 | | -29.8 | | 38.1 |
| total | 6.3 | 12.5 | 0.2 | 7.2 | 6.9 | 16.1 | -0.5 | 16.4 | 8.2 | 13.3 | -4.9 | 8.8 |
| GINI 1994 ×1000 | 252.4 | | 264.7 | | 229.9 | | 241.4 | | 270.5 | | 300.3 | |
| GINI 2009 ×1000 | 271.2 | | 272.2 | | 252.8 | | 257.3 | | 292.0 | | 304.1 | |
| difference | 18.8 | | 7.5 | | 22.9 | | 15.9 | | 21.5 | | 3.8 | |

日本語訳

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これまでの先行研究では、高齢化が日本における所得格差拡大の主な要因であることが示されてきた。本研究では、年齢の定義の違いが所得格差に与える影響を検証している。先行研究と同様に世帯主の年齢を用いた場合、人口高齢化が不平等増加の主な要因である。その代わりに、個人の年齢を用いた場合、各年齢グループ内の所得不平等の変化が、全体的な不平等の増加に大きな影響を与える。この年齢の定義による差は、若年層で親と同居する単身者の割合が増加しているため、世帯主の高齢化が個人よりも進んでいることによる。つまり、世帯主の年齢は、人口動態が不平等に与える影響を過大評価しているといえる。さらに、世帯主の年齢を用いた場合、高齢者の不平等の縮小が大きく、生産年齢人口の不平等の拡大を一部相殺する。また、こうした家族の変化は各年齢層内の不平等に影響を与える。本研究の分析からは、若年層における不平等の拡大は、親と同居する単身者の増加によってある程度引き起こされている。一方、高齢者では、子との同居の変化が所得格差の拡大に寄与しているが、所得格差は全体としては縮小している。