The Time Trend and Life-cycle Profiles of Consumption*

Sagiri Kitao*† University of Tokyo

Tomoaki Yamada‡ Meiji University

April 10, 2024

Abstract

This paper analyzes the time trend of household consumption in Japan between 1981 and 2020, using microdata from the Family Income and Expenditure Survey (FIES). We examine how the trends in the levels, shares, and growth of consumption vary across categories of consumption, items and age groups, and assess changes in consumption inequality over time. Our analysis shows that consumption inequality mildly increased, driven primarily by the trend of service consumption and a shift in the age distribution. Additionally, we estimate the life-cycle profiles of consumption and find that the age component of total consumption follows a standard hump-shaped pattern, but varies significantly across goods and service categories and item groups. Finally, using the estimated age profiles of different consumption items, we project how aggregate consumption and its composition may evolve as Japan's population ages in the coming decades.

Keywords: Consumption, Life-cycle Profiles, Inequality, Non-durable goods, Durable goods, Service, Demographic Aging.

JEL Classification: D12, D30, E21

---

*This study is conducted as a part of the Project "Macroeconomic and social security policies under demographic aging: dynamics of firms, individuals and inequality" undertaken at the Research Institute of Economy, Trade and Industry (RIETI). The Statistics Bureau of Japan provided us with the microdata from the Family Income and Expenditure Survey (FIES). We are grateful to the editor and two anonymous referees, Tomoko Hayashi, Hirokazu Ishise, Keiichiro Kobayashi, Masato Mizuno, Masayuki Morikawa, Kentaro Nakajima, Daigo Nakata, Michio Suzuki, Shujiro Urata and seminar participants for useful comments. Ryohei Koganemaru provided excellent research assistance. Yamada gratefully acknowledges financial supports from the Grant-in-Aid for Scientific Research(C) 21K01404 and Fostering Joint International Research (A) 18KK0368, and Kitao from the International Leading Research 22K21341. The views expressed in this paper are those of the authors and do not represent those of the institution the authors are affiliated with.

†Graduate School of Economics, The University of Tokyo. E-mail: sagiri.kitao@gmail.com (corresponding author)

‡School of Commerce, Meiji University. E-mail: tyamada@meiji.ac.jp.

1 Introduction

Understanding inequality is crucial in discussions about economic policies, including areas such as income taxation, social security, and various subsidies and transfers. While considerable attention has been directed towards the origins and evolution of income and wealth inequality, relatively less focus has been placed on the inequality in consumption expenditures. Nevertheless, consumption is ultimately more relevant to the economic well-being and quality of life experienced by households.

A typical life-cycle model of households exhibits a 'hump-shape' with varying levels of consumption across age groups. Consumption initially increases with rising earnings, and then declines as households approach retirement age and near the end of the life-cycle. However, this profile conceals significant heterogeneity in consumption bundles across households of different ages, as well as inequality in both total and specific items of consumption among households.

Some households, perhaps older ones, may allocate a considerable portion of total expenditures to medical and health-related items, while others might spend extensively on their children's education. The profile of certain goods and services may follow a hump-shaped path, while other items may exhibit monotonically increasing or decreasing profiles. Understanding the trend of aggregate consumption and the drivers of changing cross-sectional inequality, as well as predicting the future trajectories of these patterns, requires a detailed analysis of consumption expenditures over time and across heterogeneous groups of households using microdata. We aim to address these issues in this paper.

More precisely, this study poses the following questions: How have the consumption level and inequality evolved over time? Do they differ across consumption categories and items? How different is the pattern of consumption among the young, middle-aged, and the old, and how does consumption inequality vary with age? What are the implications of ongoing demographic aging for the future path of aggregate consumption and the composition of the consumption items?

We take data from Japan, a country currently undergoing the most rapid demographic aging among developed nations, to address these questions. Utilizing microdata from the Family Income and Expenditure Survey (FIES), we examine the time trends of consumption, both in aggregate and segmented by age groups, broad categories of durable and non-durable goods, services, and more detailed item groups. Employing the method of Aguiar and Hurst (2013), we estimate a model to extract age components of consumption data, extending this analysis to disaggregated components of consumption.

Our study also examines how consumption inequality evolves over the life-cycle across various goods and services, collectively contributing to overall inequality among households. In contrast to Aguiar and Hurst (2013), who focus on nondurable consumption and its disaggregated components across ages, we examine the time trends and life-cycle patterns of all categories and items of household consumption. Additionally, we conduct detailed analysis of inequality in consumption of these items across households.

We find that average household consumption increased from the early 1980s to the early 1990s, followed by a decline thereafter, forming an inverted v-shaped pattern. This

trend is primarily driven by the movement of services and non-durable goods during the same period. Conversely, the average consumption of durable goods showed a non-monotone movement and increased mildly between the early 1980s and 2020. The time trend exhibits even greater heterogeneity across various types of goods and services. For instance, the average consumption of items such as medical care and transportation & communication showed continuous growth throughout the sample period, while other items such as food and clothing & footwear continued to decline.

The decline in average consumption is also attributed to changes in household size and the shift of age distribution. When household expenditures are adjusted using an equivalence scale, the decline is less pronounced after the 1990s. Consumption levels are the highest among middle-aged households and lowest among the elderly. The combination of increased longevity and low fertility over an extended period results in a higher proportion of the elderly in the population, contributing to the decline in average household consumption.

The estimated life-cycle profile of total consumption is hump-shaped, as commonly observed in empirical studies. However, this shape varies across consumption categories and specific items. The average household consumption of non-durable goods sharply rises until their early 40s and then remains in a narrow range thereafter, with a mild decline after their late 60s. Spending on durable goods follows a hump-shaped pattern, increasing until around age 50 and declining thereafter. Service consumption remains stable until their 50s and then declines rapidly. The hump-shaped profile of total consumption profile consists of the profiles of three consumption categories, which significantly differ from each other.

Some consumption items, such as medical care and fuel, light & water, continue to increase throughout the life-cycle. However other items, such as clothing & footwear, declines throughout. Food consumption exhibits a hump-shaped pattern, but while food at home gradually and slightly declines, food away from home starts to fall sharply at around age 40.

Inequality in consumption across households, measured in terms of the variance of residuals from the estimation, increases from their 30s to 60s and shows only a small change after age 60. Similar to the average levels of consumption, the age profile of inequality varies across consumption categories and items. Inequality in food and fuel, light & water charges remains low and barely changes over the life-cycle, while the profiles of other items fluctuate more.

Finally, we conduct simple projections of aggregate consumption over the next three decades, relying on demographic projections and age components of consumption estimated from the FIES data. The total population in Japan is expected to decline rapidly for coming decades due to a persistently low fertility rates and a rise in the number of deaths among baby-boomers born in the late 1940s. Our analysis indicates that the aggregate consumption will decline even faster, driven by a decrease in average per-capita consumption, resulting from changes in age distribution and the composition of consumption items.

We anticipate a decline in the shares of durable goods and services over the coming decades, while that of non-durable goods is expected to rise. This is attributed to

the relatively higher shares of items such as food at home, and fuel, light & water charges among middle-aged and old households compared to young households. While this exercise underscores the importance of considering heterogeneity in consumption bundles, there are limitations in this simple analysis. We discuss possible extensions of the analysis using a structural model before we conclude.

2 Related Literature

Standard single-good life-cycle models of optimizing households typically generate a hump-shaped consumption profile, aligning with life-cycle consumption profiles estimated using microdata.[1] More recent works that analyze microdata have revealed that life-cycle profiles of consumption vary across different types of expenditures, such as durable vs non-durable consumption (Ferńandez-Villaverde and Krueger, 2011), and work-related items vs others (Aguiar and Hurst, 2013). These profiles also vary according to family size and household composition (Ferńandez-Villaverde and Krueger, 2007), as well as health shocks and wealth levels (Blundell et al., 2024) among other factors.

It is also well-known that inequality in consumption does not remain constant over the life-cycle, as documented by Storesletten et al. (2004), for example. Krueger and Perri (2006) find that consumption inequality increases with age, but to a lesser degree than income inequality. Aguiar and Hurst (2013) demonstrate heterogeneity in life-cycle consumption inequality across different commodities. Hubmer (2023) finds that high-income households spend relatively more on labor-intensive commodities than low-income households, leading to a shift in the aggregate labor share with income inequality. Straub (2019) uses the PSID data to estimate the elasticity of consumption to permanent income and shows that a model with non-homothetic preferences, implying a higher saving rate for richer households, predicts the empirical pattern well.

There are papers that explore the time trend of consumption inequality using various sources of microdata, such as Aguiar and Bils (2015), Heathcote et al. (2010), and Krueger and Perri (2006). The time path of inequality varies for various reasons, but most studies find that inequality either remained mostly unchanged or increased over the last few decades.[2] Attanasio and Pistaferri (2014) provide a comprehensive survey of consumption data and various issues associated with the analysis of consumption inequality using expenditure data.

There is also a large literature investigating consumption dynamics along the business cycle. Attanasio et al. (2022) use the CEX data for the spending on cars during the Great Recession, as an example of large durable goods that generate heterogeneous

[1] See, for example, Deaton and Paxson (1994), Attanasio and Browning (1995), Attanasio et al. (1999), Gourinchas and Parker (2002), Ferńandez-Villaverde and Krueger (2007), Hansen and İmrohoroğlu (2008))

[2] Differences in the outcome of the analysis of consumption inequality arise from reasons such as the use of different microdata sources, alternative definitions of consumption (measuring expenditures or quantities of consumption, or subtracting saving from income), items to include in the definition (non-durable and durable goods and service), and methods of correcting measurement errors. See Meyer and Sullivan (2023) for alternative methods to account for measurement errors in consumption data.

consumption responses across households. They estimate a rich life-cycle model with endogenous durable goods purchases in both intensive and extensive margins. Berger and Vavra (2015) use PSID microdata to find muted responses in durable goods purchases during recessions. They estimate a general equilibrium model of incomplete markets to assess effects of stimulus policies.[3]

Turning our attention to Japan, an early study by Ohtake and Saito (1998) uses the National Survey on Family Income and Expenditure (NSFIE) to assess the trend of consumption inequality since the 1980s. They demonstrate that the aging of the baby-boom cohort drove a rise in inequality in the 1980s as they approached their 40s, when expenditure level is high and inequality starts to increase. Another study by Lise et al. (2014) uses the NSFIE and the Family Income and Expenditure Survey (FIES) to evaluate the trend of consumption inequality, along with those of wage and income. They find that the inequality of consumption mirrored that of income between 1981 and 2008. Additionally, they show that in the life-cycle dimension, consumption inequality does not increase as much with age as income does.

Cashin and Unayama (2021) analyze households' response to a rise in consumption taxes using the FIES expenditure data before and after the 1997 VAT rate increase. Hausman et al. (2019) study effects of low interest rate policy under "Abenomics," with a focus on consumption differences between homeowners and renters. Using the FIES data, Higa (2019) estimates the trend of consumption inequality and examines sensitivity to the treatment of measurement errors in the survey. Kubota (2020) investigates effects of income shocks on consumption using the Japanese Panel Survey of Consumers (JPSC) data.

3 Data: Family Income and Expenditure Survey (FIES)

3.1 Overview

This study uses microdata of the Family Income and Expenditure Survey (FIES), collected by the Statistics Bureau of the Ministry of Internal Affairs and Communications. The FIES is a monthly survey that has been conducted since 1981, and we use the data spanning from 1981 to 2020.[4] The household survey is a reliable source of statistical forming the basis of Japanese economic statistics. It is also instrumental in estimating aggregate private consumption in the System of National Accounts (SNA) statistics and compiling the consumer price index.[5]

[3]See also Kaplan et al. (2020) who build a life-cycle model to study housing boom and bust during the Great Depression and emphasize the roles of wealth in accounting for the consumption elasticity, as also emphasized by Mian et al. (2013).

[4]We draw on material in Kitao and Yamada (2024) for some of the results with the FIES.

[5]Other officially collected microdata sources of household consumption in Japan include the National Survey of Family Income and Expenditure (NSFIE), Comprehensive Survey of Living Conditions (CSLC), and Annual Report on the Survey of Household Economy (ARSHE). See Unayama (2015) (in

The FIES covers two-or-more person households throughout the sample periods, and single-person households have been included since January 2002. Members of two-or-more households do not necessarily include a married couple. The samples include households headed by single-mothers and fathers, as well as singles living with their parent(s).

The FIES compiles monthly data on household expenditures as well as labor and other income data. Since January 2002, the survey has also collected data on savings and debt. The FIES requires each household to fill out a household account book (*kakeibo*), which distinguishes it from other surveys on consumption that rely on memory recall. The survey collects detailed item-by-item expenditure data.

The household survey is panel data, providing up to six months of responses for each household. Being a rotating panel, approximately one-sixth of the sample is replaced each month. However, due to some households dropping out within six months, the data becomes unbalanced. During the first survey month, each household reports basic attributes such as family structure and housing information. Annual income for the previous year is reported only once, with households providing information on total annual income without details about its composition.[6]

3.2 Sample Selection and Household Characteristics

We use monthly consumption data of 7,000-8,000 households with two or more members, collected each month between 1981 and 2020. Figure 1 provides a basic description of the data over the sample period.

As depicted in Figure 1a, the sample size in each year falls within the range of 90,000-96,000. Figure 1b illustrates the average age of household heads in our sample each year, steadily increasing from around 45 in 1981 to nearly 60 in 2020. The average size of households continued to decline from above 3.8 in 1981 to below 3.0 by the late 2010s, as indicated in Figure 1c. This decline is primarily driven by a decrease in the number of children aged 16 and below in households, as shown in Figure 1d.

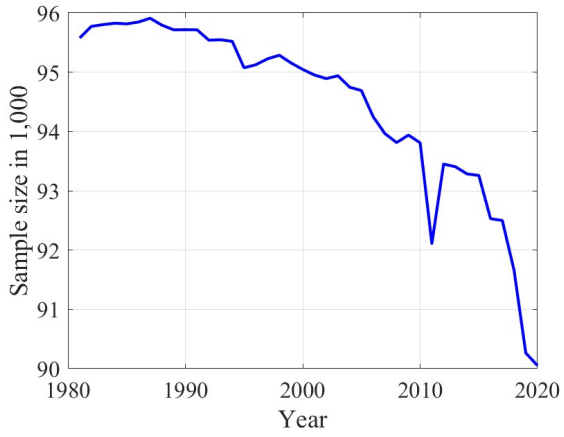
Figure 1e indicates that the share of married households in our sample is approximately 90% and has been declining since the 1980s.[7] The share of households aged 25-59 in which both a husband and a wife work has increased from around 45% to above 55%,

Japanese) for more details about these surveys and comprehensive comparison across them. Unayama (2015) shows that the total consumption level of the FIES is in line with those of the NSFIE and CSLC, but lower than that of ARSHE. Stephens and Unayama (2012) point out the possibility that the samples of the FIES underreport the expenditures due to the "survey fatigue" from the multiple reporting requirements during the six-month survey period and Unayama (2015) argues that the FIES samples underreport expenditures of high-cost items compared to the ARSHE samples and this is likely due to the different survey methods (a household account book of the FIES vs the pre-code method of the ARSHE).

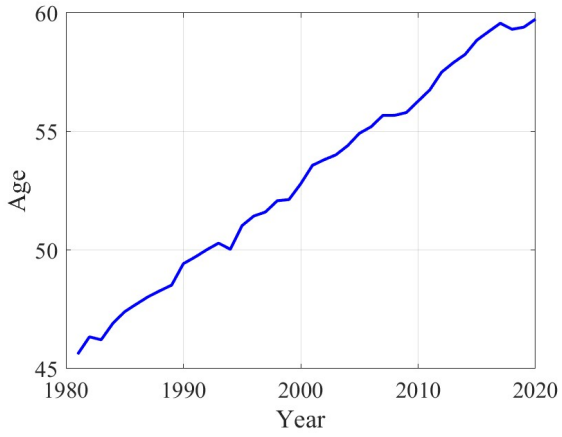
[6] In addition to the annual income, each household reports its monthly income. For monthly income, they report labor income and more details about other sources of income such as property income, rental income, private transfers such as remittances, and public transfers such as social security benefits.

[7] Figures 1e and 1f begin in 1987, as a variable that indicates the relationship of household members is available only after that year.

