

# Child poverty in Japan: comparing the accuracy of alternative measures

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November 7, 2014

Preliminary and incomplete draft

## Abstract

In this paper I compare alternative indexes of child poverty in Japan, which are based on either household income or consumption. Using micro data from the National Survey of Family Income and Expenditures, I found that consumption-based measures showed less child poverty compared with income-based measures. The paper considered three explanations for the difference: under-reporting of incomes (which would inflate the number of income-poor), over-reporting of consumption (which would reduce the number of consumption poor), and consumption smoothing in response to negative income shocks. I present evidence that the lower rates of consumption-based poverty are primarily due to the income under-reporting, with less evidence for consumption over-reporting and for consumption smoothing. Finally, the paper compared income- and consumption-based poverty measures in their ability to identify households with lower material well-being (measured by the inability to own a house or the lack of major household appliances). Out of 27 indicators of material well-being, consumption was always superior to income in identifying disadvantaged households with children, with nearly all cases statistically significant.

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\*I gratefully acknowledge financial support from the Grant-in-Aid for Scientific Research C-25380287 from the Japan Society for the Promotion of Science. I also grateful to the National Statistics Center of Japan for kindly providing me with anonymized data from the National Survey of Family Income and Expenditures. I would like to thank Aya Abe, Yoshihiro Kaneko and Hidefumi Kasuga for their comments. All remaining errors are mine.

# 1 Introduction

For a long time, the problem of child poverty was downplayed by the government in Japan. In consequence, the first official estimate of child poverty rate was made only in 2009, even though household data to calculate the estimate had been available over decades. The poverty problem turned out particularly serious for Japanese children, for whom poverty rate turned out among the highest among developed countries.

The situation has hardly improved in subsequent years. According to the latest official estimate, the child poverty rate was 16.3 percent, which puts Japan well above the median poverty rate for children among OECD countries (12.3 percent, according to OECD (2014)). Moreover, the child poverty rate is not only high in international comparisons, but also keeps on growing over time. In 1985, child poverty rate 10.9 percent, which put Japan only slightly above the median level for OECD countries in mid-1980s (9.8%).

In contrast to the delayed official recognition of child poverty, a number of academic studies examined the severity, causes and negative consequences of child poverty in Japan (Abe, 2008, 2014). Typically, these studies defined child poverty by low incomes, and less attention was paid to alternative measures of household resources (such as consumption or wealth). Exceptions to this general trend are Ohtake and Kohara (2011), who calculated child poverty rates by income and consumption, and Saunders and Abe (2010), who compared income poverty with the overall incidence of deprivation (defined as the lack of items which are considered necessary for child's development).

In this paper I examine three alternative measures of household resources: disposable income, consumption expenditures and non-durable consumption. Compared with previous studies, the paper makes three novel contributions. First, it confirms previous results of Ohtake and Kohara (2011) that consumption-based measures of child poverty are consistently lower compared with income-based measures, and the result holds with various alternative definitions of income and consumption.

Second, the paper evaluates three explanations why the income-based and consumption-based poverty indexes could diverge, and provides evidence that the divergence is mostly due to the under-reporting of income compared with over-reported consumption expenditures. The paper's result contradicts Ohtake et al. (2013), who claimed that consumption-based poverty is lower because "some people facing an income drop can cope by reducing their savings, by borrowing, and/or by receiving other transfer incomes to sustain the same level of consumption, while other people facing an income increase may restrain expenditure to protect against future shocks by raising savings, investment, and/or transferring to others". The paper demonstrates that the consumption-smoothing behavior is unlikely among poor households with children, and provides evidence that income under-reporting is more likely to inflate income-based indexes of child poverty. The finding for Japan agrees with previous studies by Meyer and Sullivan (2003, 2011) for the United States, Brewer et al. (2006); Brewer and O'Dea (2012) for the United Kingdom, and Brzozowski and Crossley (2011) for Canada, who compared various attributes of income-poor

and consumption-poor households, and concluded that the primary reason for lower rates of consumption-based poverty is income under-reporting among the poor households.

Third, the paper compares children that were identified as either income-poor or consumption-poor, and examined the incidence of other indicators of material well-being (such as the availability of various household appliances, land and house ownership, and the possibility to have a child studying in university). In this comparison of material well-being of income- and consumption poor, I used two tests that were proposed by Meyer and Sullivan (2003, 2012a). Though these tests are not strictly comparable, both of them consistently indicated that consumption was better in identifying households with worse material conditions. Out of 27 indicators of material well-being, consumption was always superior to income in identifying disadvantaged households with children, with nearly all cases statistically significant.

## **2 Income and consumption as alternative measures of living standards**

While income continues to be most widely used for measuring poverty, a number of conceptual and practical reasons exist why consumption could be a better measure of well-being. Income and consumption could be different in two cases: when households save a part of their incomes, or when they smooth consumption in response to a temporal drop in income by running down their assets (or piling up new debts). The second case is at the center of permanent-income hypothesis, which asserts that consumption is more closely related to life-long resources, while income is more volatile in response to short-term shocks that people try to smooth out. Based on this theoretical background, the conceptual advantage of consumption for measuring poverty was advocated by Cutler and Katz (1992), Slesnick (1993, 2001), and Blundell and Preston (1996), with a typical conclusion by Deaton and Grosh (1998) that “given the choice [between income or consumption], (perfectly measured) consumption is a more useful and accurate measure of living standards that is (perfectly measured) income”.

More recent studies compared measurement errors in income and consumption among poor households, and found that the measurement error could be particularly severe for income, with reported incomes often much lower than expenditures among income-poor households. For example, Sabelhaus et al. (2014), Attanasio et al. (2006) and Fisher et al. (2012) found that living expenditures were twice as high as reported incomes for the bottom percentiles of income-poor, with no evidence that such households had sufficient assets or debt that could account for the income deficit. Similar finding was reported by Brewer et al. (2006) for the United Kingdom, and Brzozowski and Crossley (2011) for Canada.

### 3 Data and definitions

Household data for this paper were taken from the National Survey of Family Income and Expenditure (NSFIE). The survey is conducted by the Ministry of Internal Affairs and Communications every five years, and the paper uses household data from four waves of the survey (1989, 1994, 1999, and 2004). The data were provided by the National Statistics Center of Japan as a random sub-sample of the original dataset, with the sample size of about 80 percent of the original.

The NSFIE is conducted from September to November for multiple-person households, while single households are surveyed in October and November. A particular feature of the survey is the lack of recall period, so income and expenditure typically refer only to the survey period. In consequence, consumption data need to be seasonally-adjusted to refer for the whole year. Moreover, monthly income data are of little use, because they do not include bonus payments that are paid outside of the survey period (namely, in July and December).

The survey gathers data from about 60 thousand households, and collects exceptionally detailed information on their living conditions, including income, consumption expenditures of a large number of goods and services, the stock of financial assets and liabilities, changes in the balance sheet of households over the preceding year, and the ownership of various household durables.

In subsequent subsections, I explain definitions of major variables, discuss major data adjustments, and explain in more details the data-cleaning process.

#### 3.1 Poverty indexes

To get comparable estimates to previous studies of child poverty in Japan, the headcount poverty rate was defined as one-half of median income (or consumption). Poverty gap was defined as the amount of money, which is needed to raise all poor children up to the poverty line, and was measured in percent of disposable income or consumption. To account for differences in household size, I normalized income and consumption by an equivalence scale, equal to the square root of the total number of household members.

Both headcount poverty rate and poverty gap are expressed in percent, and could be calculated with nominal data. When nominal data had to be converted to real terms, I used the consumer price index with the base in 2010.

#### 3.2 Children

Poverty indexes for children were calculated on individual basis, with child poverty rate defined by the number of children living in poor households, compared to the total number of children. Children were defined as unmarried household members, who were younger than 20 years old. The age limit is higher compared with the official child poverty in Japan,

with age limit of 18 years. The age limit of 20 years had to be used because of the way the age information was aggregated in the anonymous NSFIE data. The data provides two options: either use annual age data, but only to 15 years old, or use a higher age limit, but in aggregated age bands (namely, 0–4, 5–9, 10–14, and 15–19 years old). For this paper, I opted for the second option, but this choice results in this paper not strictly comparable to the official child poverty rates in Japan.

### 3.3 Variables

Variable definitions broadly followed the ones used by Hayashi (1997) and Lise et al. (forthcoming). Disposable income was the difference between gross income and non-living expenditures (essentially, taxes and social security contributions). Gross income mainly contained wages, income from assets (such as dividend and interest income), income in kind, and social security benefits. For households with house ownership, gross income also included the imputed rent from owner-occupied housing. Non-living expenditures included taxes (mainly income and residential taxes) and social security contributions (such as public pension fees, health insurance fees, and similar payments).

Total consumption expenditures were the sum of all living expenditures, including the imputed rent from owner-occupied housing from house owners. Similarly to Lise et al. (forthcoming), I defined non-durable consumption by omitting from the total consumption expenditures a number of consumer durables<sup>1</sup>. Following Hayashi (1997) and Deaton and Zaidi (1999), consumption expenditures and non-durable consumption did not include remittances to other households. Exact formulas are provided in *Data Appendix* (sub-section A.1).

### 3.4 Data adjustments

As already mentioned, most data in the NSFIE do not refer to the full calendar year, but to the survey period (two months for single households, and three month for multiple-person households). While the survey collects data for gross annual income, consumption expenditures refer only to the survey period. To remove the impact of seasonal factors, I calculated seasonal adjustment coefficients for 10 major categories of consumption expenditures, using comparable consumption categories from the Family Income and Expenditure Survey (FIES). Unlike the NSFIE, the FIES is conducted monthly, and the survey's reports contain aggregate data for the whole calendar year. While household coverage of these surveys is not strictly comparable, they are broadly similar in the coverage of workers' households. Following Hayashi (1997) and Lise et al. (forthcoming), I calculated seasonal coefficients of 10 major consumption categories in FIES and NSFIE for 1989, 1994, 1999 and 2004, and used them to extrapolate the NSFIE data to the whole calendar year.

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<sup>1</sup> These categories included (1) housing rent, (2) durable goods for housework, (3) interior furnishings and decorations, (4) bedding, (5) purchase of vehicles and bicycles, and (6) recreational durable goods.

### 3.5 Missing data

The NSFIE data does not contain information for taxes and social security (SS) contributions for the category of ‘other households’ (which mostly include self-employed individuals and executives). For earlier two waves of the survey (1989 and 1994), the tax and social security information was fortunately available, so that the problem needed to be solved for the remaining two waves of the survey (1999 and 2004).

I used two approaches to calculate the missing data. First, I followed Hayashi (1997, p. 412–413), who suggested to use effective tax rates for major income brackets that are reported in *Annual Reports* of Japan’s National Tax Bureau for 1999 and 2004.

Second, I imputed the rate of taxes and SS contributions, using income, tax and SS data for ‘other households’ in 1989 and 1994. Specifically, the rate of tax payments and SS contributions was regressed on the following explanatory variables: annual income, gender, age of household head, region of residence, and a year dummy for 1989. To avoid unrealistic tax rates, I restricted them to remain in the interval between 0 and 1, using the predictive mean matching imputation method (provided by `pmm` option in STATA’s `impute` command).

To check the accuracy of the imputation procedure, I also applied the procedure to NSFIE waves in 1989 and 1994, and then compared imputed and actual data for disposable incomes. The match turned out very close, with the Spearman rank correlation 0.9927 for 1989, and 0.9947 for 1994.

### 3.6 Data cleaning

The initial dataset contained information on 192,599 households, and contained a number of unreliable observations. Table 1 describes major steps in cleaning up the initial dataset. First, I omitted households that were flagged to have unreliable incomes. Then I omitted households with either negative or zero values of disposable income, total consumption expenditures, and non-durable consumption. Finally, I dropped households with married household head who was younger than 20 years old. The final sample size contained 188,391 households, with the largest reduction in the sample size due to households with unreliable income information.

## 4 Results

### 4.1 Poverty rate and poverty gap with different measures of household resources

Figure 1 (Panel A) displays changes in the income-based poverty rate for children, and compares it with the official poverty rate, calculated from the Comprehensive Survey of Living Conditions (CSLC). Previously, Ohtake and Kohara (2010) estimated the poverty

rate for the total population, and found that the rate was lower with the NSFIE data compared with the CSLC data. Similarly, the difference between poverty rates in Figure 1 exceeded 5 percentage points in the late 1980s, and then decreased to 3.7 percentage points in mid-2000s.

According to Ohtake and Kohara (2011), this difference could be attributed to using very detailed family account books in the NSFIE, which record expenditures for a large number of goods and services. In contrast, CSLC asks households to give a rough estimate of their total living expenditures, with no family account books used in the survey. In consequence, both rich and poor households tend to be under-represented in the NSFIE, due to the high opportunity cost of rich households, and the inability of poor household to afford keeping the family account books.

To check this explanation, I compared poverty lines from the two surveys, and show them in Panel B of Figure 1. If both rich and poor households are equally under-represented in the NSFIE, then the poverty lines from NSFIE and CSLC should be similar. Panel B shows that the two poverty lines are very close, and virtually coincide in 1989, 1994, and 1999. Evidently, the higher child poverty rate with the CSLC data may reflect a larger degree of cooperation of poor households with this relatively less demanding survey.

Child poverty rates with different resource measures are reported in Table 2, with poverty rates for all households in Panel A, while Panel (B) reports poverty rates for different family types. Child poverty rate was the highest with disposable income, rising from 7.4 percent in 1989 to 9.9 percent in 2004. Conversely, the use of total consumption spending produced the lowest child poverty rates, with rise from 4.2 percent in 1989 to just 5.0 percent in 2004. Poverty rates from non-durable consumption were in the intermediate range, and once again indicated increasing child poverty, from 4.9 percent in 1989 to 7.5 percent in 2004. Finally, the poverty rate with the second imputation for disposable income produced very similar results, with difference of just 0.2 percentage points in both 1999 and 2004. Due to the small difference between alternative imputations of disposable income, subsequent results will refer to the first imputation of disposable income.

Panel B of Table 2 shows child poverty rates for major family types. When measured by disposable income, the poverty rate was highest for single mothers, with around one half of children poor in such families. Conversely, the lowest poverty rate was in multi-generation households, with only 3.9 percent of poor children in 2004. Families with both parents and 'other families' (such as children who were raised by grandparents) had intermediate levels of child poverty, at around 10 percent. For other measures of resources, the ranking of poverty rates remained the same across family types, with single mothers consistently having the highest poverty rates, followed by single fathers, 'other families', families with both parents, while the lowest child poverty was in multi-generation families.

Table 3 reports child poverty with a different index of poverty (poverty gap), and similarly to Table 2, compares poverty estimates with different definitions of household resources. Once again, disposable income produced the largest estimates of poverty gap,

which increased from 1.5 percent in 1989 to 2.4 percent in 2004. Conversely, the poverty gap was much smaller with total consumption expenditures and non-durable consumption. Moreover, the increase from 1989 to 2004 was also less pronounced, by 0.1 and 0.7 percentage points, respectively.

The choice of different resource measures resulted not only in different rates of child poverty, but also in significant differences which children were identified as poor. Figure 2 illustrates the difference between income- and consumption poor in 2004. As shown in Panel (A) of Table 2, the income-based poverty rate was 9.9 percent, while it was 7.5 percent with non-durable consumption. Figure 2 shows that the overlap between these two resource measures was only partial, with only 3.9 percent of children identified as poor by both measures. On the other hand, as much as 6.0 percent of children were income-poor (but not consumption-poor), while 3.6 percent of children were consumption-poor (but not income-poor). Evidently, the choice of resource measure matters a lot for the choice which children are classified as poor.

Given the large mismatch between the composition of income- and consumption-poor, two questions need to be answered: first, why the poverty rates were different for income and consumption, and second, with only partial overlap between income- and consumption-poor, which of these two resource measures is better in identifying children in material need? Possible answers to the first question will be examined in Section 5, while Section 6 will consider the ability of income- and consumption-based poverty measures to identify children with worse material conditions.

## **5 What explains differences in income and consumption poverty among children?**

The difference between income- and consumption-based measures of poverty is a common finding, with consumption-based poverty typically smaller compared with income-based poverty. Three possible explanations have been suggested for the difference: measurement errors in either income and consumption, or consumption smoothing in response to negative income shocks (Meyer and Sullivan, 2012b; Brewer et al., 2013). To have consumption poverty less than income poverty, the measurement error should have specific patterns: either incomes are under-reported (which would inflate the number of income-poor, or consumption expenditures are over-reported (which reduces the number of consumption-poor). Consumption smoothing also should be in particular form, with households either reducing their assets, or running up new debts. The rest of this section, I will consider evidence for each of these alternative explanations, and will argue that the best evidence is available for the income under-reporting among the poor households.