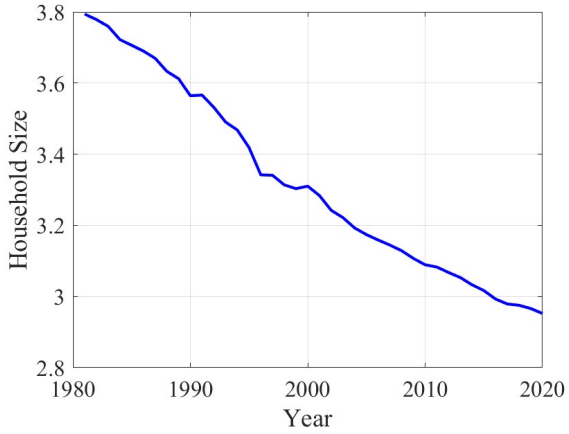
as shown in Figure 1f.



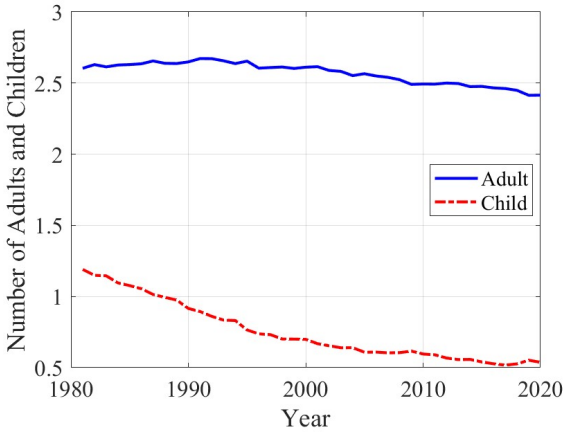
(a) Sample Size (in 1,000)



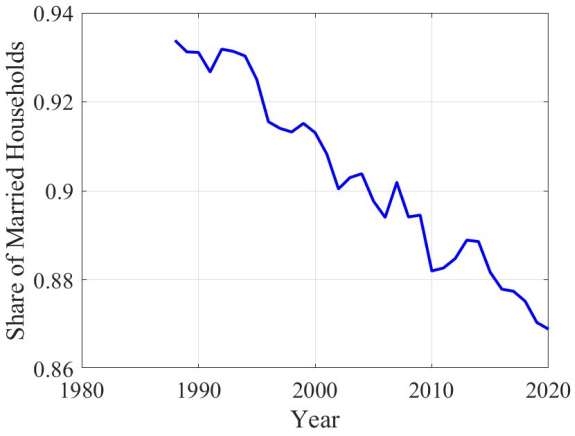
(b) Age of Household Heads



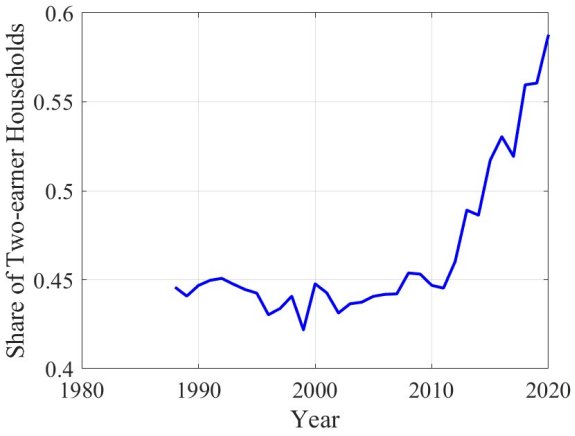
(c) Size of Households



(d) Number of Adults and Children



(e) Share of Married Households



(f) Share of Two-earner Households

Figure 1: Sample Description

Figure 2 shows the average sample size by the age of household head, averaged over 1981-2020 period. Our sample comprises households with two or more members, and there are fewer households aged 20s and early 30s. The sample size decreases beyond the age of 70.

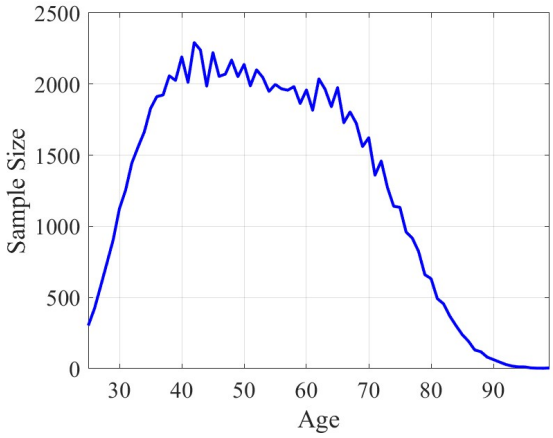


Figure 2: Sample Size by Age (Averaged over 1981-2020)

3.3 Consumption Data and Classifications

Our main analysis is based on the monthly consumption expenditure data of the FIES.[8] The FIES classifies consumption expenditures into four categories of goods and services. Goods are classified into three categories; non-durable goods, full-durable goods and semi-durable goods.[9] According to the definition, non-durable goods are the goods whose expected life is less than one year and full-durable and semi-durable goods are expected to last for one year or longer. Full-durable goods are "relatively expensive" and semi-durable goods are not as expensive.

In our analysis, we combine full and semi-durable goods into one group as durable goods, and classify all consumption expenditures into three categories: (1) durable goods, (2) non-durable goods, and (3) services. Table 1 shows items included in each category. For more details of the classification, see Appendix A.

Nominal expenditures are deflated by the 2020-based monthly consumer price index (CPI), comprehensive index of all items, including fresh food and energy. Consumption expenditures of specific categories and items are deflated with corresponding price index for each category and item. Note that there are two expenditure items, pocket money without detailed description of the usage, and remittances, which are not classified to one of the four categories. We exclude these two items from the analysis as it is not clear what items are purchased, or if they were in fact spent to purchase goods or services.

[8]Note that we focus on consumption expenditure data of a given month and this is not necessarily the month in which the goods or services are consumed.

[9]In the FIES classification, this "full-durable" category is simply called "durable," but we add "full" to distinguish it from our own classification of durable goods, which include both durable and semi-durable goods according to the FIES definition.

Table 1: Consumption Categories

Category and Items
Durable Goods
Full-Durable goods
· Household durable goods, furnishing & decorations, bedding
· Medical supplies & appliances
· Purchase of vehicles and bicycles
· Recreation durable goods
Semi-Durable Goods
· Tools for repair & maintenance
· Domestic utensils
· Clothing & footwear items
· Maintenance of vehicles
· Recreational goods
· Personal care goods, personal effects
Non-Durable Goods
· General food items
· Fuel, light & water charges
· Domestic non-durable goods
· Medicines, health fortification
· School textbooks, books
· Tobacco, other miscellaneous
Services
· Eating out, school lunch
· Rents, repairs & maintenance
· Domestic services
· Services related to clothing
· Medical services
· Public transportation & communication
· School fees, tutorial fees, recreational services
· Personal care services, social expenses
Uncategorized
· Pocket money (with no details), remittance

3.4 Adult Equivalence Scale

The average household size has changed significantly between 1981 and 2020. Therefore, we compute both the simple household expenditure data and equivalized data to account for the different family size of each household. We use the OECD Equivalent Scale to calculate equivalent consumption and income statistics. The OECD Equivalent Scale adjusts for the number of family members with the first adult as 1, each of the second

and subsequent adults as 0.7, and children under 16 as 0.5. For example, a family with a married couple and one child each in junior high school and elementary school would be 1 + 0.7 + 0.5 + 0.5 for 2.7 and household consumption data is divided by 2.7 to obtain the equivalent consumption. The same calculation is used for income data.

Ferńandez-Villaverde and Krueger (2007) point out that the pattern of consumption expenditures over the life cycle varies by the scale used for equivalence adjustment. For example, the OECD-modified equivalent scale uses an adjustment of 0.5 and 0.3 for the second and subsequent adults and children under 16, rather than 0.7 and 0.5, respectively. Another frequent adjustment method is to take the square root of the number of family members. Deaton and Paxson (1994) calculate adult equivalence by leaving the number of adults aged 17 and older unchanged and adding 0.5 for those aged 16 and younger. See Kaplan (2012) for more discussions about the impact of various equivalence scales. Appendix A contains more discussion on alternative methods to equivalize household consumption.

4 Time Trends of Consumption

In this section, we examine the time trends of consumption between 1981 and 2020. We will first study the trend of overall consumption and then by major consumption categories, followed by more detailed analyses by item groups and household age groups. We also discuss the trends of consumption inequality across households and the time paths of household income and income inequality. As explained in section 3.3, consumption expenditures are deflated by specific price index and expressed in 2020 Japanese yen.

4.1 Consumption Time Series

Figure 3 shows the trend of the average monthly consumption per households. It increases from less than 290,000 yen in 1981 to around 330,000 yen in the early 1990s, and declines thereafter. With the onset of the COVID-19 crisis, there is a visible decline in total consumption in 2020.

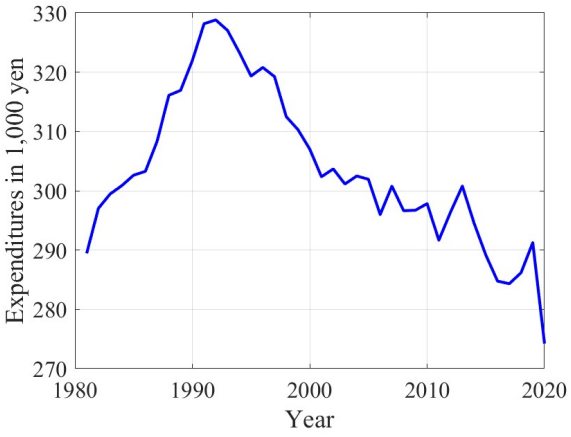
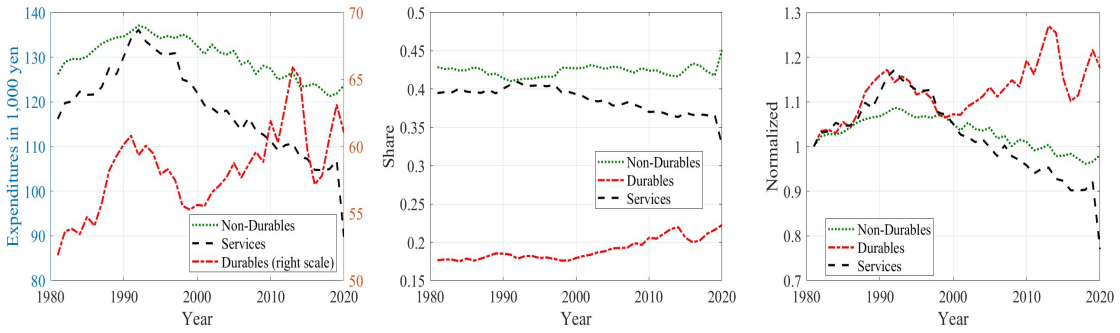


Figure 3: Total Consumption (Household)

The composition of household consumption has undergone significant changes over the last four decades. Figure 4 illustrates the trends of consumption across broad categories of non-durable goods, durable goods and services. Non-durable goods expenditures have shown a mild decline since the early 1990s, but have stayed within a narrow range around 130,000 yen, as shown in Figure 4a. Durable goods expenditures (on the right scale) experienced an increase of about 10,000 yen from 2000 to the early 2010s, and moved at around 60,000 yen in the 2010s. Service expenditures saw a significant surge in the 1980s, but have declined monotonically since then. Consequently, due to these changes in composition, the share of services declined monotonically since the early 1990s, as shown in Figure 4b. Moreover, service consumption experienced a sharp decline in 2020 due to the COVID-19 crisis. The share of non-durable goods initially but stayed in the range of 0.4-0.45 throughout the sample period.



(a) Levels (b) Shares (c) Growth (1981=1)

Figure 4: Consumption by Categories (Household)

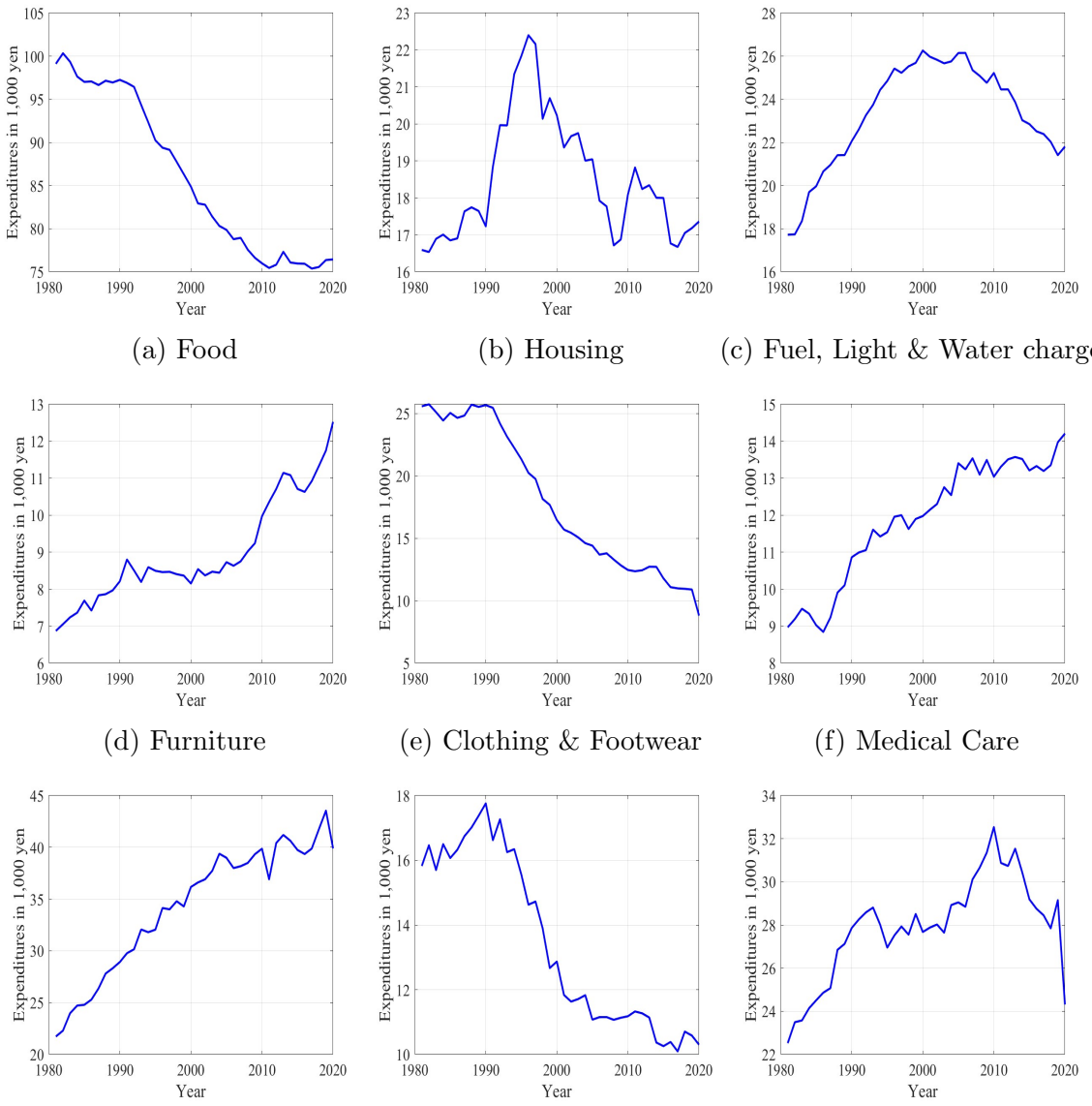
4.2 Trends by Item Groups

In this section, we present the trends of consumption by more detailed item groups, using the categorization of the FIES. Expenditure items are divided into ten groups, (1) food (at home and eating out); (2) housing; (3) fuel, light & water charges; (4) furniture and household utensils; (5) clothing & footwear; (6) medical care; (7) transportation & communication; (8) education; (9) culture and recreation; and (10) others.