## 5.1 Over-reporting of consumption

There is scarce evidence that household consumption could be over-reported. In fact, the opposite is a common finding in studies that compared consumption expenditures in household surveys with the corresponding aggregates from the national accounts. Barrett et al. (2014) made such a comparison for Australia, Canada, the United Kingdom and the United States, and found that households typically substantially under-reported their consumption expenditures compared with the national account aggregates, with only Canada having a close match between the two expenditure measures. In other three countries, the expenditure shortfall in household surveys became even larger over time, and has approached 30 percent in recent years.

Similar comparisons for Japanese household expenditures were reported by Sakai (2010) and Maeda and Umeda (2013), who examined NSFIE data in 2004 and 2009, respectively. Both studies found that consumption expenditures were under-reported in Japan as well. For example, the shortfall for total consumption expenditures was 12.1 percent in 2004, and 6.8 percent in 2009.

Moreover, the mismatch with national account is likely to be even smaller for the poor households, because their major expenditure categories (on food, housing and recreation) had smaller mismatch with national accounts. Using expenditure weights for households in the first income decile, I re-calculated the difference between total expenditures between NSFIE and national accounts. In 2004, the expenditure shortfall diminished from 12.1 to 5.8 percent, while in 2009, the initial shortfall of 6.8 percent turned into surplus of 3.4 percent. In both cases, use of expenditure shares for the poorest households resulted in even better match between expenditures in NSFIE and national accounts.

## 5.2 Under-reporting of income

In contrast to the measurement error in consumption, there is considerable evidence that poor households are likely to under-report their incomes. Such evidence was available for the United States (Meyer and Sullivan, 2012b), the United Kingdom (Brewer et al., 2006), and Canada (Brzozowski and Crossley, 2011). To examine income under-reporting in Japan, I followed Brewer et al. (2006), and divided households with children into 100 sub-groups (percentiles) by their equivalised disposable income (that is, their real disposable income per the number of equivalised adults). Then I calculated the median expenditures for each of these sub-groups. Figure 3 shows median expenditures for lowest 20 income percentiles. For each percentile group, median expenditures are plotted by dots, starting from the lowest percentile of income on the left. Without saving or dissaving behavior, expenditures and disposable incomes in each sub-group should be equal. This condition is indicated in Figure 3 by the straight line.

In each panel of Figure 3, total consumption expenditures are presented in 2010 prices. At the lowest income percentiles, there is a remarkable stability in consumer expenditures,

at around 100 thousand yen per equivalent adult. For the lowest income percentiles, the level of expenditures greatly exceeds the reported income per equivalent adult, with the income deficit equal to the difference between the straight line and hollow circles. In each panel, the income deficit is the largest for the first income percentile, at around 30,000 yen per month in 1989, and then increases to around 50,000–60,000 yen per months in subsequent surveys. To finance this income shortfall, households need to run down their assets or increase their debts in a sustainable way. If households are not using their balance sheets to fill in the income shortfall, this will provide evidence for income under-reporting among households. In next subsection, I will examine evidence whether the poorest households were using their balance sheets to finance the shortfall in their incomes compared with expenditures.

### **5.3 Consumption smoothing by reducing assets or running-up debt**

There are three pieces of evidence that consumption smoothing was unlikely among the poorest households by income. The first one refers to the flow measure of household balance sheets, the real change in household net worth per equivalent adult. The flow measure is shown by vertical bars in Figure 3 for the bottom 25 income percentiles. In strict accounting identity, the shortfall of income compared with expenditures should be matched by negative change in net worth. Figure 3 demonstrates that the income shortfalls for the lowest income percentiles were not matched by reduced net worth of households. The negative change in net worth could be observed for the lowest two income percentiles in 1999 and the lowest three percentiles in 2004, but in both years the reduction in net worth was much smaller than the income shortfall. For example, the income shortfall for the first income percentile in 2004 was 44 thousand yen per month, which was almost double of the negative net worth for this poorest income group (27 thousand yen). In all other groups with the income shortfalls, changes in net worth were never sufficient to financing these income shortfalls.

The second piece of evidence that consumption-smoothing was unlikely among income-poor households comes from their stock of financial assets and debts. Figure 5 shows the median levels of household assets and debts for the bottom 10 percentiles of income-poor households. The picture is clearest for households debt: with no exception, the income-poor households had zero stock of debts. As for the stock of household assets, it was also insufficient to support sustainable income deficits compared with expenditures, especially for the lowest income percentiles. For example, the median assets of the lowest income percentile in 2004 was 562 thousand yen, compared to the income shortfall for this household group of 44 thousand yen (Table 5). For household groups with income shortfalls, I calculated their asset coverage, defined as the number of months that households could finance their income shortfalls from their asset stocks. For example, the median asset coverage for the first income percentile was 13 months in 2004, and was even lower in previous years.

Overall, the available assets by income-poor households make consumption-smoothing very unlikely.

Third piece of evidence that income-poor households are unlikely to smooth their consumption comes from examining components of changing net worth of households. By accounting identity, change of household net worth can be decomposed into three parts: (1) change in financial assets, (2) change in financial liabilities (with the minus sign), and (3) change in real assets<sup>2</sup>. Table 4 reports changes in the constituent parts of the net worth. The balance sheets of the poorest households changed mostly through net financial assets. Conversely, in agreement with zero stocks of financial debts, the poorest households did not engage in running up new debts, or in net purchases of real assets. For the latter two components, the median net change was zero in all four NSFIE cross-sections. As for the net financial assets, they did not change much in 1989 and 1994, and turned into negative values in 1999 and 2004, but were much lower than the difference between the reported expenditures and incomes. Overall, both the stock and flow measures of balance sheets of the poorest households are in wide disagreement with the amount of income deficit for income-poor households, indicating little scope for any sufficient consumption smoothing activity.

To compare the reliability of expenditure data for the poorest households, I repeated the same comparison of disposable income and expenditures, but this time — for the bottom 25 percentiles of consumption-poor households. For these groups of households, I calculated the median disposable income, and results are shown in Figure 4. Similarly to Figure 3, the straight line indicates the condition when disposable incomes are equal to consumption expenditures, with no saving or dissaving activity.

In contrast to income-poor households, no percentile of consumption-poor households has an income shortfall, with median incomes always above expenditures (as shown by hollow dots above above the straight line, for which incomes and expenditures are equal). Moreover, changes in net worth for consumption-poor households are in better agreement with the difference between their incomes and expenditures, with positive savings matching positive increases in net worth.

## **6 Alternative indicators of material well-being of children, classified as income- and consumption-poor**

This section provides additional evidence that income is an inferior measure of child poverty in comparison with consumption. While the previous section discussed the possibility of income under-reporting among households with children, this section will point at another problem with income-based poverty measures: their relative failure to identify households with low material standards of living, associated with owning a house, a plot

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<sup>2</sup> Data Appendix (Subsection A.2) describes this decomposition in more details

of land or a car ownership, the availability of various consumer appliances and amenities (such as air conditioners, refrigerators, computers, television, digital and video cameras), and the chance to have a child study in university.

I use two tests to identify whether income or consumption is better in identifying households with worse material conditions by alternative measures of material well-being. The first test was proposed by Meyer and Sullivan (2003), and its recent applications include Meyer and Sullivan (2011) and Brewer et al. (2013) for poor households in the U.S. and U.K., respectively.

The test classifies households into 4 groups. The first two groups include households with low and high incomes. The income-poor group includes households at the bottom 5 percent of income distribution, while the second group with relatively high incomes includes the rest of households. Let these two groups be denoted by  $Inc_{low}$  and  $Inc_{high}$ .

The other two groups are classified by non-durable consumption, with group  $Cons_{low}$  including households with lowest 5 percent in the distribution of non-durable consumption, and group  $Cons_{high}$  including the remaining households with relatively high levels of non-durable consumption.

Consider a case when material conditions are measured by the ownership of a consumer appliance. Let  $S(i)$  be the mean ownership share for category  $i$ . If the consumer appliance is a valid indicator of material conditions, the ownership share is likely to be lower for poor households, with

$$S(Inc_{low}) - S(Inc_{high}) < 0 \text{ and } S(Cons_{low}) - S(Cons_{high}) < 0$$

To study whether it is income or consumption that identifies better the material hardship in living conditions, the test uses a difference-in-difference statistic

$$\lambda = [S(Cons_{low}) - S(Cons_{high})] - [S(Inc_{low}) - S(Inc_{high})]$$

When the test statistic is negative, consumption provides a better measure of material hardship than income, while positive values of  $\lambda$  indicate that income is superior to consumption in identifying the disadvantaged households.

Table 7 reports results of applying the test to NSFIE data in 2004<sup>3</sup>. The first column shows characteristics of income-poor households, while income-rich households are described in second column. The third column shows the difference between income-poor and income-rich households. In total, the table reports comparisons for 27 characteristics of living conditions. They mostly included various consumer durables (system kitchen, solar water heaters, water heaters, etc.), house and land ownership, and the possibility that a child is currently a university student. For all of these characteristics, the difference between  $Inc_{low}$  and  $Inc_{high}$  households is always negative (as shown in column 3), though the

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<sup>3</sup> The initial cross-section contained 46,610 households. After omitting households with no children, the sample size was reduced to 18,234 households. This sample included 245 households that were flagged to have unreliable information on durables. After omitting these households, the final sample size was 17,989 households.

difference is just -1.3 percentage points for some widely-used durables (such as vacuum cleaners and TV).

The similar comparison is done for consumption-poor and consumption-rich households in columns (4) and (5). Once again, the difference in column (6) is always negative. Most notably, the test statistic  $\lambda$  is negative in cases, indicating that non-durable consumption is a better predictor of relatively worse living conditions compared with income. To evaluate the statistical significance of  $\lambda$ , I re-sampled the household data by bootstrap sampling, and calculated the empirical distribution of  $\lambda$  for specific household characteristics. Then using this empirical distribution, I calculated empirical p-values for specific for of  $\lambda$ , and report them in column (8) of Table 7.

Consider results for the ownership of system kitchen, which are shown in the first row of Table 7. The  $\lambda$  statistic was -7.1 percentage points, and its bootstrap p-value was less than 0.001, indicating a highly significant result for this household characteristics. Overall, in only 4 comparisons the test produced insignificant results, with p-values above the significance level of 0.05. In other cases, the consumption-poor children were living in households with lower availability of various consumer durables, and such households were less likely to own a plot of land or a house, while their living space was more limited, by 6.6 square meters per equivalent adult. Finally, consumption-poor households had lower probability of having a child, studying in university, and the difference with income-poor households was highly statistically significant.

The second test was proposed by Meyer and Sullivan (2012a). The test compares characteristics of households that are added to poverty by either income-based or consumption-based poverty measures. The test begins by fixing a baseline poverty cutoff, such as 9.9% of poor children in 2004 when measured by disposable income (as reported in Table 2). Then the same poverty cutoff is applied to a consumption-based household data. The same cut off is used to ensure that differences in household characteristics do not emerge from looking at different cut-offs in the distribution of income or consumption. With the same number of people classified as either income- or consumption-poor, some households would be classified as (1) both income- and consumption poor, while the rest could fall into three categories: (2) only income-poor, (3) only consumption-poor, (4) neither income- nor consumption-poor.

The test focuses on households that change their poverty status according to either income-based or consumption-based measure (namely, the second and third groups). A valid poverty measure would add to poverty households with *less* ownership of consumer durables, and other similar indicators of enhanced material well-being. In particular, consumption would have advantage over income if the third group of “only consumption-poor” have lower materials standards compared with the second group of “only income-poor” households. A t-test can be applied to examine whether differences in ownership rates are significantly different between the second and third groups. The null hypothe-

sis of the test is that households in second and third groups of households have identical characteristics of material well-being.

I applied the test to the same 27 measures that includes the availability of various consumer durables, the ownership of land and housing, and the probability of having a child studying in a university. Test results are shown in Table 6. Consider the availability of system kitchen, shown in the first row. For households that were both income- and consumption poor, only 12.2 percent owned system kitchens (as shown in column (1)). In contrast, households who were neither income- nor consumption-poor, 62.7 percent had the household amenity (column (4)). The group of “only income poor” has households that are added to the poor by income (but not by consumption). In this group, the availability of system kitchens was 30.9 percent (column (2)). In contrast, the availability of system kitchens was lower for consumption-poor households, at 23.0 percent (column (3)). The difference of -9.9 percentage points between income-poor and consumption poor households implies that consumption was a better indicator of worse material conditions, with p-value less than 0.001.

Overall, the difference between income- and consumption-poor households was negative in all 27 indicators of well-being. Moreover, the difference turned statistically significant in 25 cases, with p-values exceeding the significance level of 0.05 for only solar water heaters and video cameras.

In summary, even though the first and second tests are not comparable in their specifications, their results in comparing income- and consumption-based poverty measures were broadly comparable. Consumption was always a better indicator of worse material conditions among households with children, and in nearly all the cases the result was statistically significant. These results are remarkably similar to findings by Meyer and Sullivan (2003, 2011, 2012a) and Brewer et al. (2013), who examined poverty rates for all households in the United States and the United Kingdom, respectively. The results presented in this paper for Japan gives further empirical evidence about the overwhelming superiority of consumption for identifying the truly disadvantaged households, including, in particular, households with children.

## 7 Conclusion

This paper examined the sensitivity of Japan’s child poverty rates to various definitions of household resources. In broad agreement with previous studies for other developed economies, consumption-based measures indicated less child poverty compared to income-based measures. To explain the difference across alternative definitions of household resources, the paper examined three alternative hypothesis (over-reporting of consumption, under-reporting of income, and consumption-smoothing behavior), and concluded that the lower rates of consumption-based poverty occurred because of the income under-reporting among the poorest households. While similar results were reported for poor households

in the U.S. and U.K., the paper's results for Japanese households with children appears to be a novel one.

The relative advantage of consumption over income was further demonstrated by two tests that compared consumption and income in their ability to identify households with lower material well-being (such as less likely ownership of land, housing, and major consumer durables, the small total floor space of housing, and the lower chance to have a child who is studying in a university). In total, the paper examined 27 alternative indicators of well-being, and consumption was always superior to income in identifying disadvantaged households with children, with most results statistically significant. While the conceptual advantage of consumption over income for identifying poverty is widely known (as an implication of permanent-income hypothesis), practical advantages of using consumption to identify poverty are relatively less acknowledged. This paper fills in the gap, and provide new evidence for two practical advantages of consumption to measure child poverty in Japan: because consumption has lower measurement error (especially compared with the severe under-reporting of income among the poorest households), and because low consumption showed better association than income with alternative indicators of worse living conditions.

If consumption is in fact a better measure of worse material conditions, but incomes are used instead to identify child poverty, this creates two problems. The first problem is *false positives*, when some children are classified as "poor", even though they are not really the most disadvantaged ones. The second problem is *false negatives*, when by using income, we fail to identify children who really the most disadvantaged.

How large is the number of false positives and false negatives among Japanese children? This can be calculated from Figure 2, which shows how poor children were classified with NSFIE data for 2004. False positives refer to children who were income-poor, but not consumption-poor, accounting for 6% of children. Conversely, false-positives were consumption-poor, but not income-poor, accounting for 3.6% children. Only for 3.9% the classification was consistent for both income and consumption. The large number of false positives and false-negatives in poverty classification has an important policy implication, when public funds are allocated to children are not really the most disadvantaged, and when the society fails to support children who are truly in need. Evidently, the use of income may create a serious misclassification of child poverty in Japan.

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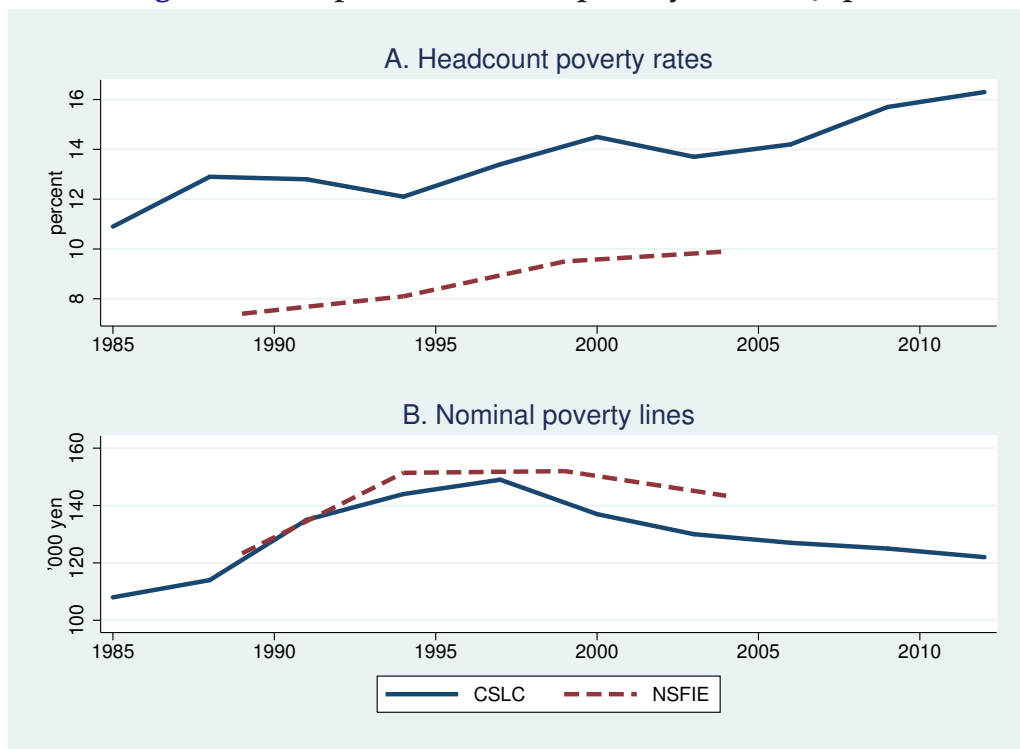