Some groups include items that belong to multiple broad categories of service, durable and non-durable goods. For example, food includes grocery items which are classified as non-durable goods, as well as meals outside the home, which belong to the service category.[10]

Figure 5 illustrates the trend of household consumption by item groups. Food, clothing & footwear, and education declined since the early 1990s. Food expenditures saw the largest decrease, with a significant portion of it attributed to the decline in family size. In Appendix C, we show the path of equivalized consumption items, and demonstrate that the decline in food expenditures is more muted with the adjustment for the family size. Expenditures on medical care and transportation & communication continued to increase throughout the sample period. We also examined the consumption trend of each item by age groups (not displayed here) and found that expenditures on transportation and communication increased for all of young (25-44), middle-aged (45-64) and old (65 and above) groups, while medical expenditures rose more sharply for middle-aged and old groups.

[10] See Appendix A for more details about the categorization. In Appendix B, we include imputed rents to the housing item and show how the inclusion affects the paths of housing expenditures and other related statistics.



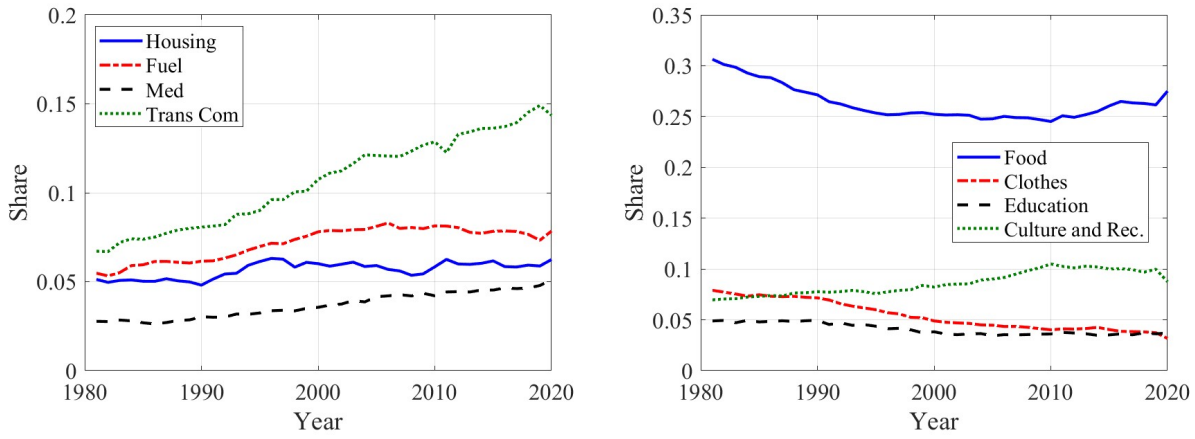
(a) Food (b) Housing (c) Fuel, Light & Water charges

(d) Furniture (e) Clothing & Footwear (f) Medical Care

(g) Transp. & Communication (h) Education (i) Culture and Recreation

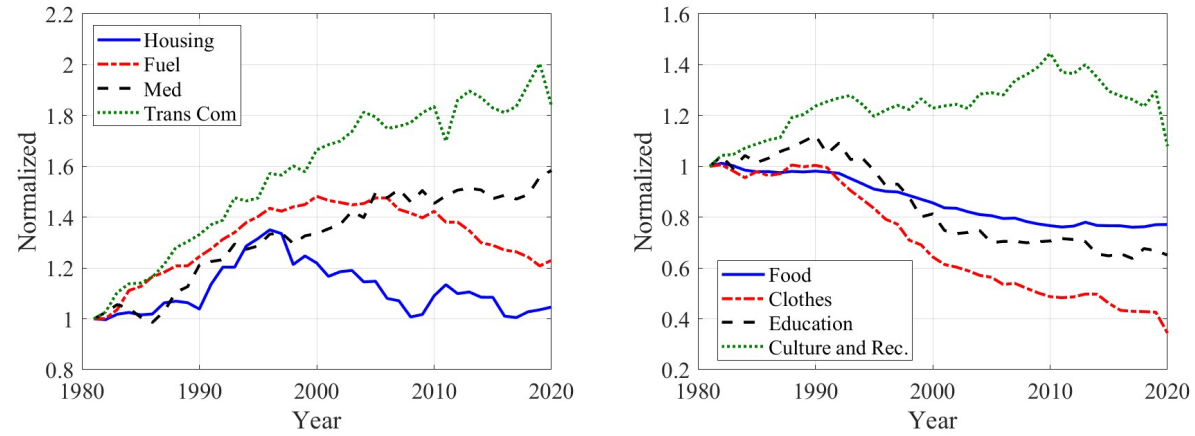
Figure 5: Consumption by Item Groups (Household)

Figure 6 shows the trends in the shares of consumption items as a percentage of total consumption. Food holds the largest share at about one-quarter. Items such as transportation & communication, and medical care show a steady increase in their shares. In Figure 7, we illustrate the growth in the consumption level relative to the level of each item in the initial year of 1981.



(a) Group (1) (b) Group (2)

Figure 6: Consumption Shares by Item Groups (Household)



(a) Group (1) (b) Group (2)

Figure 7: Consumption Growth by Item Groups (Household, 1981=1)

4.3 Trends of Equivalized Consumption

Figure 8 shows the path of the equivalized total consumption, where the household consumption is adjusted by the OECD equivalence scale. There is no sharp decline in consumption after 1990, as was seen in Figure 3, implying that a part of the decline there was associated with a drop in the household size. In Appendix C, we show the path of consumption equivalized by different methods other than the OECD equivalence scale, as well as that of a married couples without children.

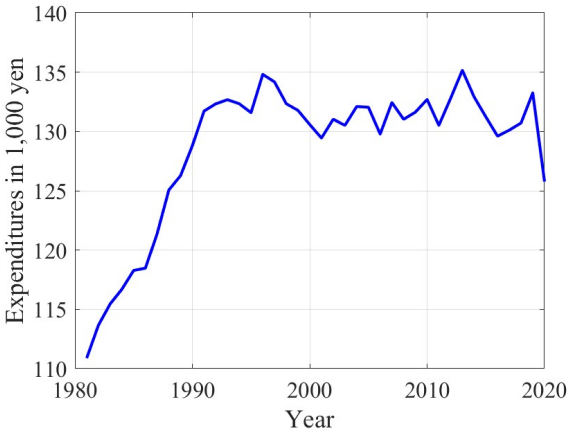


Figure 8: Total Consumption (Equivalized)

Figure 9 shows the paths of equivalized consumption by broad categories. Similar to the overall consumption trend, the change over the last three decades since 1990 is milder compared to the household consumption paths. Non-durable goods consumption increases monotonically, indicating that much of the decline in household non-durable consumption was due to a shift in family size. Service consumption, on the other hand, has been declining since the mid-1990s.

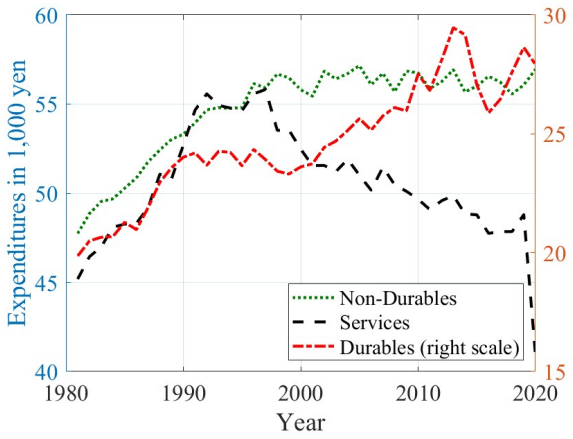


Figure 9: Consumption by Categories (Equivalized)

4.4 Trends by Age Groups

In this section, we examine consumption trends by age groups, dividing households into three groups based on the age of the household head: 25-44, 45-64, and 65 and above. Figure 10 shows the path of average total consumption for these three age groups. Middle-aged households spend the most, while elderly households aged 65 and above spend the least. Consumption levels rose in the 1980s and the early 1990s for all age

groups, declining thereafter for the young and middle-aged households but remaining flat for the old age group.

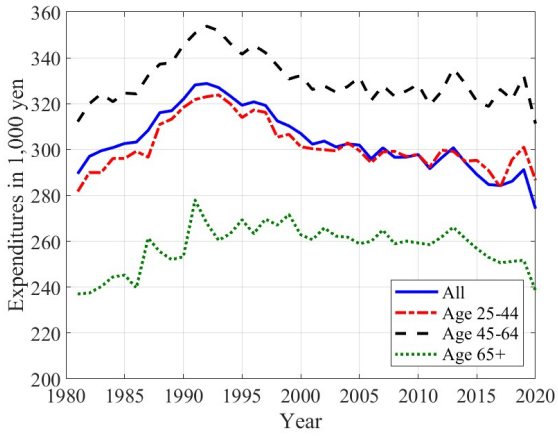
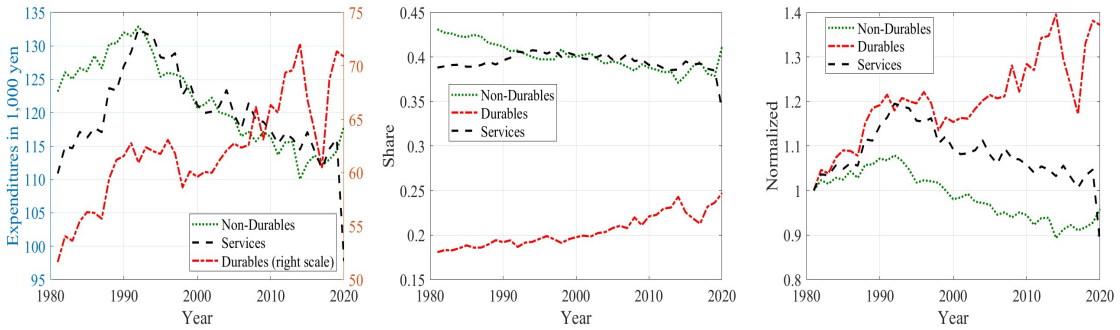


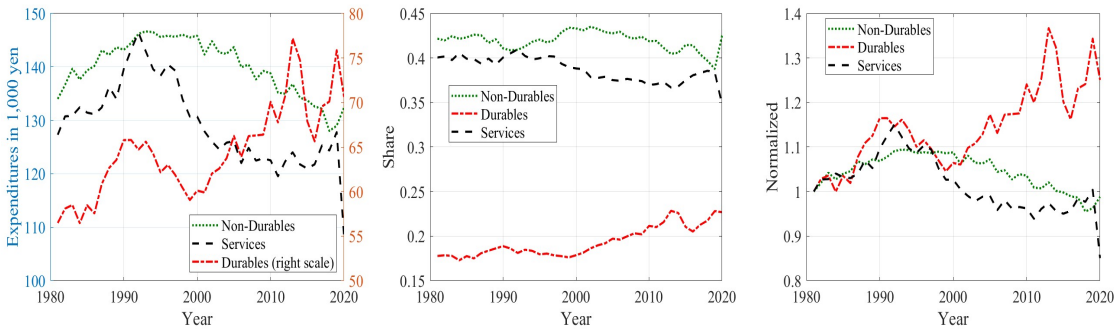
Figure 10: Total Consumption by Age Groups (Household)

Figures 11, 12, and 13 show the consumption trend by the three broad categories for each age group. The share of durable goods increased for all groups. The share of services for young households remained flat at around 40% except for 2020, when the share declined sharply due to the COVID-19 crisis. The share of services for middle-aged and old households decreased since the mid 1990s.



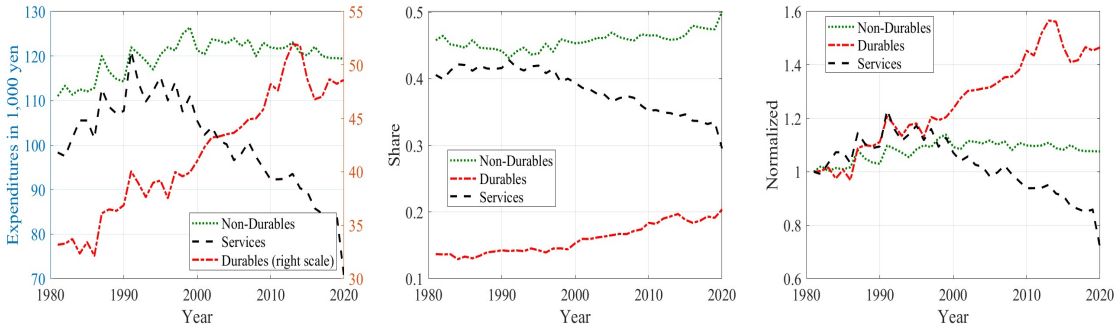
(a) Levels (b) Shares (c) Growth (1981=1)

Figure 11: Consumption by Age Group (1) 25-44 (Households)



(a) Levels (b) Shares (c) Growth (1981=1)

Figure 12: Consumption by Age Group (2) 45-64 (Households)



(a) Levels (b) Shares (c) Growth (1981=1)

Figure 13: Consumption by Age Group (3) 65 and above (Households)

Age Effects on Average Consumption: Over the sample period, the demographic structure underwent significant changes in Japan, with the share of the elderly rising while the share of the young decreased. This shift is shown in Figure 14, computed based on the weight distribution of our samples.

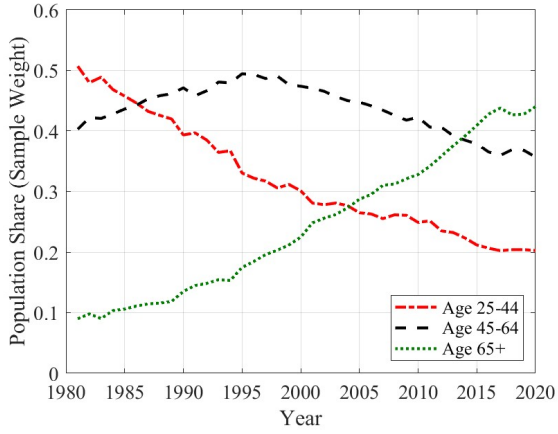


Figure 14: Distribution of Age Groups (Sample Weight)

As the pattern of consumption differs across age groups, the demographic transition would impact the time trend of average consumption and its composition. Figure 15 compares the path of average consumption in the baseline to the path in a hypothetical scenario where the distribution of age groups is exogenously fixed to the distribution of the initial year, 1981. Total consumption would be higher under the fixed age distribution, and the divergence from the baseline widens from the 2000s, when the shares of not only the young but also middle-aged households, who consume the most, start to decline in the baseline.

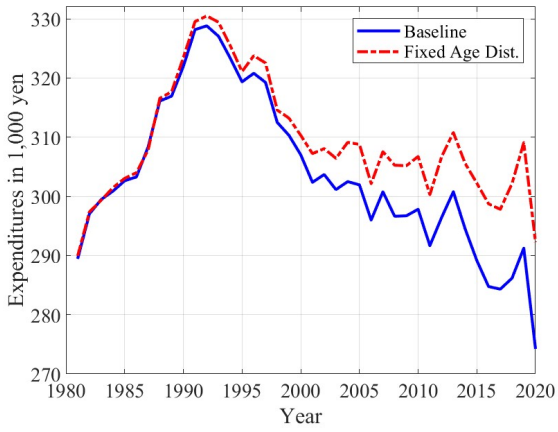
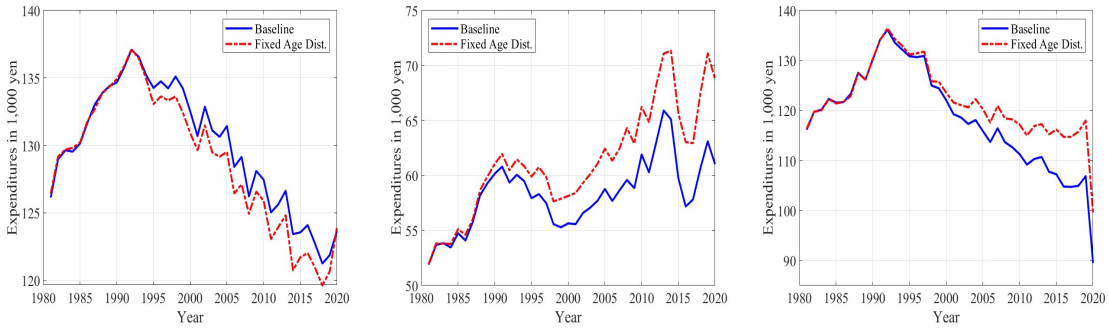


Figure 15: Total Consumption (Fixed Age Distribution)

The disparity between the baseline and the hypothetical scenario also varies across consumption categories, as illustrated in Figure 16. Since elderly households tend to spend relatively more on non-durable goods, total non-durable consumption would be lower under the hypothetical scenario, as shown in Figure 16a.