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**Table 1. Changes in the sample size after data cleaning**

1. Original sample size	192,599
2. Less: households, marked for unreliable income information	189,107
3. Less: households with negative income or consumption	189,036
4. Less: households with zero income or consumption	189,035
5. Less: household with married household head, younger than 20 years old	188,679

**Figure 1. Comparison of child poverty rates in Japan.**



*Note:* the figure compares the headcount poverty rates for children and the nominal poverty lines from two household surveys: the Comprehensive Survey of Living Conditions (CSLC) and the National Survey of Family Income and Expenditures (NSFIE). The poverty line is one-half of median household income per equivalent adult. The number of equivalent adults equals to the square root of the total number of household members. Units of measurement are the share of the total number of children in percent (Panel A) and thousand yen (Panel B).

**Table 2. Child poverty rate with different measures of household resources**

	1989	1994	1999	2004
<b>(A) Child poverty rate for all families</b>				
Disposable income	7.4	8.1	9.5	9.9
Consumption spending	4.2	4.9	5.5	5.0
Non-durable consumption	4.9	6.3	7.6	7.5
Disposable income with alternative imputation	7.4	8.1	9.7	9.9
<b>(B) Child poverty rate for major family types</b>				
	Disposable income			
Both parents	7.2	7.9	9.1	8.7
Single mother	46.3	32.5	44.5	43.4
Single father	22.8	9.6	10.5	21.7
Multi-generation	5.2	5.0	4.7	4.0
Other families	6.6	8.8	6.8	12.7
	Consumption spending			
Both parents	3.5	4.5	4.9	4.1
Single mother	19.0	15.9	23.1	20.8
Single father	13.5	9.1	4.5	9.6
Multi-generation	3.9	3.8	3.8	2.9
Other families	7.3	7.6	7.9	9.0
	Non-durable consumption			
Both parents	4.9	6.6	7.8	7.1
Single mother	27.5	21.4	29.9	27.4
Single father	13.5	11.6	9.2	19.9
Multi-generation	2.9	3.0	2.7	2.1
Other families	5.9	6.1	6.7	9.1
	Disposable income with alternative imputation			
Both parents	7.2	7.9	9.3	8.7
Single mother	46.3	32.5	44.4	43.4
Single father	22.8	9.6	10.5	20.0
Multi-generation	5.2	5.0	5.0	4.1
Other families	6.6	8.8	7.2	13.0

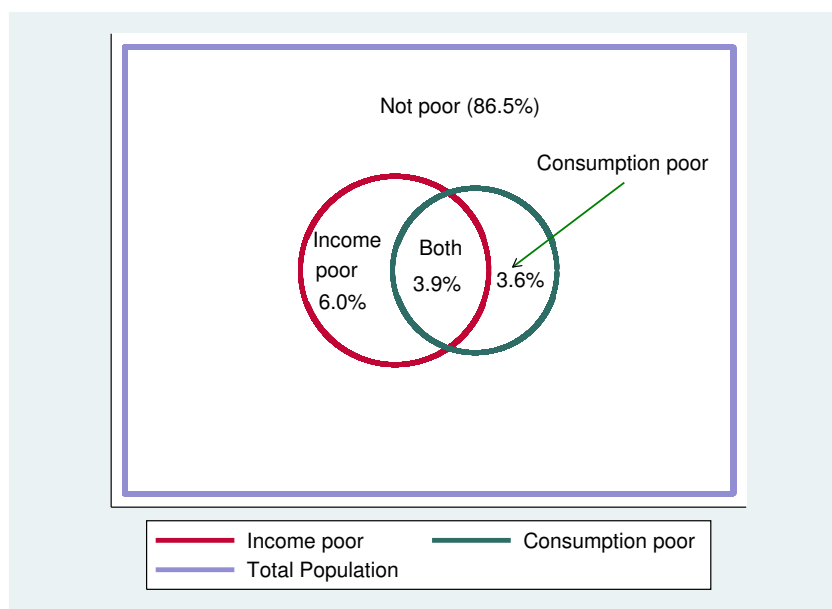
*Note:* disposable income is defined as total income from all sources (salaries, public and private pension benefits, interest and dividends, etc.) and the imputed rent for owner-occupied housing, less taxes and social security contributions. Consumption spending includes total living expenditures and the imputed rent for owner-occupied housing. Non-durable consumption is based Lise et al. (forthcoming), and equals total consumption spending, less transfers to other households and spending on housing rent and expenditures on durables. Income, expenditures and non-durable consumption are normalized using the square root of total number of household members. Children are defined as unmarried members of household who are younger than 20 years old. The unit of measurement is the percentage of the total number of children (Panel A), and the percentage of the total number of children in a specific family type.

**Table 3. Poverty gap for children.**

	1989	1994	1999	2004
<b>All families</b>				
Disposable income	1.5	1.8	2.2	2.4
Consumption spending	0.7	0.8	0.9	0.8
Non-durable consumption	0.8	1.2	1.5	1.5
Disposable income (alternative imputation)	1.5	1.8	2.2	2.5
<b>By family type</b>				
	Disposable income			
Both parents	1.3	1.5	1.8	1.8
Single mother	15.3	11.1	17.2	17.0
Single father	6.5	2.1	3.2	7.4
Multi-generation	1.0	1.1	0.9	0.7
Other families	1.6	2.3	1.5	3.5
	Spending			
Both parents	0.6	0.7	0.7	0.6
Single mother	4.1	3.4	4.7	4.9
Single father	3.1	0.9	0.5	2.5
Multi-generation	0.5	0.6	0.5	0.4
Other families	1.3	1.4	1.4	1.6
	Non-durable consumption			
Both parents	0.8	1.2	1.4	1.3
Single mother	6.1	5.5	7.4	8.0
Single father	4.7	1.6	1.5	5.5
Multi-generation	0.4	0.4	0.4	0.3
Other families	1.0	1.1	1.2	1.7
	Disposable income (alternative imputation)			
Both parents	1.3	1.5	1.9	1.8
Single mother	15.3	11.1	17.0	16.9
Single father	6.5	2.1	3.2	7.3
Multi-generation	1.0	1.1	0.9	0.7
Other families	1.6	2.3	1.6	3.6

*Note:* Poverty gap is the average shortfall from the poverty line, expressed as a percentage of the poverty line. Variable definitions are the same as in Table 2.