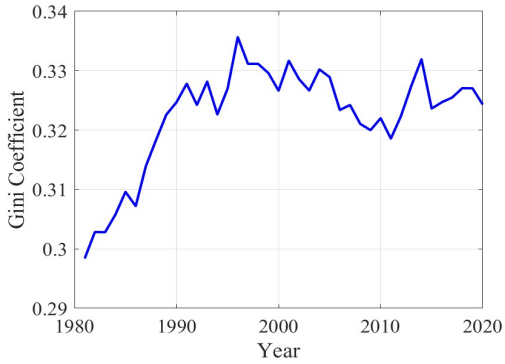
(a) Non-Durable (b) Durable (c) Service

Figure 16: Consumption by Categories (Fixed Age Distribution)

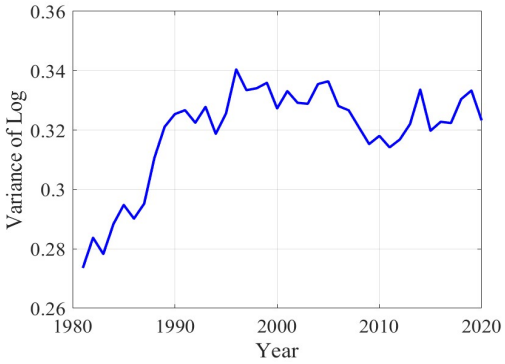
4.5 Trends of Inequality

Figure 17 shows the trends of four indicators of inequality in consumption: Gini coefficient, variance of log, and ratios of consumption at the 90th and 50th percentiles, and the 50th and 10th percentiles. Both the Gini coefficient and variance of log increased from the early 1980s to the late 1990s and stabilized thereafter. The rise in these indices occurred when both the ratio of consumption at the 90th percentile to median and the ratio of median to the 10th percentile increased in the 1980s.[11]

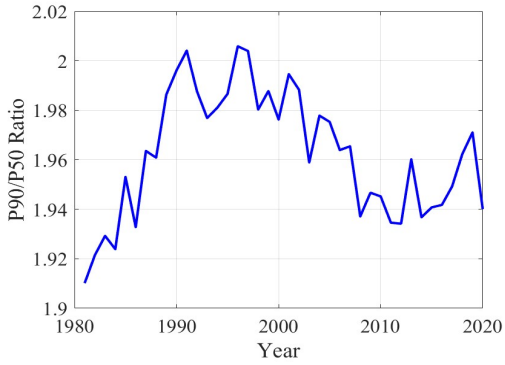
[11] In Appendix C, we compute inequality statistics after controlling for month effects by regressing the consumption data on monthly dummies and removing the effects. Profiles are similar to those in Figure 17.



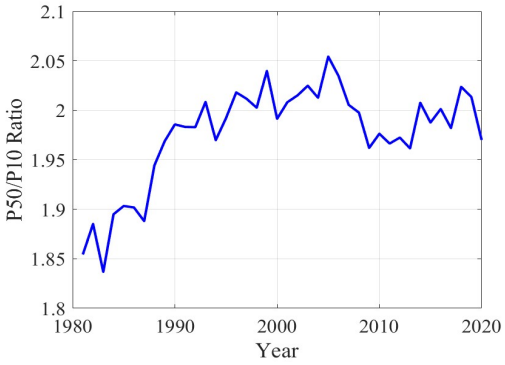
(a) Gini Coefficient



(b) Variance of Log



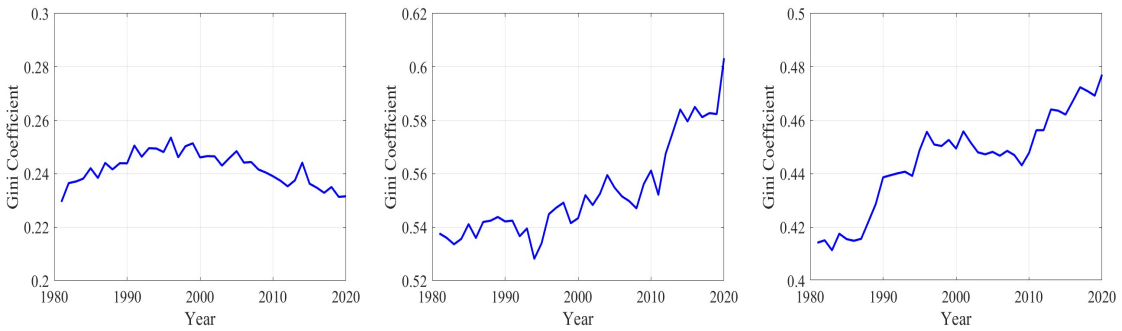
(c) P90/P50 Ratio



(d) P50/P10 Ratio

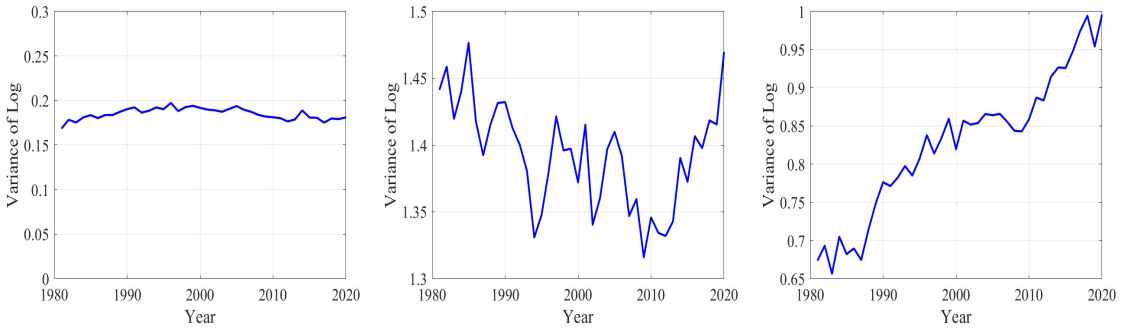
Figure 17: Consumption Inequality: Total Consumption (Households)

Figures 18, 19 and 20 show the trends of the four inequality statistics for the consumption of the three categories. Inequality of non-durable consumption has not changed much over the last four decades. Inequality increased in durable goods and service consumption in different time periods. While durable goods inequality rose after the 2000s, service consumption inequality rose continuously, driven by a rise in the disparity between the consumption at the median and the lower percentiles.



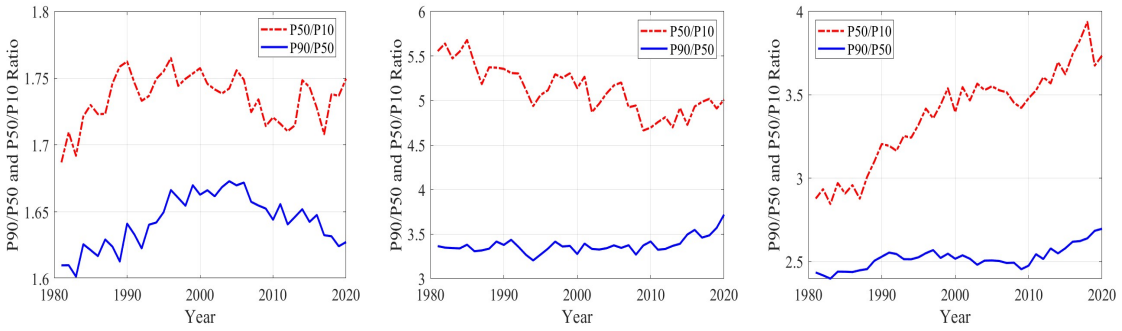
(a) Non-Durable (b) Durable (c) Services

Figure 18: Gini Coefficients by Consumption Category (Households)



(a) Non-Durable (b) Durable (c) Services

Figure 19: Variance of Log by Consumption Category (Households)



(a) Non-Durable (b) Durable (c) Services

Figure 20: P90/P50 and P50/P10 Ratios by Consumption Category (Households)

4.6 Income Trend

The FIES contains two types of income data. The first is the annual gross income of households, which is reported once a year for the entire household. The second is monthly income, comprising labor income (the sum of wages, salaries, and piecework income), gross income before taxation (including labor income, asset income, and private transfers), and disposable income (encompassing gross income before taxation plus social security, net of taxes and social insurance premiums).

On the one hand, while annual income data is available for most households, it lacks information about income sources and breakdowns. On the other hand, monthly income data offers more details, but has limitations in coverage, being available only for households with employed heads. Monthly income data is not available for households headed by self-employed individuals or those not in labor force. Additionally, households are followed for only six months, providing an incomplete picture of earnings for the entire year, and the bonus payments are only partially included, if at all. Given these limitations, we focus on and report only the trend and inequality of annual income below. The values of nominal income are deflated using the CPI of all items.

Figures 21 and 22 show the time trends of average annual income and Gini coefficients. Household income increased until the mid-1990s and declined thereafter, a trend confirmed in other studies such as Kitao and Yamada (2019).

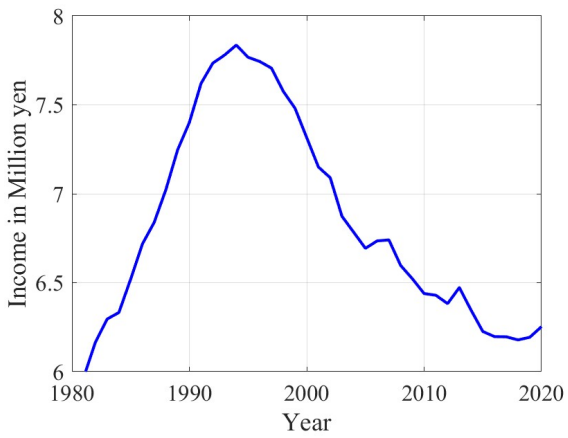


Figure 21: Annual Income (Households)

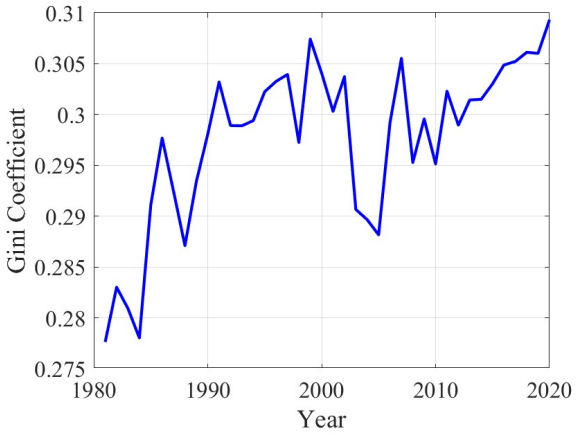


Figure 22: Income Inequality: Gini Coefficient (Households)

5 Estimation of Age Profiles

5.1 Statistical Model

We use the FIES data to estimate the life-cycle consumption profile of households, following the methods of Aguiar and Hurst (2013). For the estimation, we deflate total expenditures by the CPI of all items, and expenditures of different categories and items by corresponding price indexes.

Our sample consists of households headed by individuals aged between 25 and 80, using data from the years 1987 to 2020. The following model is estimated.[12]

$$\ln C_{it}^{k} = \beta_0 + \beta_{\text{age}} D_{it}^{\text{age}} + \beta_c D_{it}^{\text{cohort}} + \beta_t D^{\text{year}} + \beta_m D^{month} + \beta_{\text{fam}} \mathbf{X}_{it} + \epsilon_{it} \qquad (1)$$

where C_{it}^{k} is expenditure of household i in period t on consumption item k, D_{it}^{age} is a vector of age dummies (for ages 25-80), D_{it}^{cohort} is a vector including fourteen five-year birth cohort dummies, D^{year} is a vector of year dummies from 1981 to 2020 and D^{month} is the vector of month dummies. $\mathbf{X}_{it}$ is a vector of family structure dummies that include a gender dummy, a marital status dummy, the number of adult dummies (2-5), and dummies for the number of children by age groups: 0-2, 3-5, 6-13, 14-17, 18-21.[13]

To deal with the multicollinearity problem of including age, year and cohort effects in the estimation, we follow Deaton (1997) and Aguiar and Hurst (2013) and impose the following two restrictions on coefficients on the year dummies: $\sum_{t=1981}^{2020} \beta_t = 0$ and

[12] See Appendix E for more details on the estimation results, including the profiles of consumption expenditures over the life-cycle for different cohorts, and year effects of the estimated model. In the estimation, we use data since 1987 since some of the variables we use in the estimation, including variables to identify the family size and household structure, are not available prior to 1987.

[13] See, for example, Gourinchas and Parker (2002), for alternative specifications to estimate consumption profiles. Ferńandez-Villaverde and Krueger (2007) estimate consumption over the life cycle using semi-nonparametric methods.

$\sum_{t=1981}^{2020} t\beta_t = 0$.[14]

5.2 Age Profiles of Consumption

Figure 23 shows the life-cycle profile of total consumption per household. The figure is based on the age effects of consumption extracted from the estimation; the values of coefficients on age dummies in equation (1).[15]

The profile exhibits a standard hump-shape over the life-cycle, as typically assumed in the literature. The consumption increases by about 20%, from below 150,000 yen at age 25 to the peak of 175,000 yen in the mid-40s. Thereafter, the consumption decreases monotonically to reach about 130,000 yen by age 80.

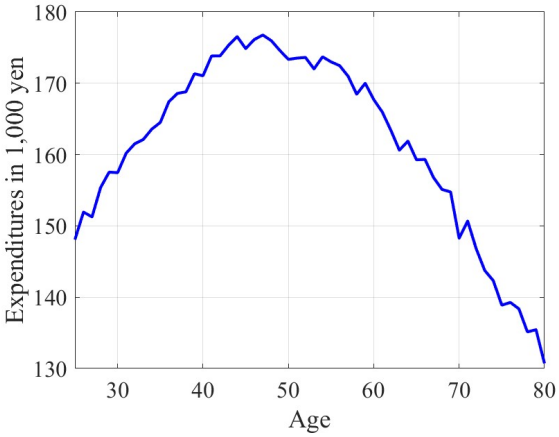
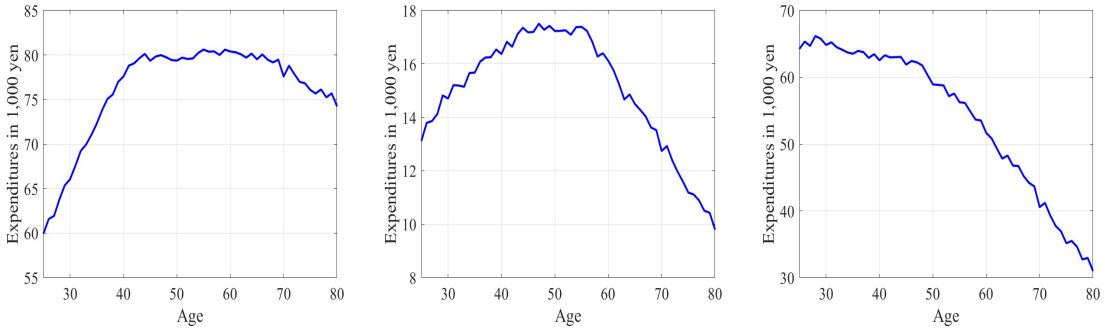


Figure 23: Life-Cycle Profile of Total Consumption

The composition, however, of the total consumption and profiles by consumption categories show different pictures, as depicted in Figure 24. Non-durable consumption increases rapidly from age 25 to their early 40s and remains flat thereafter, with a mild decrease after age 60. Durable expenditures follow a hump-shaped profile, similar to the profile of the total consumption, although the decline begins later in their mid-50s. Service consumption stays within a narrow range until around age 50 and decreases sharply thereafter.

[14] As alternatives, we also estimate models of cohort effects only (without year effects) and year effects only (without cohort effects) and estimated age profiles are similar across alternative specifications. For detailed discussion on the control for cohort effects or for time effects, see Heathcote et al. (2005).

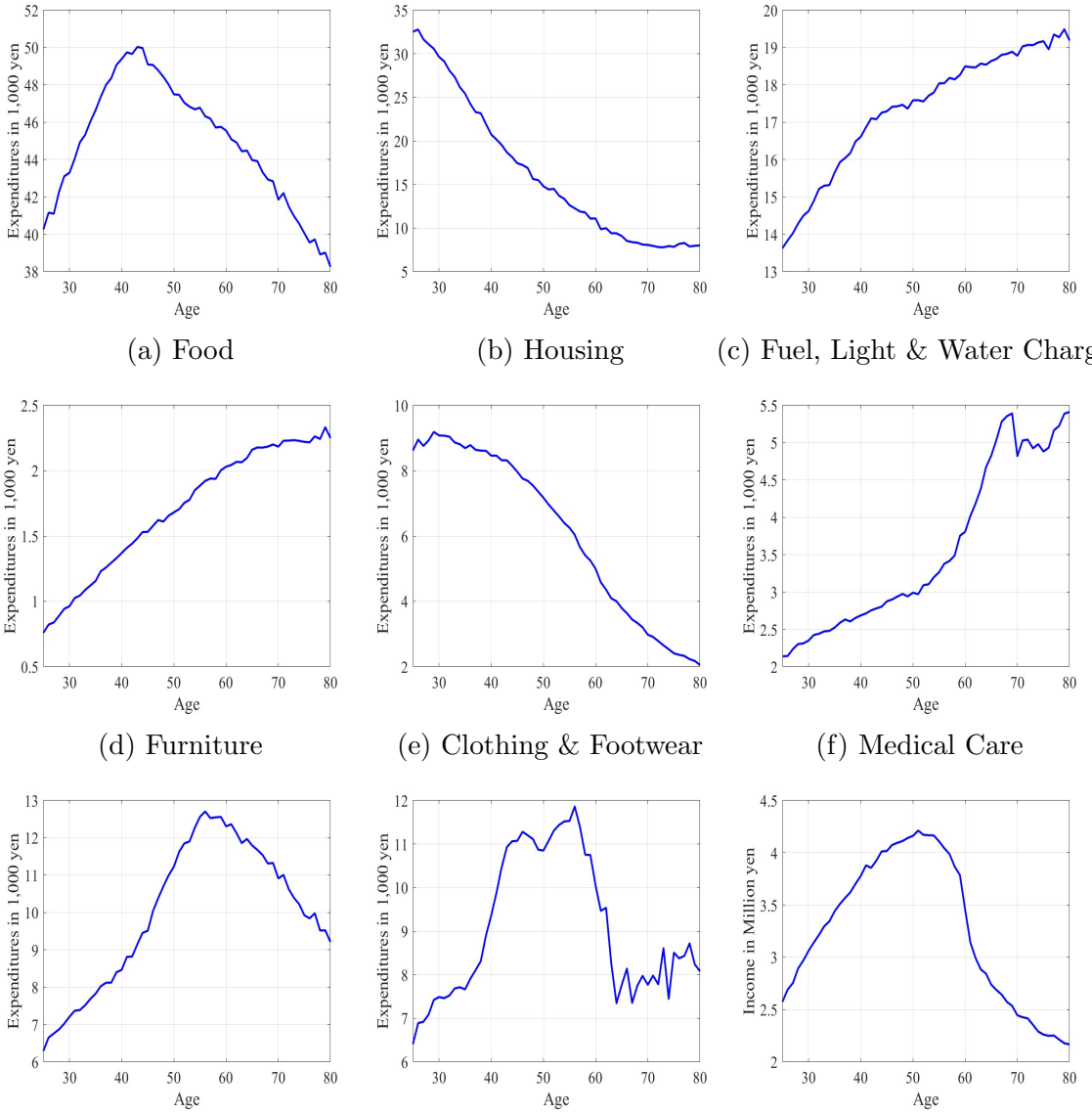
[15] The age profile can also be interpreted as the life-cycle consumption profile of a male head in a household with two or more members.



(a) Non-Durable (b) Durable (c) Services

Figure 24: Life-Cycle Profiles of Consumption by Categories

Figure 25 shows the age-profile of consumption by item groups. The shapes vary across items and only a few items such as food, transportation & communication, and culture and recreation exhibit a hump-shape. Consumption of some items such as housing and clothing & footwear monotonically declines over the life-cycle, and other items such as fuel, light & water charges, furniture, and medical care continue to rise.



(a) Food (b) Housing (c) Fuel, Light & Water Charges

(d) Furniture (e) Clothing & Footwear (f) Medical Care

(g) Transp. & Communication (h) Education (i) Culture and Recreation

Figure 25: Life-cycle Profiles of Consumption by Item Groups

The food category has the largest share and exhibits a hump shape, but the profiles vary with a more detailed decomposition of food items. As shown in Figure 26, the profiles of food at home and eating out both decline after their 40s, but the latter falls much more sharply.

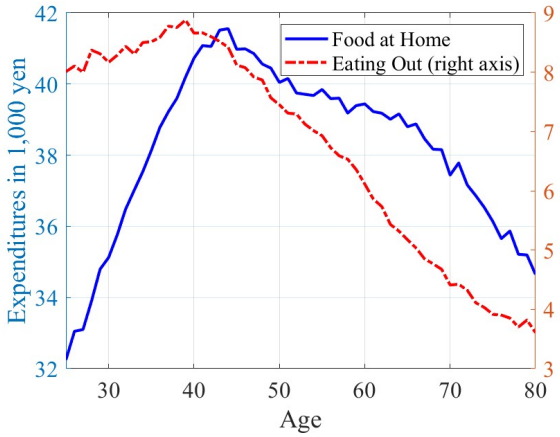


Figure 26: Life-cycle Profiles of Food at Home and Eating Out

To facilitate the comparison of consumption growth across categories and item groups, Figures 27 and 28 show the levels of consumption by category and item relative to the levels at age 25.

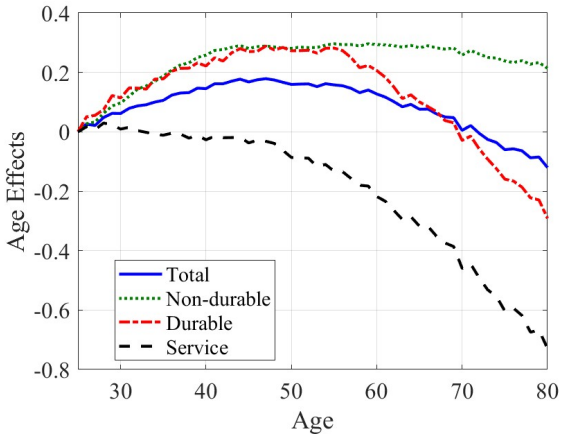
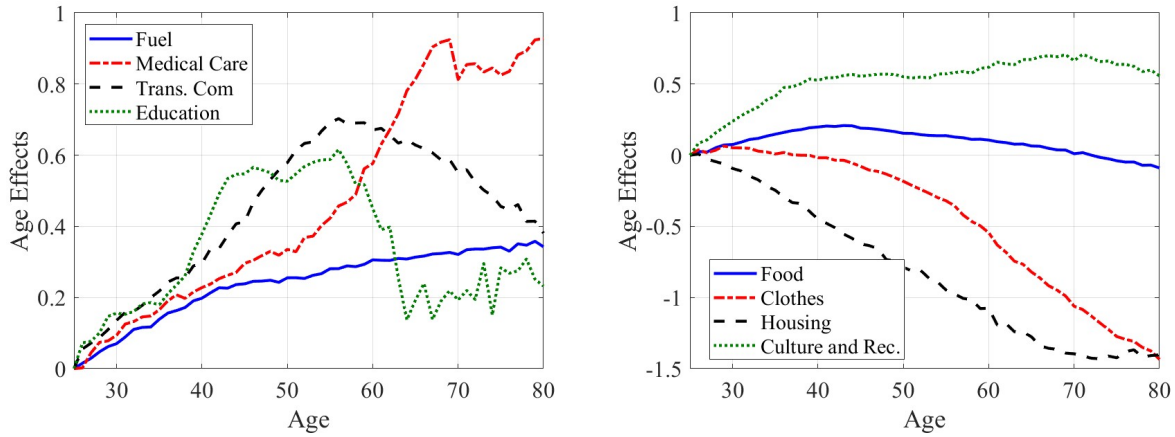


Figure 27: Age Effects of Consumption by Categories



(a) Group (1) (b) Group (2)

Figure 28: Age Effects of Consumption by Item Groups

5.3 Age Profiles of Residual Variance

To assess the age profile of the dispersion of consumption across households, Figure 29 shows the variance of residuals from the regression at each age. The variance declines slightly from the late 20s to the early 30s and increases sharply from around 0.22 to 0.34 at age 60 and stays above 0.3 thereafter.

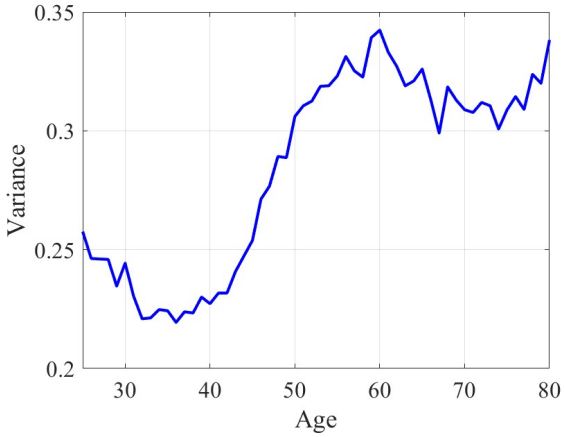


Figure 29: Variance of Residuals: Consumption

Figure 30 shows the variance of residuals by broad consumption categories. Although the levels differ across categories, the pattern over the life-cycle is similar among the three, showing paths of variances that are initially flat or declining until around age 40 and then increase thereafter.

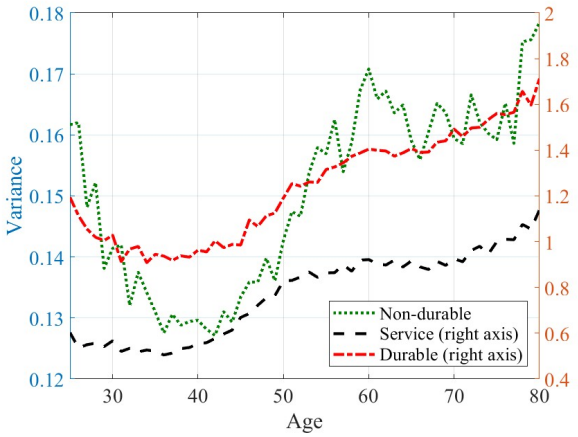
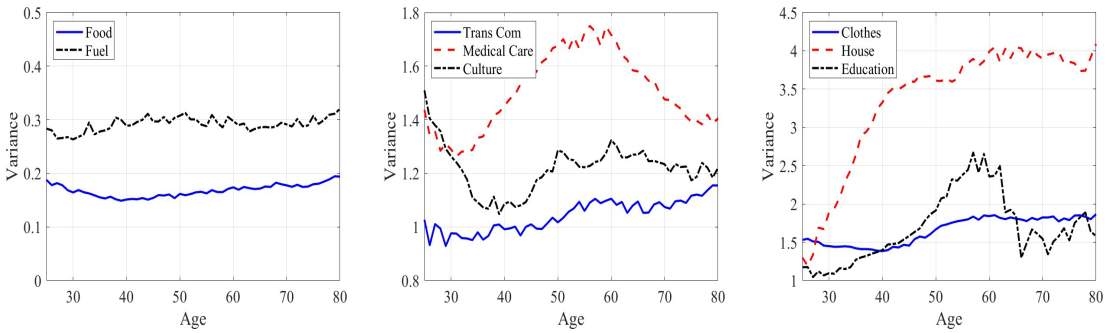


Figure 30: Variance of Residuals: Consumption by Categories

The profiles, however, vary significantly by item groups, as shown in Figure 31. Variance of food and fuel, light & water charges remains consistently low, at about 0.3 and below 0.2, respectively, showing no significant increase throughout the life-cycle. In contrast, other items have much higher variance and exhibit different patterns over the life-cycle.



(a) Group (1) (b) Group (2) (c) Group (3)

Figure 31: Variance of Residuals: Consumption by Item Groups

5.4 Age Profiles of Income

To evaluate the age profile of income, we use the same specification as in equation (1), replacing consumption with annual income as the dependent variable and estimate the model. Figure 32 shows the profile of regression coefficients on ages. Income rises in age, reaching a peak at around age 50. Subsequently, income declines, with a sharper decrease after age 60, coinciding with the timing of individuals starting to exit the labor force. Figure 33 shows the profile of the variance of the regression residuals, indicating that income becomes more dispersed in age, peaks at around age 60.

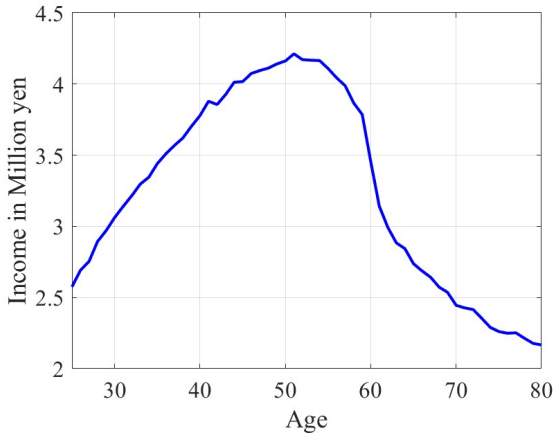


Figure 32: Life-Cycle Profile of Annual Income

Figure 33: Variance of Residuals: Annual Income

6 Demographic Aging and Simple Projections

With the age profiles estimated above, we conduct simple simulations to calculate a projected path of consumption over the next few decades. This assumes that age-specific consumption follows the life-cycle path estimated in the previous section.

More precisely, we estimate smooth age polynomials for each consumption item using the life-cycle profiles estimated in section 5. We use these polynomials to compute the aggregate consumption path based on the population projections of the National Institute of Population and Social Security Research (IPSS).[16] We focus on the consumption of adults aged 25 and above.

[16]Since we lack reliable estimates for expenditures beyond age 80 and find it challenging to extrapolate the profile based on the pre-80 estimates, we assume that age-specific expenditures remain the same after age 80.

Figure 34 shows the projected percentage change in the population aged 25 and above and the total consumption, both relative to the levels in 2020. The two paths do not exactly overlap because consumption vary by age, and the age distribution shifts over time. The faster decline in total consumption than population implies that the average per capita consumption declines over time with the projected demographic aging.

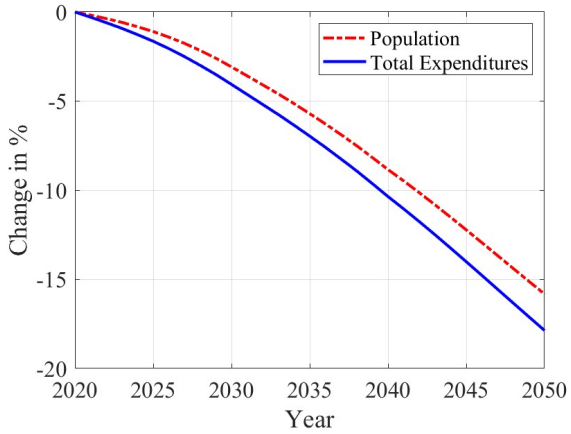


Figure 34: Population (aged 25-105) and Consumption Projections

Figure 35 illustrates the change in the levels durable, non-durable, and service consumption. Although consumption in all three categories is projected to decline over the next three decades, the speed of this decline varies across them. This divergence is due to the observation in Figure 24 where the profile of non-durable consumption does not exhibit a hump-shape with age nor a sharp decline after the 50s, as observed in the profiles of durable goods and service. Given that elderly households, representing a higher fraction of the population, tend to spend relatively more on non-durable goods than on services and durable goods, the consumption of non-durable goods is expected to decline more slowly compared to the consumption of the other two categories.