**Figure 2.** Composition of children, defined as income-poor and consumption-poor (2004).



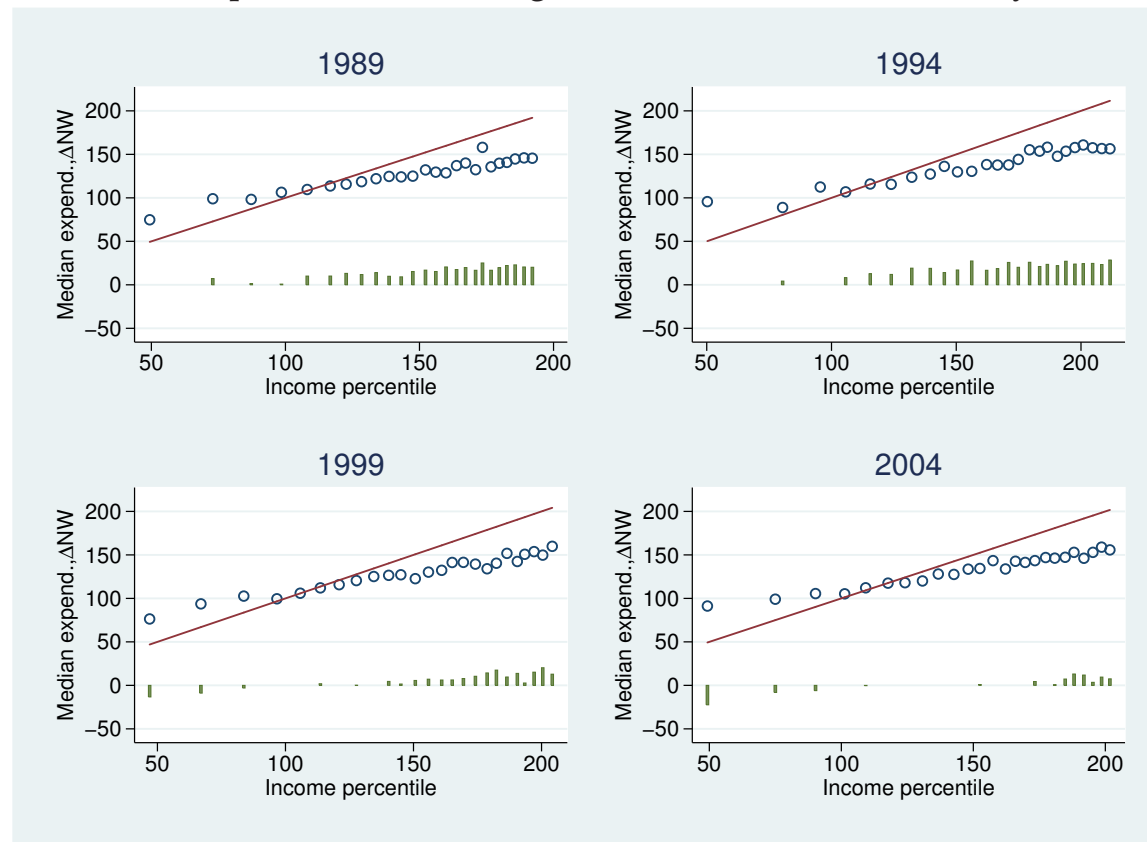
*Note:* The figure shows the degree of overlap between children, identified as income-poor and consumption-poor in 2004. Income and consumption are disposable income and non-durable consumption, respectively.

**Table 4.** Comparison of total consumption expenditures in Japan's System of National Accounts (SNA) and National Survey of Family Income and Expenditures (NSFIE).

<b>Panel A: Comparison with national accounts in 2004</b>			
	NEFIE/SNA ratio	Expenditure weights for:	
		SNA	Poorest 10 percentile
Food and non-alcoholic beverages	1.161	0.139	0.234
Alcoholic beverages and tobacco	0.539	0.027	0.017
Clothing and footwear	1.124	0.034	0.036
Housing, electricity, gas and water	0.954	0.254	0.316
Furniture and household utensils	0.772	0.039	0.036
Medical care	0.842	0.043	0.052
Transportation	0.777	0.106	0.069
Communication	1.038	0.029	0.028
Entertainment and cultural services	0.932	0.102	0.111
Education	1.203	0.023	0.004
Restaurants and accommodation	0.673	0.066	0.039
Other	0.528	0.137	0.059
<i>Total consumer expenditures:</i>			
<i>SNA weights</i>	0.876		
<i>Poorest 10% households</i>	0.942		
<b>Panel B: Comparison with national accounts in 2009</b>			
	NEFIE/SNA ratio	Expenditure weights for:	
		SNA	Poorest 10 percentile
Food and non-alcoholic beverages	1.271	0.139	0.234
Alcoholic beverages and tobacco	0.646	0.027	0.019
Clothing and footwear	1.064	0.034	0.030
Housing, electricity, gas and water	1.131	0.254	0.338
Furniture and household utensils	0.765	0.039	0.038
Medical care	0.860	0.043	0.052
Transportation	0.735	0.106	0.054
Communication	1.089	0.029	0.031
Entertainment and cultural services	1.014	0.102	0.102
Education	1.064	0.023	0.007
Restaurants and accommodation	0.744	0.066	0.034
Other	0.440	0.137	0.061
<i>Total consumer expenditures:</i>			
<i>SNA weights</i>	0.933		
<i>Poorest 10% households</i>	1.034		

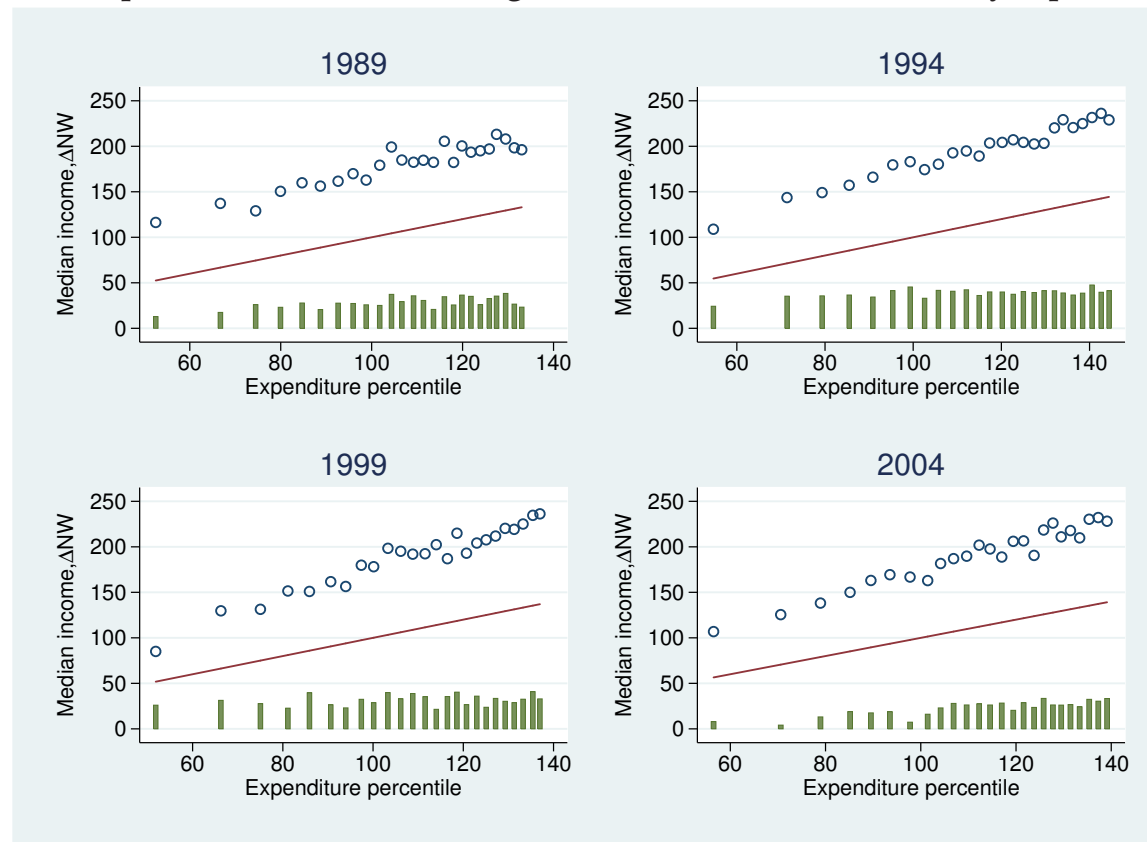
Source: Panel A: Sakai (2010); Panel B: Maeda and Umeda (2013).

**Figure 3.** Median total expenditures and changes in net worth of households by income percentile.



*Note:* the figure shows median total expenditures and changes in net worth for the bottom 25 percentiles of disposable income. Hollow circles show median expenditures for specific percentiles of disposable income, which range from 1 to 25. The straight line indicates when total expenditures (on axis Y) and disposable income (on axis X) are equal. Bar graph shows median change in net worth for a specific income percentile. By accounting identity, change in net worth should be equal to the difference between disposable income and total consumption expenditures (i.e., the difference between the straight line and hollow circle for a specific income percentile). All variables are divided by the number of equivalent adults, and are measured in 2010 prices. The unit of measurement is 1000 yen.

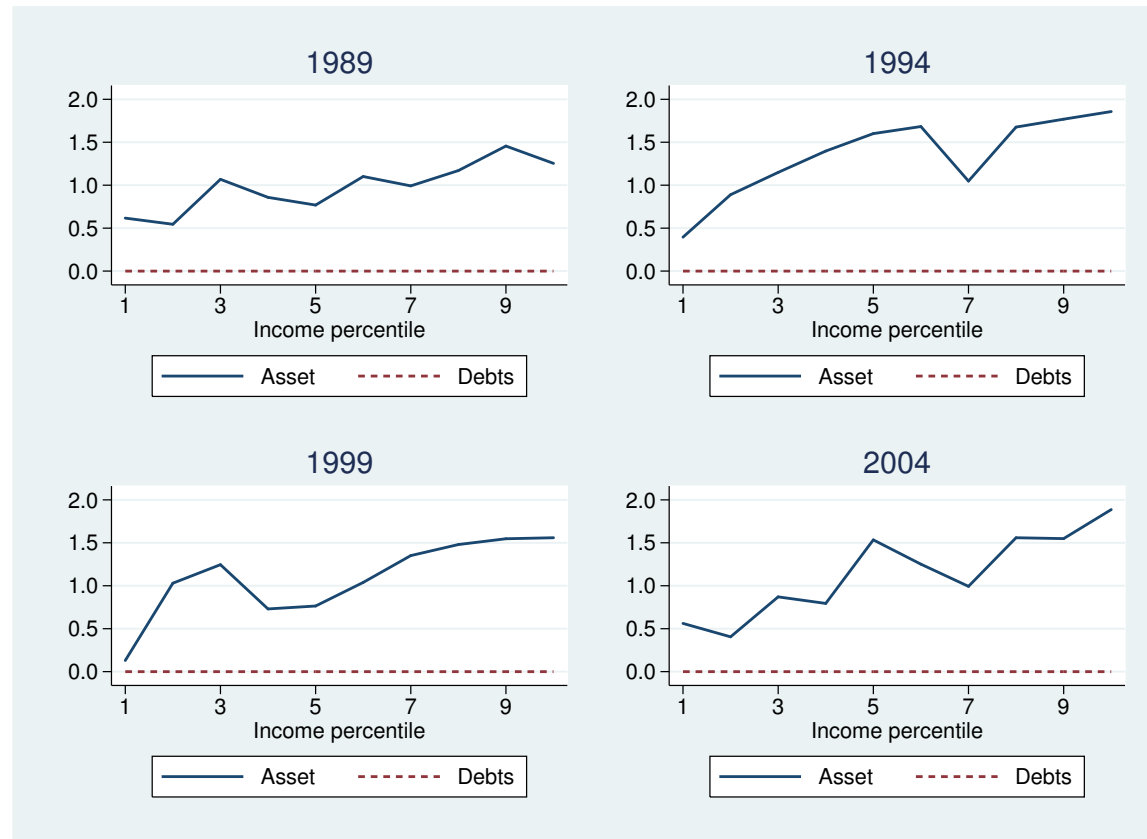
**Figure 4. Median disposable incomes and changes in net worth of households by expenditure percentile.**



*Note:* the figure shows median total income and changes in net worth for the bottom 25 percentiles of total consumer expenditures. Hollow circles show median incomes for specific percentiles of expenditures, which range from 1 to 25. The straight line indicates when disposable income (on axis Y) and expenditures (on axis X) are equal. Bar graph shows median change in net worth for a specific income percentile. By accounting identity, change in net worth should be equal to the difference between disposable income and total consumption expenditures (*i.e.*, the difference between hollow circle and the straight line for a specific income percentile). All variables are divided by the number of equivalent adults, and are measured in 2010 prices. The unit of measurement is 1000 yen.



**Figure 5. Median assets and debt for households at the bottom 10 percentiles of disposable income.**



*Note:* the figure shows household assets and debts, normalized by the number of equivalent adults. The unit of measurement is million yen (in 2010 prices).

**Table 5. Income, expenditure, savings and balance sheet flows for households at the bottom 10 percentiles of disposable income.**

	Income percentiles									
	1	2	3	4	5	6	7	8	9	10
1989										
<i>Disposable income</i>	49	73	87	99	108	117	123	128	134	139
<i>Expenditures</i>	75	99	98	106	110	114	116	119	122	125
<i>Saving</i>	-29	-26	-11	-7	-1	3	8	9	11	14
<i>d(Asset)</i>	0	4	0	0	6	7	8	9	8	3
<i>d(Debt)</i>	0	0	0	0	0	0	0	0	0	0
<i>d(RealAsset)</i>	0	0	0	0	0	0	0	0	0	0
<i>d(NetWorth)</i>	0	7	1	1	10	10	13	11	14	8
<i>Asset (stock)</i>	617	545	1,069	858	769	1,101	992	1,170	1,456	1,254
<i>Debt (stock)</i>	0	0	0	0	0	0	0	0	0	0
<i>Asset coverage</i>	14	27	42	44	37					
1994										
<i>Disposable income</i>	50	80	96	106	116	124	132	140	145	150
<i>Expenditures</i>	96	89	112	107	116	116	124	127	136	130
<i>Saving</i>	-41	-10	-17	-1	-3	5	10	11	10	20
<i>d(Asset)</i>	0	0	1	5	10	9	14	13	6	9
<i>d(Debt)</i>	0	0	0	0	0	0	0	0	0	0
<i>d(RealAsset)</i>	0	0	0	0	0	0	0	0	0	0
<i>d(NetWorth)</i>	0	4	0	8	13	12	19	20	14	16
<i>Asset (stock)</i>	395	889	1,149	1,398	1,601	1,683	1,048	1,677	1,769	1,858
<i>Debt (stock)</i>	0	0	0	0	0	0	0	0	0	0
<i>Asset coverage</i>	7	51	50	54	65					
1999										
<i>Disposable income</i>	47	67	84	97	106	114	121	128	134	140
<i>Expenditures</i>	76	94	103	100	106	112	116	121	125	127
<i>Saving</i>	-39	-31	-17	-3	0	3	5	8	8	13
<i>d(Asset)</i>	-13	-8	-3	0	0	0	0	0	0	1
<i>d(Debt)</i>	0	0	0	0	0	0	0	0	0	0
<i>d(RealAsset)</i>	0	0	0	0	0	0	0	0	0	0
<i>d(NetWorth)</i>	-13	-8	-3	0	0	2	0	2	0	5
<i>Asset (stock)</i>	130	1,030	1,246	730	764	1,039	1,351	1,480	1,547	1,559
<i>Debt (stock)</i>	0	0	0	0	0	0	0	0	0	0
<i>Asset coverage</i>	4	41	35	33						
2004										
<i>Disposable income</i>	49	75	90	101	109	118	124	131	137	143
<i>Expenditures</i>	91	99	106	105	112	118	118	120	128	128
<i>Saving</i>	-44	-24	-14	-5	-2	1	7	10	10	15
<i>d(Asset)</i>	-23	-10	-8	-1	0	0	0	0	0	0
<i>d(Debt)</i>	0	0	0	0	0	0	0	0	0	0
<i>d(RealAsset)</i>	0	0	0	0	0	0	0	0	0	0
<i>d(NetWorth)</i>	-27	-8	-6	0	0	0	0	0	0	0
<i>Asset (stock)</i>	562	405	871	794	1,534	1,251	993	1,559	1,549	1,887
<i>Debt (stock)</i>	0	0	0	0	0	0	0	0	0	0
<i>Asset coverage</i>	13	17	34	40	57					

Note: the table shows median disposable income, expenditure, saving and balance sheet flows for households at the bottom 10 percentiles of disposable income. Variable *d(NetWorth)* is the net change in net worth of poor households with children, which is decomposed into three contributing factors: (1) net change in financial assets *d(Asset)*, (2) net change in financial debt *d(Debt)*, (3) net purchase of real assets *d(RealAsset)*. *Asset coverage* shows the median number of months, required to cover the income shortfall (namely, negative savings), by running down the stock of available financial assets. Exact variable definitions are provided in *Data Appendix*. All variables are normalized by the number of equivalent adults. The unit of measurement is thousand yen (in 2010 prices).