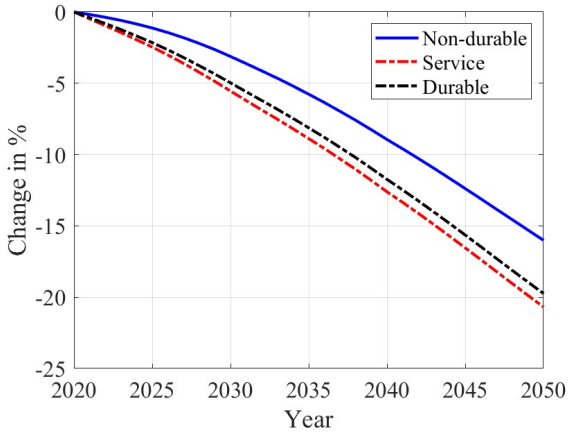
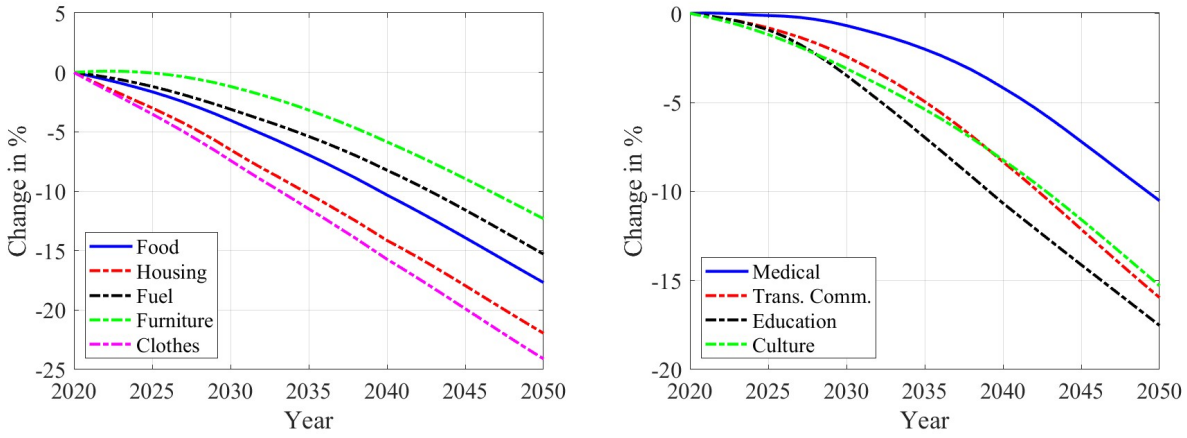


Figure 35: Consumption Projections by Categories

Figure 36 shows the projected consumption paths for various item groups, presented as percentage changes relative to their 2020 levels. Notably, the consumption of medical care, furniture, and fuel is anticipated to decline at a slower pace compared to other items. This trend is attributed to the fact that the elderly tend to allocate a higher proportion of their spending to these specific items.



(a) Group (1) (b) Group (2)

Figure 36: Consumption Projections by Items

We acknowledge that this is a simple partial equilibrium exercise, making a strong assumption that age-specific consumption remains time-invariant. Despite its simplicity, the findings underscore two potentially important factors in forecasting the future path of consumption in an economy experiencing undergoing aging. First, while aggregate consumption decreases with the population, the decline may accelerate further due to shifts in the age distribution. Second, a transformation in the age structure implies a shift in the composition of aggregate consumption expenditures, given the substantial variations in consumption bundles across age groups.

A structural model that incorporates age-specific demands for various types of goods and services, as observed in the data, would provide a foundation for more accurate predictions of future consumption composition. Accounting for households' responses to changes in the environment could enhance the precision of such forecasts. Recent studies have explored the modeling of demand for multiple consumer goods. For instance, Aguiar and Hurst (2013) develop a model distinguishing between core non-durable goods and home-production-related expenditures to capture the life-cycle pattern of consumption inequality. Berger and Vavra (2015) and Ferńandez-Villaverde and Krueger (2011) construct models where households choose consumption of durable and non-durable goods separately. Papers such as Greenwood et al. (2023) and Kitao and Nakakuni (2023) consider the demand for durable goods for home production, separately from other consumption goods, to understand households' responses to rapid declines in the prices of housework-assisting durable goods. De Nardi et al. (2010) find that medical expenditures grow rapidly with age and constitute a large fraction of household expenditures

at older ages. Braun et al. (2019) focus on nursing-home expenditures of the elderly. Investigating a consumption structure that accounts for demand heterogeneity based on factors such as age, family structure, and other household characteristics, in a unified structural model is an interesting avenue for future research.

Furthermore, changes in the demand structure prompted by demographic aging may lead to shifts in equilibrium prices of different goods and services. For instance, increased demand for health and care services may result in a rise in the prices of such goods. Prices could also be influenced by government policies and capacity constraints due to the shrinking labor force and changing skill composition. These extensions are left for exploration in future research.

7 Conclusion

The consumption patters of households over the life-cycle are fundamental to individuals' welfare, and understanding them is crucial for formulating optimal government policies. However, recent developments in research on inequality have predominantly focused on earnings and wealth inequality. This paper aims to address this gap by contributing to the literature that investigates trends in consumption across households and patterns of consumption inequality. We also highlight a significant degree of heterogeneity in consumption bundles across households. Moreover, the life-cycle pattern of consumption varies significantly across different consumption categories and items, deviating from a typical hump-shaped profile.

Using micro data from the Family Income and Expenditure Survey (FIES) covering the period from 1981 to 2020, we examined trends in household consumption and inequality in Japan. The average consumption of households increased until the early 1990s, followed by a subsequent decline. This trend is primarily driven by changes in service and non-durable goods consumption, while durable goods consumption mildly increased over the sample period. Regarding consumption inequality, measured by the Gini coefficient, there was an increase from the early 1980s to the mid-1990s, after which it stabilized within a narrow range. The rise in inequality was most prominent in service consumption and it is primarily attributed to a change in the age distribution, shifting towards older households whose service consumption displays a greater degree of inequality compared to young and middle-aged households.

We also examined the age profile of consumption using the estimation method of Aguiar and Hurst (2013). Average total consumption displays a standard hump-shape over the life-cycle, although the shape varies across consumption categories. Non-durable goods consumption exhibits a rapid increase until around age 40 and then remains in a narrow range thereafter, only mildly decreasing after their mid-60s. In contrast, durable goods and service consumption show a sharp decline after age 50.

We further examined the life-cycle consumption patterns across different items and found significant variations across them. Consumption items such as medical care, furniture, and fuel, light & water charges continue to increase over the life-cycle, while others such as food and transportation & communication follow a hump-shaped pattern. Items

such as clothing & footwear exhibit a monotonic decline.

The demographic structure has changed dramatically over the last few decades in Japan and is expected to continue evolving in the coming decades. Our analysis reveals substantial differences in consumption behavior across households of different ages. In an aging economy, aggregate consumption may decline more sharply than the population itself, if there is a rise in the share of the elderly, whose average consumption is lower than the average. Some categories of consumption expenditures, such as non-durable goods, may be less affected because the life-cycle pattern of non-durable consumption indicates a relatively flat profile after their 40s. Service and durable goods consumption may decline more rapidly as the elderly population consume fewer of these goods and services.

Our study underscores to the importance of incorporating life-cycle dimensions to understand the consumption trends, especially in economies experiencing a significant shift in demographic structure. The changing demand pattern is likely to influence equilibrium prices for different goods and services. Developing a structural life-cycle model to account for consumption patterns and exploring how demographic aging will impact consumption across various sectors of the economy remains an interesting avenue for future research.

A More Details on Data Construction

Consumption expenditures are classified into four categories: (1) nondurable expenditure, (2) service expenditure, (3) semidurable expenditure, and (4) durable expenditure. The breakdown of each category with the survey's classification numbers is as follows.

1. Food (c_{FD}): "food (1)" − "meal outside the home (1.12)" + "tobacco (10.1.4)"
2. Nondurables (c_{ND}): Food (c_{FD}) + "fuel, light & water charges (3)" + "domestic nondurable goods (4.5)" + "medicines (6.1)" + "health fortification (6.2)" + "school textbooks and reference books for study (8.2)" + "books and other reading materials (9.3)" + "other miscellaneous (10.1.5)"
3. Services (c_{SV})[17] : "meal outside the home (1.12)" + "rents for dwelling and land (2.1)" + "service charges for repairs & maintenance (2.2.2)" + "domestic services (4.6)" + "services related to clothing (5.8)" + "medical services (6.4)" + "public transportation (7.1)" + "communication (7.3)" + "education (8)" − "school textbooks and reference books for study (8.2)" + "recreational services (9.4)" + "personal care services (10.1.1)" + "social expenses (10.3)"
4. Semidurables (c_{SD}): "tools and materials for repairs & maintenance (2.2.1)" + "domestic utensils (4.4)" + "clothing & footwear (5)" − "services related to clothing (5.8)" + "maintenance of vehicles (7.2.3)" + "recreational good (9.2)" + "personal care goods (10.1.2)" + "personal effects (10.1.3)"
5. Durables (c_{D}): "household durable goods (4.1)" + "interior furnishing & decorations (4.2)" + "bedding (4.3)" + "medical supplies & appliances (6.3)" + "purchase of vehicles (7.2.1)" + "purchase of bicycles (7.2.2)" + "recreation durable goods (9.1)"
6. Total expenditure (c_T): Sum of 2-5.

Detailed Items: In addition to the consumption of broad consumption categories above, we analyze data of the following item groups. Note that the items from the four categories of expenditures are discretely added to the more subdivided item groups.

1. Food
    - Non-durable: general food items (cereals, fish and shellfish, meat, dairy products and eggs, vegetables and seaweeds, fruits, oils, fats and seasonings, cakes and candies, cooked food, beverages, alcoholic beverages)
    - Service: meals outside the home (eating out, school lunch)

[17] Note that Aguiar and Hurst (2013) do not include health expenditures and education from service category.

2. Housing[18]
    - Service: rents for dwelling and land, service charges for repairs & maintenance
    - Semi-durable: tools and materials for repairs & maintenance
3. Fuel, light & water charges
    - Non-durables: electricity, gas, other fuel and light, water and sewerage charges
4. Furniture & household utensils
    - Durable: household durable goods, interior furnishing & decorations, bedding
    - Semi-durable: domestic utensils
    - Non-durable: domestic non-durable goods
    - Service: domestic services
5. Clothing & footwear
    - Semi-durable: Japanese clothing, clothing, shirts and sweaters, underwear, cloth and thread, other clothing, footwear
    - Service: services related to clothing (washing charges, charges for clothing rent, etc)
6. Medical care
    - Non-durable: medicines, health fortification
    - Durable: medical supplies & appliances
    - Service: medical services (medical treatment, dental treatment, delivery fees, other hospital charges, fees for medical checkups, etc.)
7. Transportation & communication
    - Services: public transportation, communication (postage, telephone charges, mobile phone charges, forwarding charges, mobile phones, other communication equipments)
    - Durable: purchases of vehicles and bicycles
    - Semi-durable: maintenance of vehicles (gasoline, automotive parts, articles related to private transportation, rent for park, charges for rental car and car sharing, auto insurance premium, etc.)
8. Education

[18]The FIES does not include imputed rents for homeowners. The System of National Accounts (SNA) includes imputed rents in both expenditures and income. See Unayama and Yoneta (2018) for more details about the discrepancy between the SNA and the FIES.

- Service: school fees (elementary school fees, junior high school fees, high school fees, college fees, pre-primary education fees, special training school fees), tutorial fees (children and elementary school tutorial fees, junior high school tutorial fees, high school tutorial and prep school fees)
- Non-durable: school textbooks and reference books for study

9. Culture & recreation

   - Durable: recreation durable goods (TV sets, video recorders and players, personal computers, cameras and video cameras, musical instruments, desks and chairs for students and office workers, etc)
   - Semi-durable: recreational goods (stationary, sporting goods, toys, games, etc.)
   - Non-durable: books and other reading materials (newspapers, magazines, books, etc.)
   - Service: recreational services (accommodation services, package tours, lesson fees, charges for NHK and cable TV license, admission fees for movies, plays and sports, gym charges, membership dues, internet charges, etc.)

10. Other consumption expenditures

    - Service: personal care services, social expenses
    - Semi-durable: personal care goods, personal effects,
    - Non-durable: tobacco, other miscellaneous

B Imputed Rents of Homeowners

In the FIES data, the housing item includes rents for dwelling for renters, but the survey does not provide information about equivalent expenditures for homeowners. In this section, we incorporate imputed rents into the consumption of homeowners and examine how they would impact the path of household consumption.

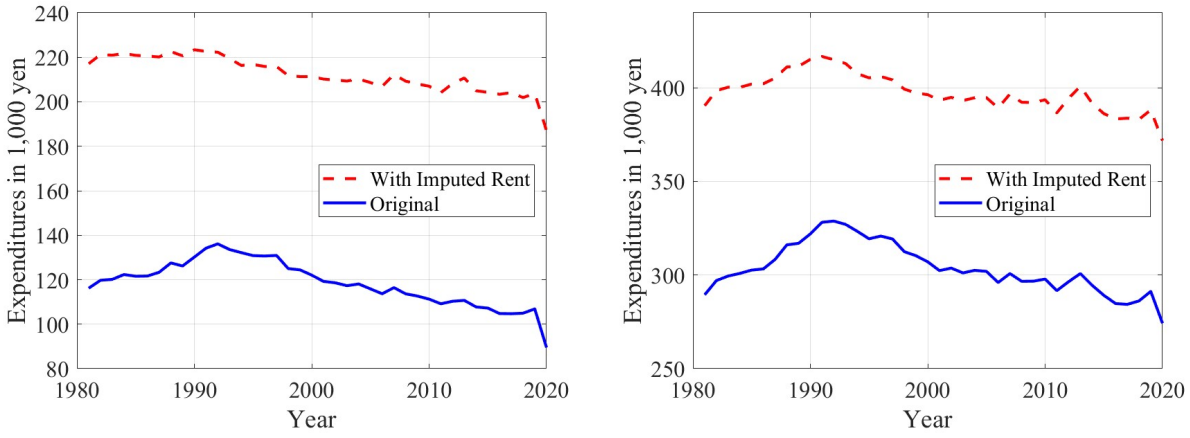
We use the average imputed rents by age group, as shown in Table B.1, which are estimated by Takayama and Arita (1995), and add them to the housing expenditures of households who own a house.

Table B.1: Imputed Rents

Age	Mean	Age	Mean
-24	1,154	$50-54$	1,346
$25-29$	1,484	$55-59$	1,412
$30-34$	1,545	$60-64$	1,364
$35-39$	1,430	$65-69$	1,374
$40-44$	1,413	$70-74$	1,337
$45-49$	1,385	$75-$	1,313

Source: Takayama and Arita (1995), Table 2 (in 1,000 yen in 1989).

With imputed rents included in the consumption of homeowners, the decline in service expenditures and total consumption expenditures is somewhat milder, as shown in Figures B.1a and B.1b, reflecting an increase in the home-ownership rate. However, the overall trend of total consumption expenditures remain the same as in the case without imputed rents.



(a) Services (b) Total

Figure B.1: Service and Total Consumption with Imputed Rents of Homeowners

C More Details on the Consumption Trend

C.1 Equivalized Consumption

Figure C.1 shows the path of consumption equivalized by three alternative methods. The OECD scale assigns the value of 1.0 to the first adult, 0.7 and 0.5 to each of additional adults and children, respectively. The OECD modified scale assigns values are 1.0, 0.5 and 0.3 to the household head, an additional adult and child, respectively. The square root scale divides household consumption by the square of the household size.

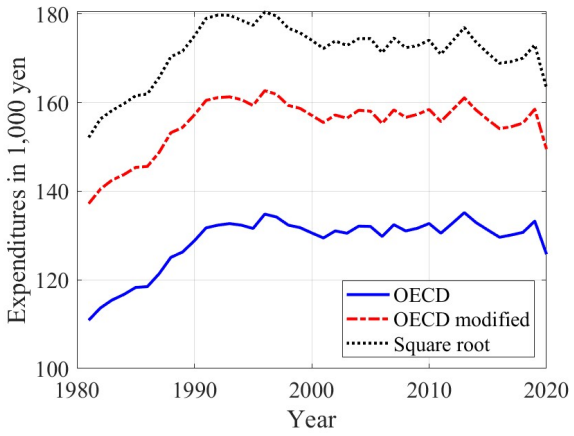
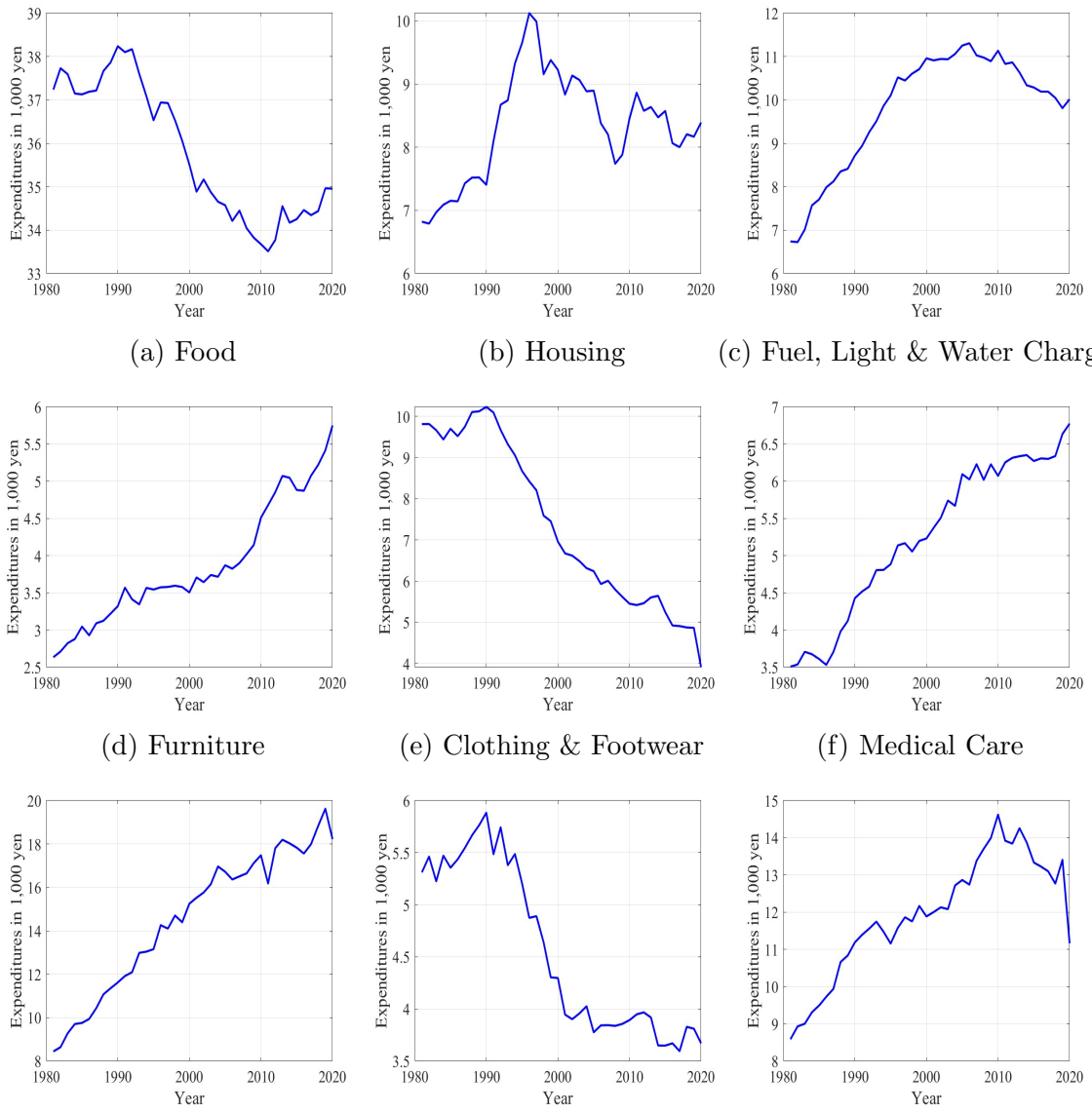


Figure C.1: Total Consumption (Equivalized)

Equivalized Consumption by Item Group: Figure C.2 shows the time trends of equivalized consumption for different item groups, using the OECD equivalence scale.



(a) Food (b) Housing (c) Fuel, Light & Water Charges

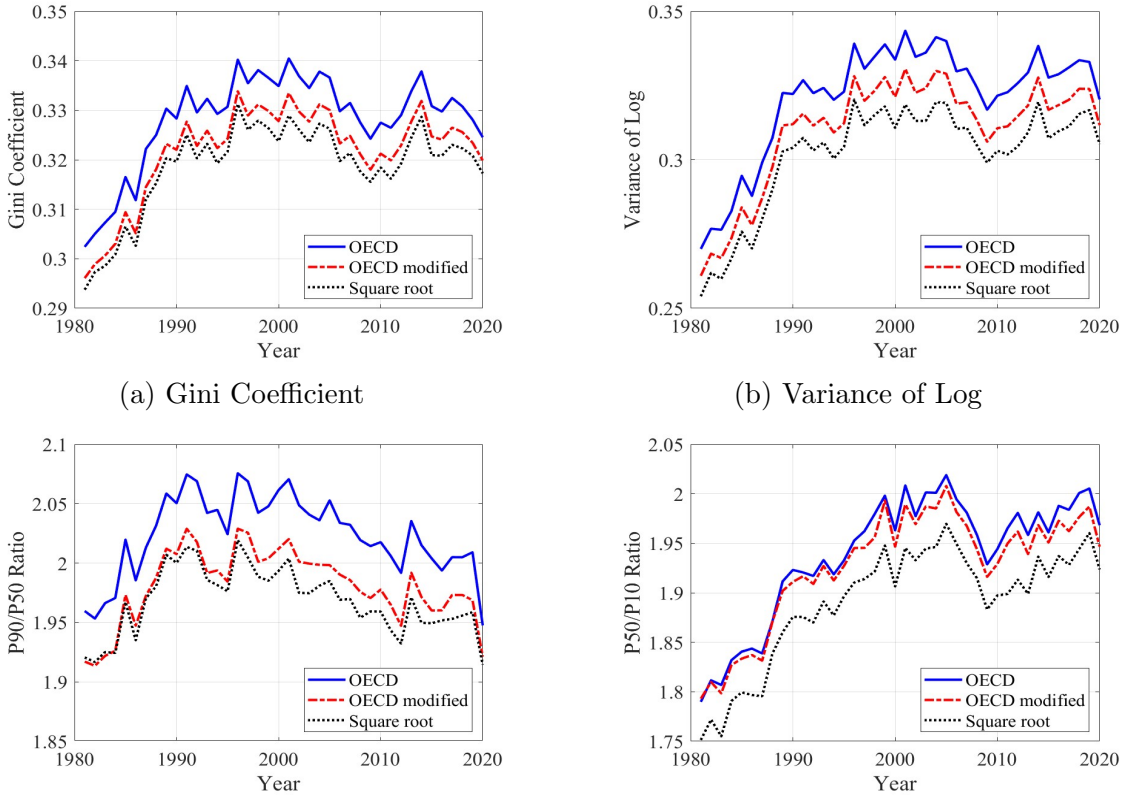
(d) Furniture (e) Clothing & Footwear (f) Medical Care

(g) Transp. & Communication (h) Education (i) Culture and Recreation

Figure C.2: Consumption by Item Group (Equivalized)

Figure 5 showed a large decline of food expenditures. As shown in Figure C.2 above, the decline in the food consumption is much subdued once the expenditures are equivalized, implying that much of the decrease is due to the change (decline) in the family size.

Equivalized Consumption Inequality: Figure C.3 shows the trend of inequality in equivalized consumption, using three different methods. Qualitative trends of inequality remain the same as in those of household consumption, shown in Figure 17, although the decline in P90/P50 ratios is milder in the equivalized profiles.



(a) Gini Coefficient

(b) Variance of Log

(c) P90/P50 Ratio

(d) P50/P10 Ratio

Figure C.3: Consumption Inequality: Total Consumption (Equivalized)

C.2 Consumption Path of Married Households without Children

Figure C.4 shows the path of the average total consumption expenditures for all households and those of married households without children. The data begins in 1987 since a variable indicating the relationship of household members is available only after that year. The decline in consumption is less pronounced compared to the baseline that includes all households. This milder decline suggests that a decrease in family size plays a role in the overall decline in average household consumption.

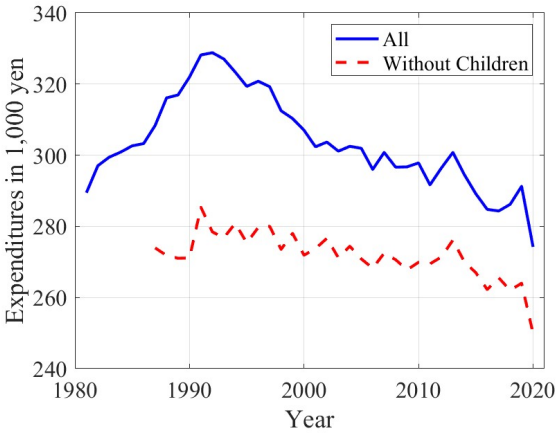
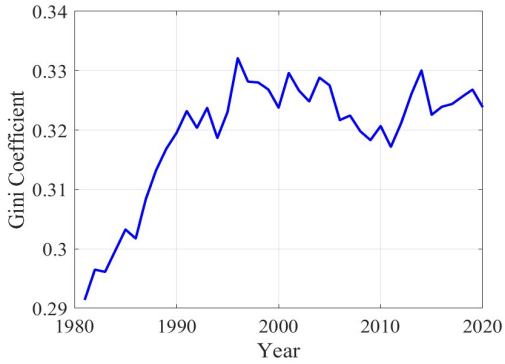


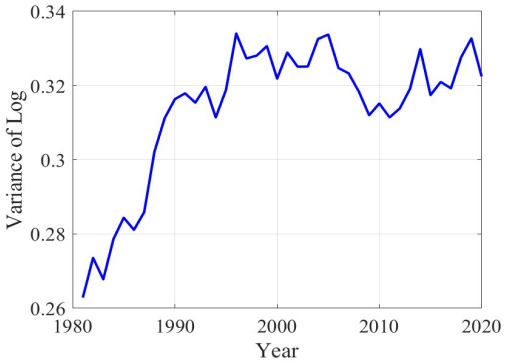
Figure C.4: Total Consumption of Married Households without Children

C.3 Consumption Inequality without Month Effects

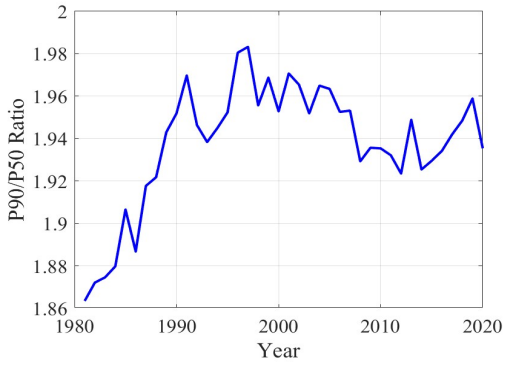
Figure C.5 shows the trend of inequality in total consumption when we remove month effects. We regress our monthly consumption data on month dummies and compute inequality statistics of the data after removing the effects. The degree of inequality is slightly lower, but the trends are the same as those in Figure 17.



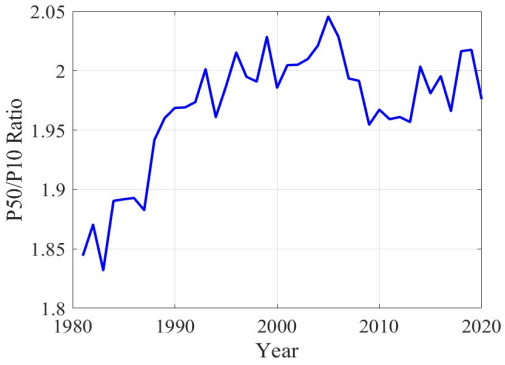
(a) Gini Coefficient



(b) Variance of Log



(c) P90/P50 Ratio



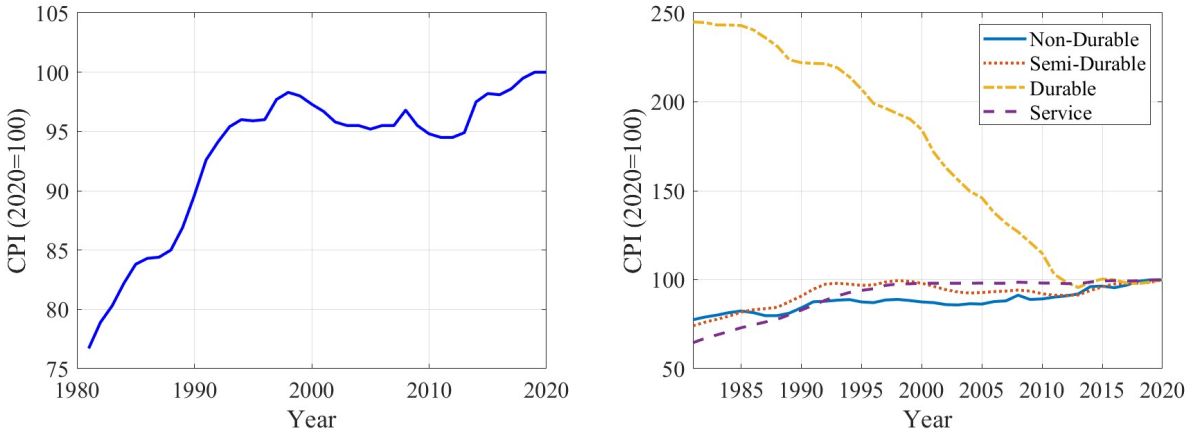
(d) P50/P10 Ratio

Figure C.5: Consumption Inequality without Month Effects: Total Consumption (Households)

D More Details on Price Indexes

Figure D.1 shows the paths of the Consumer Price Index (CPI) released by the Statistics Bureau of Japan. The CPI of all items, shown in Figure D.1a, rose from 77 in 1981 to 100 in 2020, at an annual rate of 0.7%, although the price level stayed in a narrow range between 95 and 100 since the early 1990s.

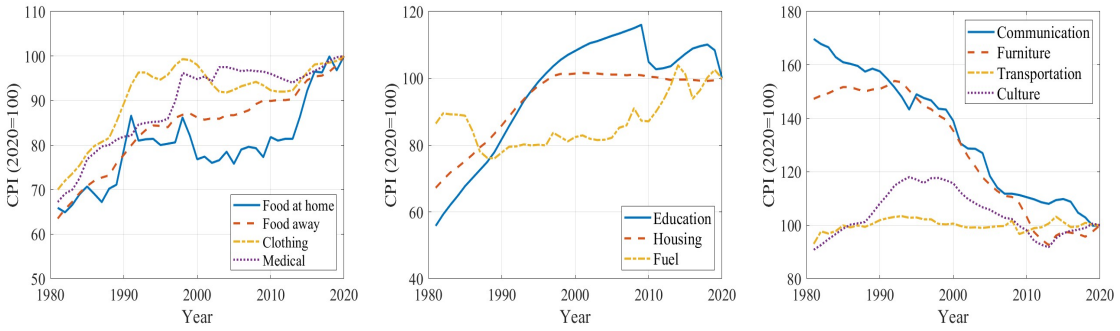
The composition of the price indexes by categories is shown in Figure D.1b. The price of durable goods declined dramatically since the 1980s and followed a very different path from those of other goods and services.



(a) CPI (All Items) (b) By Category

Figure D.1: Consumption Price Indexes

Figure D.2 shows a further decomposition of price indexes by items. Price indexes of most items grew steadily since the 1980s. Prices of items such as transportation and culture did not increase by much between the early 1980s and 2020. Two items, furniture and communication show a significant decline in their price level, which is behind the decline in the durable goods price shown in Figure D.1b.[19]



(a) Group (1) (b) Group (2) (c) Group (3)

Figure D.2: Price Indexes by Item Group

The significant decline in the price of durable goods, especially that of housework-assisting durable goods, has been associated with a decrease in the hours dedicated to housework (Greenwood et al. (2005)). Greenwood et al. (2023) argue that the rapid decline in the price of household durables constitutes one of the key drivers of the trends in the family formation and time allocation observed among U.S. households during the

[19]Note that as described in Appendix A, the item 'furniture' also includes household utensils, which are categorized in durable goods (household durable goods, interior furnishing, etc), as well as other items that belong to non-duralble goods and services.