**Table 6. Alternative indicators of well-being at the bottom 5 percent distribution of income and consumption (households with children, 2004).**

	Percentiles of income			Percentiles of consumption			$\lambda$	p-value	Favored measure
	0–5	5–100	Difference	0–5	5–100	Difference			
	(1)	(2)	(3) = (1) – (2)	(4)	(5)	(6) = (4) – (5)			
Have a system kitchen	18.2	58.5	-40.3	14.8	58.7	-44.0	-3.6	0.054	
Have a solar water heater	3.1	7.6	-4.5	2.2	7.6	-5.4	-0.9	0.271	
Have a water heater	27.9	54.8	-27.0	21.0	55.2	-34.2	-7.2	<0.001	Consumption
Have a microwave	89.5	93.4	-3.9	82.6	93.7	-11.1	-7.2	<0.001	Consumption
Have a rice cooker	78.3	82.5	-4.2	72.9	82.8	-9.9	-5.7	0.005	Consumption
Have a refrigerator	92.8	93.9	-1.1	85.5	94.3	-8.7	-7.7	<0.001	Consumption
Have a vacuum cleaner	94.1	94.2	-0.1	86.6	94.6	-8.0	-8.0	<0.001	Consumption
Have a washing machine	94.0	94.2	-0.2	86.8	94.6	-7.8	-7.6	<0.001	Consumption
Have a dishwasher	8.6	23.5	-14.9	4.5	23.7	-19.2	-4.3	0.001	Consumption
Have a sewing machine	48.1	72.0	-23.9	37.2	72.6	-35.5	-11.5	<0.001	Consumption
Have an air conditioner	72.1	84.4	-12.2	65.0	84.8	-19.7	-7.5	0.001	Consumption
Have a car	76.4	88.8	-12.4	69.6	89.2	-19.6	-7.2	0.001	Consumption
Have a mobile phone	87.1	91.6	-4.5	79.3	92.0	-12.7	-8.2	<0.001	Consumption
Have a fax	35.4	56.9	-21.6	30.6	57.2	-26.6	-5.0	0.031	Consumption
Have a TV	92.6	92.4	0.1	85.1	92.8	-7.8	-7.9	<0.001	Consumption
Have a CD stereo player	71.4	86.7	-15.3	63.3	87.1	-23.8	-8.5	<0.001	Consumption
Have a DVD player	22.7	32.7	-10.0	19.1	32.9	-13.9	-3.9	0.055	
Have a video recorder	75.5	86.8	-11.3	68.1	87.2	-19.1	-7.7	<0.001	Consumption
Have a computer	45.5	78.7	-33.2	40.8	79.0	-38.2	-5.0	0.030	Consumption
Have a (digital) camera	60.6	85.3	-24.7	57.5	85.5	-28.0	-3.2	0.136	
Have a video camera	44.2	68.6	-24.4	43.3	68.6	-25.4	-1.0	0.679	
Have a piano	7.1	32.9	-25.7	6.0	32.9	-26.9	-1.2	0.349	
Have a study desk	55.7	76.4	-20.7	42.8	77.1	-34.4	-13.6	<0.001	Consumption
Have a plot of land	24.2	70.8	-46.5	10.8	71.5	-60.7	-14.1	<0.001	Consumption
Have a house	24.8	74.0	-49.2	12.0	74.7	-62.7	-13.5	<0.001	Consumption
Total floor space	36.9	53.6	-16.7	32.4	53.9	-21.5	-4.8	<0.001	Consumption
Child in university	2.2	7.6	-5.3	0.7	7.6	-6.9	-1.6	0.016	Consumption

*Note:* the table compares income- and consumption-poor households with children at the bottom 5 percent of household distribution. For income and consumption, I used disposable income and non-durable consumption, respectively, with both measures divided by the number of equivalent adults (namely, the square root of total household members). All characteristics are for households, but weighted by the number of children. Total floor space is also divided by the number of equivalent adults. P-values are calculated from 1000 bootstrap replications. Preferred measures are not listed when the test statistic  $\lambda$  is insignificant.

**Table 7. Alternative indicators of well-being for income-poor and consumption-poor households with children (2004).**

	Both income- and consumption- poor	Only income- poor	Only consumption- poor	Neither income- nor consumption- poor	Difference	P-value	Favored measure
	(1)	(2)	(3)	(4)	(5) = (3) – (2)	(6)	(7)
Have a system kitchen	12.2	30.9	23.0	62.7	-7.8	<0.001	Consumption
Have a solar water heater	1.8	6.1	4.9	7.9	-1.1	0.280	
Have a water heater	21.2	39.0	26.8	57.8	-12.2	<0.001	Consumption
Have a microwave	87.7	94.8	85.4	93.8	-9.4	<0.001	Consumption
Have a rice cooker	77.7	80.5	74.4	83.2	-6.1	0.002	Consumption
Have a refrigerator	91.6	94.5	85.5	94.4	-9.0	<0.001	Consumption
Have a vacuum cleaner	92.9	95.7	86.2	94.7	-9.6	<0.001	Consumption
Have a washing machine	93.0	95.6	86.4	94.6	-9.2	<0.001	Consumption
Have a dishwasher	4.2	13.1	8.4	25.3	-4.7	0.001	Consumption
Have a sewing machine	42.2	60.0	50.0	74.4	-9.9	<0.001	Consumption
Have an air conditioner	69.2	80.4	70.9	85.6	-9.6	<0.001	Consumption
Have a car	72.9	85.6	79.1	89.8	-6.5	<0.001	Consumption
Have a mobile phone	85.3	92.2	81.8	92.2	-10.4	<0.001	Consumption
Have a fax	31.0	49.7	40.4	58.6	-9.3	<0.001	Consumption
Have a TV	90.9	94.1	86.0	92.8	-8.1	<0.001	Consumption
Have a CD a stereo player	70.0	81.6	73.4	87.8	-8.2	<0.001	Consumption
Have a DVD player	18.9	27.9	23.4	33.8	-4.5	0.026	Consumption
Have a video recorder	73.0	84.7	75.8	87.7	-8.8	<0.001	Consumption
Have a computer	37.7	62.6	55.6	81.5	-6.9	0.002	Consumption
Have a (digital) camera	56.5	78.1	70.6	86.8	-7.5	<0.001	Consumption
Have a video camera	42.9	57.2	55.4	70.1	-1.8	0.443	
Have a piano	4.8	16.4	12.7	35.2	-3.7	0.024	Consumption
Have a study desk	48.8	63.7	50.4	79.1	-13.3	<0.001	Consumption
Have a plot of land	11.4	43.0	22.0	76.1	-21.0	<0.001	Consumption
Have a house	12.5	45.7	24.9	79.3	-20.8	<0.001	Consumption
Total floor space	31.7	42.7	37.7	55.5	-5.0	<0.001	Consumption
Child in university	0.5	3.8	0.9	8.3	-2.8	<0.001	Consumption
Share of households	4.7	5.5	5.5	84.3			

Note: the table compares characteristics of households that are added to poverty by income- and consumption-based poverty measures. For income and consumption, I used disposable income and non-durable consumption, respectively, with both measures divided by the number of equivalent adults (namely, the square root of total household members). All characteristics are for households, but weighted by the number of children. Total floor space is also divided by the number of equivalent adults. P-values are calculated from t-test that means of two groups (only income-poor" and "only consumption poor") are the same. Preferred measures are not listed in cases when the difference between two group's averages was not significantly different, with p-value higher than the significance level of 0.05.

# Appendices

## A Variable definitions

### A.1 Income and consumption

$$\begin{aligned}\text{Disposable income} &= \text{Gross annual income}/12 \\ &\quad - \text{Total taxes} \\ &\quad - \text{Social security contributions} \\ &\quad + \text{Imputed rent from owner-occupied housing}\end{aligned}$$

$$\begin{aligned}\text{Total consumption expenditures} &= \text{Total living expenditures} \\ &\quad + \text{Imputed rent from owner-occupied housing}\end{aligned}$$

$$\begin{aligned}\text{Non-durable consumption} &= \text{Food} \\ &\quad + (\text{Housing} - \text{Rents for dwelling and land}) \\ &\quad + \text{Fuel, light and water charges} \\ &\quad + (\text{Furniture and household utensils} \\ &\quad - \text{Household durables} - \text{Interior furnishings} - \text{Bedding}) \\ &\quad + \text{Clothing and footwear} \\ &\quad + \text{Medical care} \\ &\quad + (\text{Transportation and communication} \\ &\quad - \text{Purchase of vehicles and bicycles}) \\ &\quad + \text{Education} \\ &\quad + (\text{Culture and recreation} - \text{Recreational durable goods}) \\ &\quad + \text{Other consumption expenditure} \\ &\quad - \text{Transfers to outside the household}\end{aligned}$$

### A.2 Household balance sheet

$$\begin{aligned}\text{Total change in net worth } [d(\text{NetWorth})] &= \text{Change in net financial assets } [d(\text{Asset})] \\ &\quad - \text{Change in net financial debt } [d(\text{Debt})] \\ &\quad + \text{Change in real assets } [d(\text{RealAsset})]\end{aligned}$$

$$\begin{aligned}\text{Change in net assets } d(\text{Asset}) &= (\text{Savings deposit} - \text{Savings withdrawal}) \\ &\quad + (\text{Insurance premium payments} - \text{Insurance proceeds}) \\ &\quad + (\text{Purchase of securities} - \text{Selling of securities})\end{aligned}$$

**Change in net debt**  $d(Debt)$

= (Increase in debt for houses and land – Payment of debt for houses and land)

+ (Purchase with installment credit – Payment of installment credit )

+ (Increase in other debt – Payment of other debt)

**Change in real assets**  $d(RealAsset) =$

Real properties purchased – Real properties sold