20th century. Kitao and Nakakuni (2023) extend the model developed by Greenwood et al. (2023) to include gender differences and show that the decline in household durable goods over the last half century contributed to a reduction in housework hours of married women and an increase in leisure and market work.

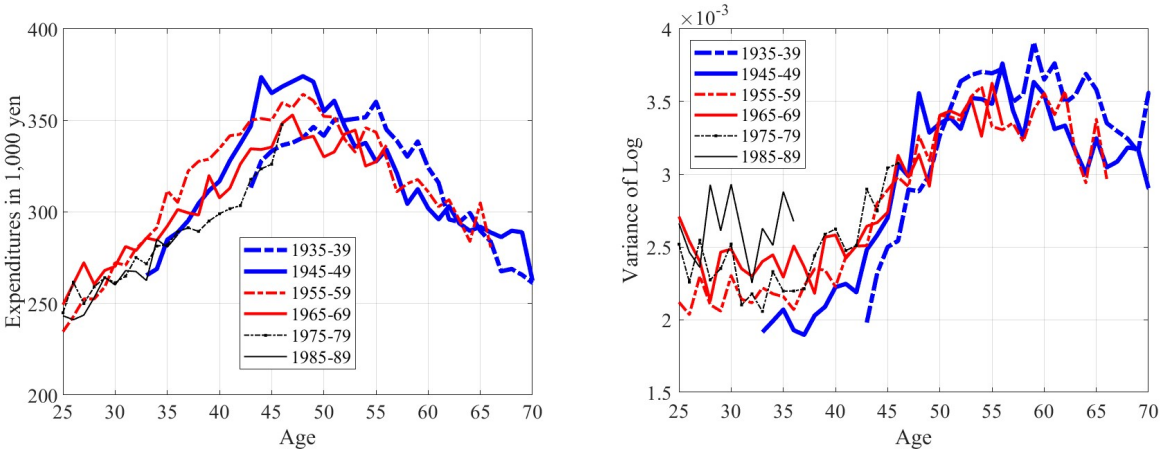
A decline in the unpaid work at home presumably may have contributed to a shift in consumption expenditures through different channels. Some of the goods and services traditionally produced at home have been outsourced to the market, such as meals served at restaurants or delivered home replacing fresh food items purchased and cooked at home. As mentioned above, a portion of the unpaid hours of housework that were used as input of home production has been replaced by household durable goods, such as washing machines with dryers and vacuum cleaners. The rapid advancement of the home production technology and a decline in prices as shown in Figure D.1 facilitated such transitions. Moreover, the responsibilities for family members, such as overseeing children's education and providing care for the elderly, are often managed beyond the confines of the home without relying on the unpaid work of household members.

Understanding how these changes contributed to a shift in the consumption expenditures over the last several decades would require a more comprehensive analysis of time use and consumption expenditures using a structural model, which remain an interesting topic left for future research.

E More Details on the Estimated Model

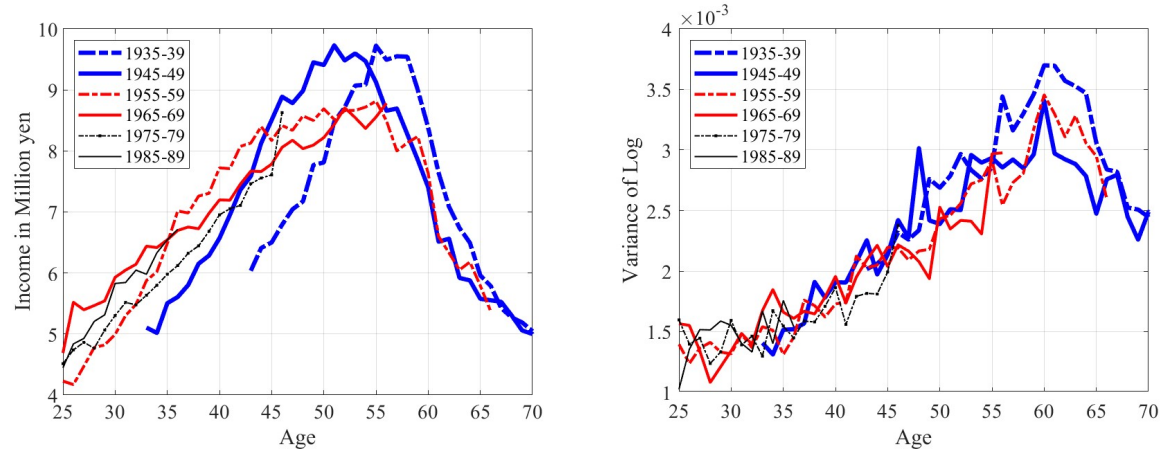
E.1 Consumption by Cohort

Figure E.1 shows the age profile of total consumption and variance of log for different cohorts. The shapes of the profiles are the same across cohorts, but the levels differ across them. Figure E.2 shows the income profile by cohort and Figures E.3 and E.4 are the equivalized versions of consumption and income profiles.



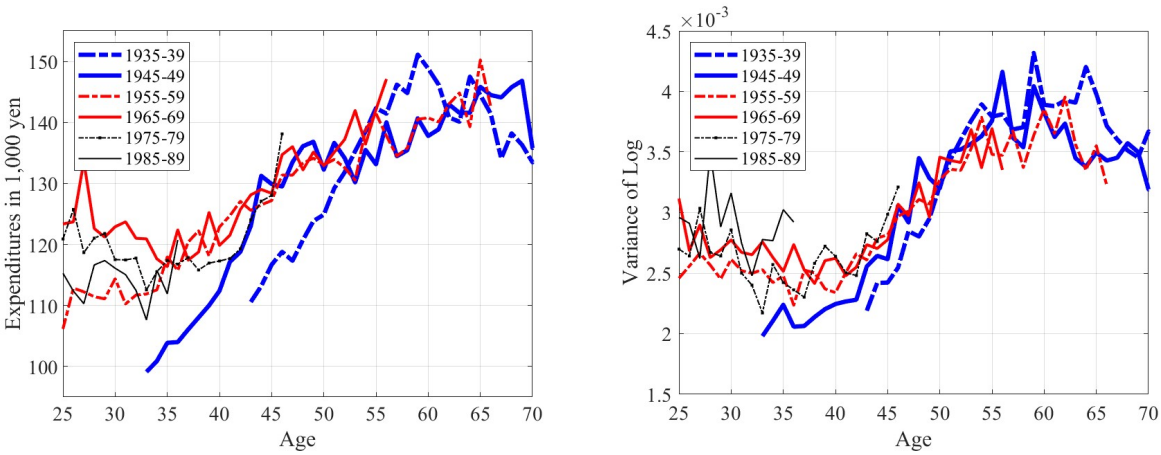
(a) Levels (b) Variance of Log

Figure E.1: Total Consumption by Cohort (Household)



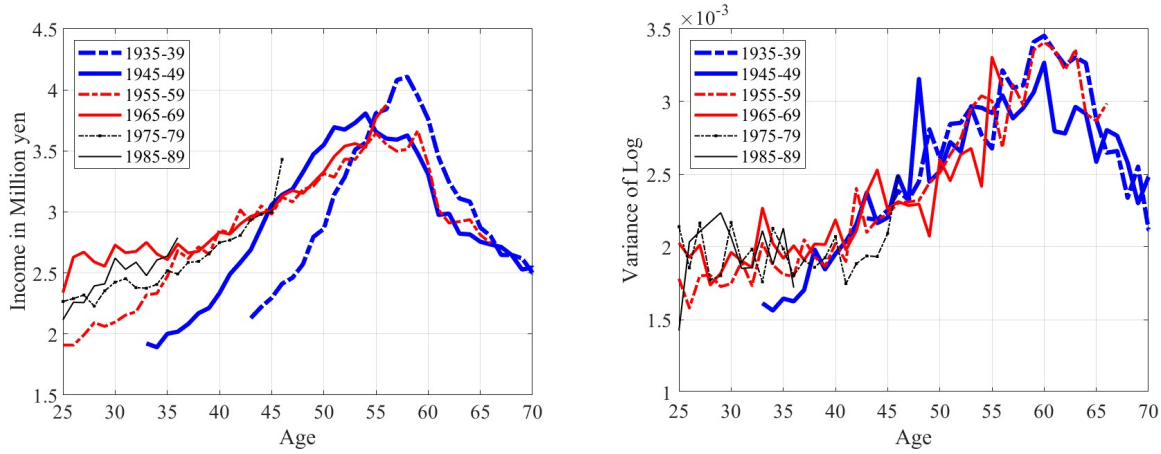
(a) Levels (b) Variance of Log

Figure E.2: Annual Income by Cohort (Household)



(a) Levels (b) Variance of Log

Figure E.3: Total Consumption by Cohort (Equivalized)



(a) Levels (b) Variance of Log

Figure E.4: Annual Income by Cohort (Equivalized)

E.2 Year Effects

Figure E.5 reports the coefficients on year dummies from the estimation of the model presented in Section 5. The year effects tend to be larger for durable goods expenditures compared to those of non-durable goods and service expenditures, except for a major decline observed in service expenditures in 2020, upon the onset of the COVID-19 crisis.

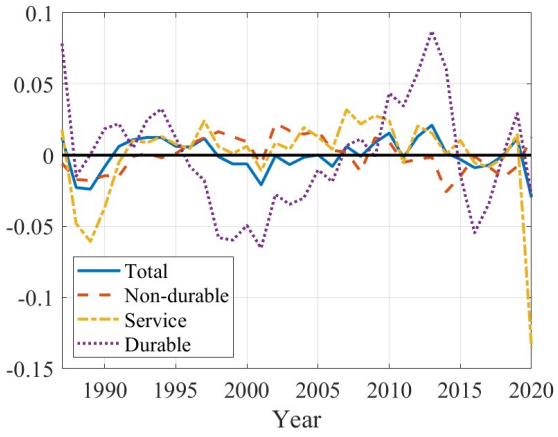


Figure E.5: Coefficients on Year Dummies

Conflict of Interest: The authors declare no competing interests.

References

Aguiar, M. A. and M. Bils (2015). Has consumption inequality mirrored income inequality? *American Economic Review 105*(9), 2725–56.

Aguiar, M. A. and E. Hurst (2013). Deconstructing lifecycle expenditure. *Journal of Political Economy 121*(3), 437–492.

Attanasio, O. P., J. Banks, C. Meghir, and G. Weber (1999). Humps and bumps in lifetime consumption. *Journal of Business and Economic Statistics 17*(1), 22–35.

Attanasio, O. P. and M. Browning (1995). Consumption over the life cycle and over the business cycle. *American Economic Review 85*(5), 1118–1137.

Attanasio, O. P., K. Larkin, M. O. Ravn, and M. Padula (2022). (s)cars and the great recession. *Econometrica 90*(5), 2319–2356.

Attanasio, O. P. and L. Pistaferri (2014). New directions and opportunities for research on consumption with the PSID. *American Economic Review: Papers & Proceedings 104*(5), 122–126.

Berger, D. and J. Vavra (2015). Consumption dynamics during recessions. *Econometrica 83*(1), 101–154.

Blundell, R., M. Borella, J. Commault, and M. De Nardi (2024, February). Old age risks, consumption, and insurance. *American Economic Review 114*(2), 575–613.

Braun, R. A., K. A. Kopecky, and T. Koreshkova (2019). Old, frail, and uninsured: Accounting for features of the U.S. long-term care insurance market. *Econometrica 87*(3), 981–1019.

Cashin, D. and T. Unayama (2021). The spending and consumption response to a VAT rate increase. *National Tax Journal 74*(2).

De Nardi, M., E. French, and J. B. Jones (2010). Why do the elderly save? The role of medical expenses. *Journal of Political Economy 118*(1), 39–75.

Deaton, A. (1997). *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*. Baltimore: The World Bank and the Johns Hopkins University Press.

Deaton, A. and C. Paxson (1994). Intertemporal choice and inequality. *Journal of Political Economy 102*, 437–467.

Ferńandez-Villaverde, J. and D. Krueger (2007). Consumption over the life cycle: Facts from consumer expenditure survey data. *Review of Economics and Statistics 89*(3), 552–565.

Ferńandez-Villaverde, J. and D. Krueger (2011). Consumption and saving over the life cycle: How important are consumer durables? *Macroeconomic Dynamics 15*(5), 725–770.

Gourinchas, P.-O. and J. A. Parker (2002). Consumption over the life cycle. *Econometrica 70*(1), 47–89.

Greenwood, J., N. Guner, and R. Marto (2023). The great transition: Kuznets facts for family-economists. In S. Lundberg and A. Voena (Eds.), *Handbook of the Economics of the Family*. Amsterdam: Elsevier.

Greenwood, J., A. Seshadri, and M. Yorukoglu (2005). Engines of liberation. *Review of Economic Studies 72*(1), 109–133.

Hansen, G. D. and S. İmrohoroğlu (2008). Consumption over the life cycle: The role of annuities. *Review of Economic Dynamics 11*(3), 566–583.

Hausman, J. K., T. Unayama, and J. F. Wieland (2019). Abenomics, the housing market, and consumption. *Economic Analysis 200*.

Heathcote, J., F. Perri, and G. L. Violante (2010). Unequal we stand: An empirical analysis of economic inequality in the United States, 1967-2006. *Review of Economic Dynamics 13*(1), 15–51.

Heathcote, J., K. Storesletten, and G. L. Violante (2005). Two views of inequality over the life cycle. *Journal of the European Economic Association 3*, 765–775.

Higa, K. (2019). Estimating consumption inequality in japan over the last three decades. *ESRI Discussion Paper Series 350*.

Hubmer, J. (2023). The race between preferences and technology. *Econometrica 91*, 227–261.

Kaplan, G. (2012). Inequality and the life cycle. *Quantitative Economics 3*(3), 471–525.

Kaplan, G., K. Mitman, and G. L. Violante (2020). The housing boom and bust: Model meets evidence. *Journal of Political Economy 128*(8), 3285–3345.

Kitao, S. and K. Nakakuni (2023). On the trends of technology, family formation, and women's time allocation. Working Paper.

Kitao, S. and T. Yamada (2019). Dimensions of inequality in Japan: Distributions of earnings, income and wealth between 1984 and 2014. RIETI Discussion Paper 19-E-034.

Kitao, S. and T. Yamada (2024). Inequality dynamics in Japan, 1981–2021. ESRI Discussion Paper (forthcoming).

Krueger, D. and F. Perri (2006). Does income inequality lead to consumption inequality? evidence and theory. *Review of Economic Studies 73*(1), 163–193.

Kubota, K. (2020). Partial insurance in japan. *Japanese Economic Review*.

Lise, J., N. Sudo, M. Suzuki, K. Yamada, and T. Yamada (2014). Wage, income and consumption inequality in Japan, 1981-2008: from boom to lost decades. *Review of Economic Dynamics 17*, 582–612.

Meyer, B. D. and J. X. Sullivan (2023). Consumption and income inequality in the United States since the 1960s. *Journal of Political Economy 131*(2), 247–284.

Mian, A., K. Rao, and A. Sufi (2013). Household balance sheets, consumption, and the economic slump. *Quarterly Journal of Economics 128*, 1687–1726.

Ohtake, F. and M. Saito (1998). Population aging and consumption inequality in Japan. *Review of Income and Wealth 44*, 361–381.

Stephens, J. M. and T. Unayama (2012). The impact of retirement on household consumption in japan. *Journal of the Japanese and International Economies* (26), 62–83.

Storesletten, K., C. I. Telmer, and A. Yaron (2004). Consumption and risk sharing over the life cycle. *Journal of Monetary Economics 51*, 609–633.

Straub, L. (2019). Consumption, savings, and the distribution of permanent income. Unpublished Manuscript.

Takayama, N. and F. Arita (1995). How is per-capita disposable income divided between generations in Japan? *Economic Review 46*(1), 43–58. (in Japanese).

Unayama, T. (2015). A comparison of consumption-related statistics. *Financial Review 122*, 59–79.

Unayama, T. and Y. Yoneta (2018). The discrepancy between the household saving rates in micro and macro statistics: An adjustment method. *Public Policy Review 14*(4), 765–776.